Sports (and) Economics

Edited by
Jaume García

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Contributors

Isabel Artero
University of Zaragoza
Zaragoza, Spain

Eduardo Bandrés
University of Zaragoza
Zaragoza, Spain

Ángel Barajas
National Research University Higher School of Economics
St. Petersburg, Russia

David Berri
Southern Utah University
Cedar City, USA

Júlia Bosch
Universitat Pompeu Fabra
Barcelona, Spain

Miquel Carreras
Universitat de Girona
Girona, Spain

Pablo Castellanos-García
University of A Coruña
A Coruña, Spain

Yulia Chikish
West Virginia University
Morgantown, USA

Julio del Corral
University of Castilla-La Mancha
Ciudad Real, Spain

Contributors

Paul Downward
Loughborough University
Loughborough, UK

Manuel Espitia-Escuer
University of Zaragoza
Zaragoza, Spain

David Forrest
University of Liverpool
Liverpool, UK

Rodney Fort
University of Michigan
Ann Arbor, USA

Jaume García
Universitat Pompeu Fabra
Barcelona, Spain

Lucía Isabel García-Cebrián
University of Zaragoza
Zaragoza, Spain

Pedro García-del-Barrio
Universitat Internacional de Cataluynya
Barcelona, Spain

Brad R. Humphreys
West Virginia University
Morgantown, USA

Stefan Kesenne
University of Antwerp and K.U. Leuven
Belgium

Contributors

Fernando Lera López
Public University of Navarra
Pamplona, Spain

Cristina Muñiz
University of Oviedo
Oviedo, Spain

Carles Murillo
Universitat Pompeu Fabra
Barcelona, Spain

Ignacio Palacios-Huerta
London School of Economics, London (UK)
Ikerbasque Foundation at UPV/EHU, Bilbao, Spain

Levi Pérez
University of Oviedo
Oviedo, Spain

Josep Maria Raya
Tecnocampus, Universitat Pompeu Fabra
Barcelona, Spain

Plácido Rodríguez
University of Oviedo
Oviedo, Spain

Ramón Sala-Garrido
Universitat de València
Valencia, Spain

Luis Carlos Sánchez
University of Vigo
Vigo, Spain

Contributors

Patricio Sánchez-Fernández
University of Vigo
Vigo, Spain

José Manuel Sánchez-Santos
University of A Coruña
A Coruña, Spain

Rob Simmons
Lancaster University
Lancaster, UK

María José Suárez Fernández
University of Oviedo
Oviedo, Spain

Stefan Szymanski
University of Michigan
Ann Arbor, USA

Juan de Dios Tena Horrillo
University of Liverpool, Liverpool (UK)
Università degli Studi di Sassari, Sassari (Italy)

Carlos Varela-Quintana
University of Oviedo
Oviedo, Spain

Introduction

Jaume GARCÍA

There exists almost unanimous consensus among researchers in sport and economics on the fact that the 1956 article by Simon Rottenberg on the organization of the professional baseball industry in the United States, and particularly on the labor market for professional baseball players, published in the *Journal of Political Economy,* is the first article including what could be considered an economic analysis of sport.[1]

In his contribution, Rottenberg focuses his attention on the uniform character of players' contracts, among whose key features is the reserve clause, which enables a club to renew a player's contract upon its termination at a price subject to minimum restraints. One of the main reasons given in defense of this clause is its role in assuring equal distribution of talent (quality of players) among teams. However, as pointed out by Rottenberg, a similar situation can be arrived at in the framework of a free market, which would later come to be known as the invariance principle, the only difference being that value is transferred from players to clubs in the presence of a reserve clause.

It should furthermore be noted that, in his article, Rottenberg explicitly refers to concepts playing a relevant role in sports economics, such as competitive balance[2] or uncertainty of outcome,[3] and includes findings related to subsequent theoretical developments and/or which have been the focus of attention of empirical analyses, such as the effect of certain measures like revenue sharing as a way of improving competitive balance, as opposed to quality of teams as a factor determining demand for sporting events.[4]

In fact, this article was the only contribution made by Simon Rottenberg to literature on sport and economics, as is also the case with the 1964 article by Walter C. Neale on theory of the firm in the framework of sporting competition, published in the *Quarterly Journal of Economics.* It is probably one of the most influential, as well as one of the most widely criticized, articles for the

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[1] The articles published by Fort (2005), Noll (2006), Sanderson and Siegfried (2006), and Sloane (2006), among others, on the occasion of the 50th anniversary of the appearance of Rottenberg's article, serve as examples of such consensus.

[2] "… to support the position that the purpose of the reserve rule was to achieve balance of playing strength among teams" (p. 247).

[3] "… uncertainty of outcome is necessary if the consumer is to be willing to pay admission to the game" (p. 246).

[4] "A rule of equal sharing of revenue leads to the equal distribution of mediocre players among teams and to consumer preference for recreational substitutes" (p. 256).

subsequent development of what we know as sports economics, since it includes ideas and concepts which would later be subject to thorough analysis within the discipline: the role played by firms in professional sport (leagues and/or clubs), the importance of competition, the "league standing effect", in Neale's terms, contributing to generate demand for this sort of events (competitive balance), or, at a more micro level, the role played by uncertainty of outcome as determinant of demand for a given event (game). As aforementioned, some of these concepts were already included in the work of Rottenberg.

But beyond its intrinsic value, Neale's contribution is acknowledged for two aspects having taken root in the discipline. On the one hand, the use of the term "peculiar" to describe the economic functioning of the professional sports market, which appears already in the tittle of his article and, in a way, accounts for the singularity of the discipline. On the other hand, the use of what Neale calls the "Louis-Schmeling Paradox" to illustrate the key considerations and findings of his work.[5] For younger readers and those who are not fans of boxing, it is worth remembering that Joe Louis and Max Schmeling were two heavyweight boxers who faced each other in two historical fights in the 1930s, the second of which for the World Heavyweight Champion title. Schmeling had become world champion a few years earlier, while Louis was considered by some to be the best boxer in history. Thus, two even (competitive balanced), high-quality fights were expected, which constituted an appealing product for the audience: both boxers therefore "needed to cooperate" with each other in order to create a demanded product (their fight).[6]

However, the paternity of some of the concepts and ideas included in the works by Rottenberg and Neale could be challenged if we consider some previously published articles on legal issues, such as that attributed by many authors to Peter S. Craig, which was published in 1953 in the *Yale Law Journal,* though it appeared unsigned.[7] Just like in Rottenberg's article, the baseball industry and its monopsonistic practices in the United States are analyzed in this work, where special reference is made to the reserve clause. In particular, the fact that many of the relevant concepts and topics having laid the foundations for sports economics are included in a single paragraph is especially striking.

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[5] Today we would probably refer, for instance, to the "Federer-Nadal Paradox" (and/or Djokovic?), or else to the "Messi-Ronaldo Paradox" in the world of football, an idea also somehow suggested in publications which do not adopt a strictly economic point of view, such as the book by Andy West (2018) from the perspective of sport science.

[6] The racial element and the existing climate of tension prior to the beginning of Second World War after Hitler's rise to power were two factors adding up to the excitement, since Schmeling was German and Louis was African American.

[7] I wish to thank Robert Macdonald, from the University of Melbourne, for making me aware of the existence of this work and the details of its contents through his e-mail exchange with Plácido Rodríguez, from the Universidad de Oviedo.

> "But professional baseball is more than a business: it is also a sport. Unlike firms in other industries, a professional sport enterprise must cooperate with chosen competitors in order to create a marketable product. Because the attractiveness of each product or exhibition depends on its uncertainty and dramatic value, this cooperation must extend beyond the mere performance of the exhibition to the creation of common trade practices which promote equality of playing skill among opposing clubs. Furthermore, in the baseball industry the sole incentive for business decisions is not the profit motive. Many club owners look upon their investments as a diverting, sometimes costly, hobbit. The rewards they seek are not profits but pennants, pleasure, and prestige." (p. 580)

In just a few lines, reference is made to the peculiar character of professional sports industry.[8] The importance of uncertainty (of outcome) for the product supplied is highlighted, as well as the dramatic value, which, in a way, is the first generic reference to the concepts of suspense and surprise recently developed by Ely, Frankel and Kamenica (2015), who thoroughly apply them to sporting spectacles. Potential measures aimed at ensuring competitive balance are furthermore mentioned. Last, the role of clubs as firms is suggested, not necessarily linked to profit maximization but to a different, more general kind of function in which profit is just one of the arguments, as pointed out by Sloane (1971) for the case of professional football in Europe.

As the case may be, on account of their contents and dates of publication, the articles by Rottenberg and Neale have set the agenda for research on sports economics over many years, being thus included in the set of 6 publications chosen by Noll (2006) as those which not only were the first to introduce relevant issues for the discipline, but also contributions exclusively devoted to sport and published in top academic journals. The other four articles are, in chronological order, those by Jones (1969), Sloane (1969 and 1971), and El-Hodiri and Quirk (1971).

As pointed out in its brief introduction, the article by Jones (1969) is intended to show that the functioning and organization of the ice-hockey industry in North America can be explained on the basis of the standard microeconomic behavior of firms seeking profit maximization, without the need for recourse to non-economic arguments such as the "love of the game". To that end, within a theoretical framework that takes account of the necessary cooperation (coalition) between clubs in order to create the product to be

[8] In fact, the word "peculiar" explicitly appears in the article (p. 624) when addressing the problems and characteristics of the baseball industry.

merchandized, a distinction is made between the behavior of each specific club, aimed at maximizing its own profit, and that of the league (association of clubs) as a whole, which seeks to maximize joint profits. As opposed to the preceding works, in particular that of Neale (1964), Jones (1969) makes explicit reference to the existence of two kinds of firms (the league and the clubs), instead of only one (the league), as apparently suggested by Neale (1964). Moreover, Jones (1969) explicitly addresses the opportunities for market expansion, besides live games attendance, through television broadcasts, which are today fully incorporated as a relevant revenue source for professional clubs. Fifty years later, sponsorship, merchandising, and the proper use of social networking and digital economy might likewise play a relevant role in the future expansion of professional sport.

The inclusion of two works by Peter Sloane in a list of six might possibly owe to the fact that there is a more or less clear reference (clearer in one case) to professional sport in Europe, in particular to football, as well as to the specificities and differences (or similitudes) that distinguish it from (or make it resemble to) professional sport in North America.[9] In his first article (1969), which appeared shortly after the publication of an official report on football in the United Kingdom, the author reflects on the labor market for professional football players from an economic perspective, both in terms of wages and working conditions. One of the topics addressed is the role played by the reserve clause, which shared certain similitudes with the clause analyzed by Rottenberg (1956) and the transfer system prevailing at the time. In this regard, Sloane (1969) points out that, while findings provided by Rottenberg (1956) suggest that, under the assumption that clubs are profit maximizers, a free market and the reserve clause would approximately entail identical talent distribution, if clubs were to maximize a utility function including motives other than profit, talent would tend to concentrate in the most successful clubs.

In fact, this focus on the maximization of a utility function instead of on profit maximization as explanatory framework of the behavior of European football clubs is the key contribution of his second study (Sloane, 1971). Clubs maximize a utility function subject to their financial viability, whose rationale includes: profit, sporting success, attendance, and the healthy position of the league as a measure of the interdependence and collaboration between clubs in order to render the game more hard-fought. A simplified version of this proposal would be that of an objective function based on a single argument, namely, the probability of win (percentage of wins). Conclusions arrived at are substantially different depending on the objective function. Thus, in terms of the size of leagues, provided utility maximization, these would tend to reduce

9 See in this respect Fort (2000) for a comparison of both ways of understanding professional sport, in terms both of differences and similitudes.

the number of participating teams, thereby rendering talent distribution more unequal than in the case of profit maximization and obtaining lower total revenues. As pointed out by Kesenne (2005), the debate on the objetive function of clubs remains an open question: "What seems to be clear is that most are sports clubs interested in more than just profit making, but also that they do not want to win at any price" (p. 608).

The sixth article included in Noll's list (2006) is that by El-Hodiri and Quirk (1971). It is the first article on the functioning of a league in a profit maximization context[10] providing a detailed mathematical formulation, though on the basis of somewhat unrealistic assumptions in some cases, for instance, that clubs do not have an impact on wages or the value of contracts, that is to say, that wages and prices of talent units are equal in all clubs. A most noteworthy conclusion of the article is that, even provided a reserve clause and draft system, talent distribution will remain unequal if players transfers between clubs are allowed and revenue generation potentials of the hometowns of clubs substantially differ. According to the authors, this finding is overall consistent with the existing evidence from all professional leagues. The contribution of El-Hodiri and Quirk (1971) has served as reference framework for numerous further theoretical developments regarding the functioning of professional leagues.

As pointed out by Noll (2006) when discussing the legacy left by the six aforementioned studies, the key limitation to be noted, besides the absence of certain topics to be covered mostly owing to motivations of authors and the time at which the articles where written, is the virtual lack of empirical evidence. In the cases in which evidence is provided, this is much too descriptive and not intended to identify causal relations or make estimates to empirically approximate behavioral relationships. Ever since, partly due to the growing possibility of accessing numerous and various databases on professional sport, empirical analyses have significantly, at times even redundantly, increased in sports economics, aimed at illustrating relevant aspects of the discipline, especially those contributing to a better understanding of the sports sector when studied from the economic perspective. Such works, together with other studies rather focused on theoretical aspects, would be part of what Jewell (2006) labels as "sports-microeconomics".

However, a complementary view has been building up over the past few years, whereby analysis of data on the sports industry may be of use for a better understanding of economic behavior in more general situations, as opposed to

[10] In a later work (1974), El-Hodiri and Quirk state that a more realistic view of the behavior of professional club owners should be based on their interest in winning games rather than in making profit.

the usual but less realistic recourse to experimental data, a perspective which Goff and Tollison (1990) dubbed as "sportometrics".[11] In other words, sport is understood as a laboratory generating relevant data for economic analysis, which, on average, include less errors than the commonly used data from surveys.

Goff and Tollison (1990) introduce the idea of "sports as economics", which considers competition sport practice an expression of rational behavior subject to certain restraints, in a similar way as usual economic approaches do. According to Tollison (2008), "sportometrics" can be defined as "the application of economic theories to the behavior of athletes to explain what they do and to see if what they do can help to explain the behavior of people in other professions and settings."

Two studies representing excellent examples of what is known as "sportometrics" have been added up to the six articles included in Noll's list (2006). The contribution of Gwartney and Haworth (1974) is, according to Jewell (2006), the first published work adopting this approach that moves from sports (data) economics to microeconomics. The second article, by McCormick and Tollison (1984), is probably the first contribution of one of the fathers of "sportometrics". Both articles are precursors of multiple studies conducted in this discipline over the past few years, among which the excellent book by Palacios-Huerta (2014), who gathers a set of studies where data generated in the world of football help carry out economic analysis in its most general wording. According to Sauer (2017), it is "an example of Tollison's vision of sportometrics at its best".

The first two paragraphs of the article by Gwartney and Haworth (1974) provide an excellent example of what is "sportometrics". According to Becker (1957), discriminating companies are at a competitive disadvantage in relation to those adopting less discriminatory practices. Specifically, the latter would tend to obtain greater profits and market shares. As pointed out by the authors, this proposition is difficult to verify in real life due to a lack of discrimination indicators. On the contrary, available information on the baseball industry enables to analyze the effects of the presence of African American players on the results achieved by clubs (number of games won) and on stadium attendance. The effect is positive in both cases, which empirically shows the validity of this theoretical proposition in the sense that clubs willing to hire African American players enjoy a competitive advantage over all other clubs, and furthermore illustrates the more general initial proposition.

[11] I would like to thank Ignacio Palacios-Huerta for having recommended me the reading of a recent article by Sauer (2017) in memory of Robert D. Tollison, which has enabled me to get acquainted with that literature in greater detail.

The article by McCormick and Tollison (1984) is an attempt to answer the question of the extent to which an increase in the number of policemen would have an impact on the number of arrests. To that end, they develop a simple theoretical model under the assumption of the existence of a criminal activities market (supply and demand), based on the ideas proposed by Becker (1968). In the solution resulting from this model, the probability of an arrest occurring depends on the number of policemen, though the effect remains undetermined because, while the number of policemen able to detect crimes increases, the probability of each of them actually doing so decreases, and criminals are likely to react by committing less crimes. For this case, the authors use information from an "experiment" conducted in American college basketball: the introduction of a third referee in matches from 1978 on. Making use of the analogy between committing personal fouls and criminal acts, they estimate a significantly negative effect of the change from two to three referees on the number of fouls committed, both for the winning and the losing team, and thus conclude that an increase in the number of policemen translates into a lower arrest rate.[12]

Jewell (2016) deems "sportometrics" (sports as economics) a second way of understanding research on sport-related topics by economists, which adds to the aforementioned "sports microeconomics". In his view, both approaches are not mutually exclusive but complementary, for they belong to the same research field: sports economics.[13] In fact, this two-fold way of understanding research in sports economics enriches the second argument provided by Noll (2006) to support its consideration as a research discipline, namely, that it poses interesting challenges, both theoretical and empirical, in microeconomics. This is precisely what Jewell (2016) understands as "sports microeconomics".

In addition, Noll (2006) provides another rationale, which he addresses first in his study and refers to the social relevance of sports industry, not in economic terms but rather as regards media coverage and the popular attention drawn by professional sport. In fact, such relevance is greater and much more heterogeneous if we do not only restrict ourselves to professional sport, but

[12] In any case, the potential endogeneity problems that affect the variable referring to the number of policemen, which are usual in this kind of model, persist despite the use of quasi-experimental data on American college basketball.

[13] Leo Kahane and Stephen Shmanske adopt a similar approach in their 2012 two-volume edition on sports economics, which includes contributions by a large number of specialists in the field. The first volume (Kahane and Shmanske, 2012), entitled *Economics of Sports,* focuses on works using the economic analytical apparatus to study specific aspects of the (professional) sports industry. The second volume (Kahane and Shmanske, 2012), entitled *Economics Through Sports,* includes works showing how the sports industry, by means of the quantity and quality of the data it generates, can help economists and economics analyze more general social and economic problems by analogy.

rather consider sport in the broader sense, for instance, in the terms included in article 2 of the European Sports Charter,[14] where it is said that "'sport' means all forms of physical activity which, through casual or organised participation, aim at expressing or improving physical fitness and mental well-being, forming social relationships or obtaining results in competition at all levels", thus including not only professional or competition sport, but also the practice of any physical activity. Furthermore, this definition makes also reference to the social relevance of sport, since the aims considered exceed those associated with professional sport.

The 2007 White Paper on Sport[15] and the 2011 Communication entitled "Developing the European Dimension in Sport",[16] both published by the European Commission, highlight four main areas on which the European agenda for sport should focus its attention: the social function of sport, its economic dimension, its organization, and cooperation with third countries and international organizations.[17]

Whereas research in the sport organization-related area focuses on topics mostly associated with professional sport (specificity of sport, free movement, transfers, media, licenses, corruption) already addressed in the traditional approach of sports economics (first research area considered), research on the social function of sport focuses on how sports practice (physical activity), in its broader sense, affects matters such as public health, education and training, social inclusion and integration, or the fight against all kinds of discrimination. Therefore, analysis of sports practice from the economic perspective, for instance understood as the result of a time-use allocation process, as well as that of the effects of such practice on relevant aspects for the welfare of individuals and society, such as the aforementioned, must be fully integrated into the research agenda of sport economists and considered under the two-fold perspective ("sports microeconomics" and "sportometrics") pointed out for the case of professional and/or competition sports.

The first empirical studies on participation in sporting activities were conducted in the 1970s, although attention was not primarily focused on

[14] https://rm.coe.int/16804c9dbb

[15] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52007DC0391

[16] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52011DC0012

[17] In the same vein, the United Nations 2030 Agenda for Sustainable Development, adopted in 2015, emphasizes the role and the potential of sport as enabler of sustainable development in relation to all 17 goals included in the document entitled *Sport and the Sustainable Development Goals. An overview outlining the contribution of sport to SDGs,* which is available at: www.un.org/sport/sites/www.un.org.sport/files/ckfiles/files/Sport_for_SDGs_finalversion9.pdf

physical activity itself, but rather on demand for recreational activities. Such is the case of the work by Davidson, Adams and Seneca (1966), probably pioneering in this literature on participation, where the authors analyze the socio-demographic variables characterizing participation in swimming, fishing, and canoeing activities, as well as their yearly frequency, by means of simple regression models. More recently, empirical studies on participation in and intensity of sports practice have been conducted within a theoretical framework based on the theory of the allocation of time (Becker, 1965) and its subsequent adaptations to the analysis of participation in sports, thereby considering the various mechanisms through which time spent on sports practice might affect individual utility.

In this respect, the article by Cawley (2004) is to be included in the aforementioned list, inasmuch as it adapts, in a way, the model of allocation of time developed by Becker (1965),[18] establishing a theoretical framework for interpreting the behavior of individuals regarding physical activity and eating habits. Such theoretical framework has been widely used as reference in many empirical analyses of participation in sport: the SLOTH model. This model assumes that individuals maximize their utility function according to three restraints: budgetary, time availability-related, and those related to caloric intake and output. The rationale for this utility function refers to the amount of time spent on different activities,[19] to eating habits, approximated through the number of calories contained in the food consumed, a good composed of all other goods, as well as to weight and health status.

Each generic use of time can be further subdivided into more specific uses. Concretely, time spent on sports practice is included in the time spent on leisure activities. Such time (as well as participation or non-participation in sporting activities) has a direct impact on the utility function of individuals, since it is one of the arguments providing the rationale for it, but it also exerts indirect effects by way of its impact on weight and health, in this latter case in a direct way.[20] Humphreys and Ruseski (2011) scale up the SLOTH model considering that the decision to practice a physical activity and its intensity are separate behavioral relationships, albeit related. In their work, they run a comparative statics analysis that yields ambiguous results as regards the effects of income and the opportunity cost of time spent on sports practice, which, in the view of the

[18] This reference theoretical framework was also used by Kesenne and Butzen (1987) for their demand model explaining spending on sport-related activities.

[19] The letters of the acronym SLOTH stand for the initial letters of the words associated with the five generic uses of time considered by Cawley (2004): S (Sleep), L (Leisure), O (Occupation), T (Transportation), and H (Home-based production).

[20] Individuals invest in their health through a combination of certain goods and the time spent on physical activity (Grossman, 1972).

authors, attaches particular relevance to the empirical analysis when it comes to explaining the importance of the different mechanisms associated with such effects.

On the other hand, both the White Paper and the Communication of the European Commission emphasize the role that sport might directly or indirectly play in achieving certain growth goals, as well as its contribution to the Europe 2020 strategy. This explains why the economic dimension of sport is one of the aspects highlighted in those reports. Specifically, the topics to which explicit reference is made are: the need to design evidence-based policies for the sports sector, sustainable funding for sport, and the contribution of sport to regional development and employability.

All three topics require previous knowledge of the sports industry in each country. Therefore, and given that sport as such is not a sector clearly identified in classifications of economic activities, it is necessary to elaborate satellite accounts enabling to quantify the added value of the sports industry on the basis of the activities considered as pertaining to that industry. At the European level, there exists a project intended to make estimates of the value added of the sports sector for European Union countries (SpEA and SIRC, 2018), besides the specific initiatives developed by each country in this regard.

On the other hand, the role played by sport in economic growth and regional development makes it all relevant to evaluate the economic (and social) impact of certain sport-related initiatives (sporting events, construction of infrastructures), particularly if they are developed with public funding. Broadly speaking, a fair proportion of such impact analyses serve ex ante to justify certain decisions made, and ex post to quantify the economic benefits of those initiatives. In the literature on sports economics, both scholarly and professional, there is a large number of works that aim at quantifying the economic impact of a given sporting event or performance by means of greatly differing quantification approaches.

Thus, it seems appropriate to add the article by Crompton (1995) to the list we have elaborated so far. Based on a set of twenty studies on economic impact, both of sporting events and the construction of sporting facilities, the author identifies a total of eleven kinds of error in the approximations used, some resulting from ignorance while others seemingly deliberate, in the author’s view.

Besides the due care when using multipliers estimated for different geographic areas or different kinds of activity (external validity), the first group includes errors related to the definition of multipliers (production or value-added multipliers), to which effect they actually measure (change in demand or relationship with the direct effect), or to the reference geographical area. The second group includes potential errors associated with the concepts used for analysis, such as the contribution of local spectators or the disregard of causal attendees, or else with estimates of both opportunity and real costs, of sporting events or facilities.[21] Last, there are errors associated with the real, short-term representativeness of impact-related figures. On the one hand, employment multipliers assume that the employment rate of the available workforce is 100%, so that effects on employment are already reflected in the first monetary unit of demand. On the other hand, it is assumed that indirect and induced effects occur instantaneously, whereas, in fact, several periods need to be completed for these effects to become apparent.

It is therefore clear that analysis and knowledge of the sports industry structure, as well as the measurement at an aggregate level of the impacts that certain sport-related initiatives might generate, should form part of the (empirical and methodological) research objectives of economists interested in sport, and consequently in sports economics, and be thus included in a fourth distinct group in the research agenda of the discipline. In fact, on account of the approximation method adopted, certain studies on economic impact could be considered examples of “sports macroeconomics” or macroeconomic analysis through sport. Such is the case of the article by Bruckner and Pappa (2015), who take a candidature to host the Olympic Games as a measure of news on anticipated shocks in public investment in order to analyze how uncertainty of news affects macroeconomic results, an aspect for which there was no previous evidence available.

For all that, even though every simplification is likely to provide an incomplete picture of what is to be described, the research agenda of sport economists and the subject matters involved in the discipline that we may identify as sports economics would not only include the conventional economic analysis of sport, which is nevertheless justified in part by the peculiarity of the market for professional and competition sport products. The economic analysis of sports practice in general and its interconnections with individual and social welfare-related aspects would therefore also form part of the agenda,[22] as well as the structural analysis of the sports industry and its interdependence with

[21] This opens the door to consideration of the cost-benefit analysis for this kind of studies.

[22] It should be noted that there are also studies adopting a political economy approach, where sport is connected with political or social rather than economic elements; such is the case of Card and Dahl (2011), who analyze how unexpected losses of the local team are associated with increased frequency of gender-based acts of violence, and of Depetris-Chauvin, Durante and Campante (2018), who analyze how the fact of sharing experiences (supporting the national team) helps to build a national identity.

the rest of the economic sectors, with special emphasis on the contribution made by the initiatives developed in the sports sector to the economic activity of certain geographical areas. The agenda would be complemented by incorporating a bidirectional view of the relationship between sport and economics: one direction corresponds to the economic analysis of sport, and its opposite to the contribution that the characteristics, quality, and quantity of the information generated in this industry could make to the knowledge and verification of certain economic behavioral relationships of a more general nature ("sportometrics", sports as economics, or economics through sports).

This set of general contents to be included in the research agenda of sport economists has been taken in account to organize the contributions included in the present monograph. Accordingly, the list of contributors includes a large number of recognized economists who partly devote their research efforts to theoretical and/or empirical analyses based on sport-related situations and/or information. This research field or discipline is relatively young, considering not only the publication date of the first studies, as aforementioned, but also the relatively young age of the two reference international journals specialized in the discipline, the *Journal of Sports Economics,* which appeared in year 2000, and the *International Journal of Sport Finance,* whose first issue was published in 2006.

The list of authors includes economists developing their academic activity in foreign universities who have made relevant contributions to different aspects of the discipline, together with economists from Spanish universities with international publications whose research areas include aspects pertaining to what has been characterized as sports economics. In this regard, the growing importance of the discipline in Spanish academia is particularly noteworthy, as shown by the bibliometric analysis of research on sports economics in Spain conducted by Castellanos and Sánchez (2012) for the 2002-2011 period; this positive trend has most certainly persisted in the following years, in view of the increased number of publications on this subject matter by Spanish economists in international journals.

In parallel with this development, three discipline-related academic initiatives have been consolidated in Spain. Firstly, in chronological order, the Gijón Conference on Sports Economics is since 2006 an internationally renowned annual meeting where most renowned sports economists at in the world have participated. Only a few years later, in 2010 and also in Gijón, the *Congreso Iberoamericano de Economía del Deporte* starts out, having ever since been celebrated in a different Spanish universities. This conference is the meeting point for Spanish researchers on sports economics, and also on sport management,[23] an equally developing research area, as attested by the growing number of studies conducted in Spanish universities which have also been published in international journals specialized in sport management.[24] Precisely, during the eighth edition of the conference, held at Ciudad Real, the Sociedad Española de Economía del Deporte was formed, which, as set out in article 2 of its statutes, "welcomes as members experts, researchers, scholars, and professionals in the field of sport economics and management".

Last, the third noteworthy initiative relates to the necessary relationship between academia and industry, from which both could benefit. Since 2013, owing to a joint initiative between the *Fundació Ernest Lluch* and F.C. Barcelona, the *Diàlegs acadèmics Ernest Lluch d'Economia i Futbol* are yearly held, where a relevant football-related topic is addressed from an economic perspective through a dialog between two internationally renowned scholars and a subsequent discussion panel including representatives of football and academic institutions.

The present monograph on *Sports (and) Economics* has been structured into four sections, whose contents correspond to the four research areas that should be covered by what we understand as sports economics, as aforementioned. Thus, the opening article puts an emphasis on the expansive approach, in terms of Jewell (2006), from sports economics to economics, which is also known as "sportometrics", economics through sports, or sports as economics. Opting for this relatively new approach should help to give a definitive impetus to a line of work in sports economics contributing to establish the discipline in all areas in an intelligent way, according to what Carlo Cipolla understands by intelligent actions in his 1988 essay entitled "The Basic Laws of Human Stupidity",[25] namely, actions entailing benefits for those who realize them (sports economics), as well as for third parties (economics in a broader sense).

The following two sections deal with what could be considered the traditional approach to the economics of professional sports, although

[23] Although in some respects the dividing line between topics addressed from the perspective of sports economics and that of sport management is very thin, contents in the present monograph are examined from the former perspective, even if in some cases, for instance in demand analysis, approaches are essentially of economic nature or adopt the perspective of sports marketing or consumer behavior. In this regard, the considerations of Macdonald (2017) on the future of research on demand for sport and the necessary integration of the different analytic approaches, in particular economic analysis and sports marketing, are of interest and could be applied to other research topics related to sport and economics.

[24] Examples are the contributions by Nuviala *et al.* (2013), Calabuig *et al.* (2015), García-Fernández *et al.* (2018), or Clavel *et al.* (2019), inter alia.

[25] In his essay, rather than characterizing actions, Cipolla characterizes individuals who carry them out.

contributions and references to the sphere of sports as economics are also included. The first of these sections focuses on those concepts and elements which render sports economics "peculiar", while the second one addresses the analysis of those markets where professional sport operates: the market for players and the market for fans (Szymanski, 2013). Finally, the fourth section focuses its attention on the economic analysis of physical activity and its relationships with other dimensions of individual and social welfare, as well as on the economic and social relevance of sport, including contributions to the study of the sports industry and its economic impact, as well as its potential future evolution and expansion.

Thus, in the first article of the present monograph, **Ignacio Palacios-Huerta**, based on the view of Becker (1976) on the applicability of the economic approach to the explanation of all human behavior, emphasizes the relevance and adequacy of data generated by sport for illustrating or verifying more general economic theories. In his overview of the existing empirical research adopting this approach, referred to as "sports as economics", Palacios-Huerta presents various relevant applications for economic analysis in fields as diverse as game theory, experimental economics, labor economics, finances, criminal behavior, or behavioral economics. For the author, this is the approach to be adopted for economic analysis using data from the sphere of sport in order to definitely establish "sports as economics", or else sports economics, in a broader sense, as a research discipline.

The concept most obviously identified with the peculiar nature of the economic analysis of professional sports is probably that of competitive balance. The article by **Stefan Kesenne**, which opens the second section of this monograph focusing on the peculiarity of sports economics, addresses the analysis of the effects of different kinds of regulations on the improvement (or not) of competitive balance. It is an excellent example of how microeconomic analysis can be used to study specific aspects of the sports industry, one of the research areas to be considered within the framework of what we could understand as sports economics. Specifically, the author examines measures such as revenue sharing, salary caps, or mobility of professional players, including an analysis of the characteristics of the transfer market. Analysis is conducted under different scenarios as regards the objective function of clubs. The article concludes with some recommendations on the actions to be taken in the framework of professional football in Europe.

Given the importance of competitive balance in much of the professional sport-related empirical research, the measurement of this concept is a relevant element in literature, given the variety of ways to approximate such measurement. In his article, **Brad Humphreys** reviews the different proposals made to quantify competitive balance, distinguishing between static and dynamic measures. The former, essentially based on the concept of standard deviation or on traditional concentration measures, such as the Herfindahl-Hirschman Index, have limited capacity to establish comparisons between competitions (leagues) in different periods, since they are unable to capture the stability of positions in table standings over time. On the contrary, dynamic measures do take account of that aspect, though their calculation is more complex. The empirical analysis of Major League Baseball for the 1906-2015 period included in the article shows differences in findings and their interpretation depending on the kind of measure used.

The article by **Rodney Ford** may be considered a retrospective analysis taking as point of departure the article that Ford himself wrote twenty years ago (Ford, 2000), where he makes a comparison of professional sports in Europe and North America. In both articles, analysis of differences between professional sports in both continents is structured around three elements, though the author is aware that other aspects worthy of comparative analysis are disregarded (the role of the public sector in professional sports, corruption, or labor relations, inter alia). The three structuring elements of this reflection are: fans (relevance of the uncertainty of outcome hypothesis), organization of professional sports (hierarchical structure, type of competition, closed or open, and talent training), and target function of clubs (maximize benefits or maximize something else). The author reasserts most of the considerations made in his 2000 article, while including new elements resulting from his research, conversations with colleagues, and counter-evidence.

The fourth article included in the second section addresses the peculiarity of sports economics, inasmuch as sport has become an excellent (real) laboratory where individual behavior-related aspects can be tested. The article by **Carlos Varela Quintana** and **Julio del Corral** addresses the existing relationship between sports economics and behavioral economics. The latter introduces concepts in economic analysis which are originated in Psychology and Sociology and enable to explain regularities through cognitive biases that could not be explained on the basis of the standard rational behavior. The authors provide a review of the key concepts associated with behavioral economics, as well as an exhaustive account of applications to sports economics, some of which are well-known not only in academia but also by the general public, such as the home advantage, the psychological pressure associated with penalty kicks, or scoring streaks ("hot hand"), inter alia. The article also suggests possible lines of future research.

The third section is devoted to the markets determining how professional sport operates: the market for fans and the market for players, including references to productivity and professional club finances. In the opening article of this section, **Stefan Szymanski** focuses on football, summarizing the profiles of football clubs on the basis of two concepts: dominance and financial problems ("financial distress"). Dominance is a common feature in major European leagues which, once achieved, is rarely lost, though the path to achieving it is somewhat idiosyncratic. The existence of such dominance can be explained by applying John Sutton's theory of sunk costs to football. In this case, dominance does not owe to the need for great infrastructures nor to the role played by advertising costs, but to the role played by talent recruitment costs, which present a barrier to smaller clubs. The latter suffer from a considerable financial pressure ("distress") due to the promotion and relegation system, which reinforces dominance of major clubs. The article, as pointed out by the author, lays the foundations for the design of measures to be adopted in order to preserve the most popular competition system in the world.

Analysis of demand for sporting events has been a most common subject matter in sports economics since its very beginning. In the article by **Isabel Artero, Eduardo Bandrés, Jaume García** and **Plácido Rodríguez** topics having drawn most of the attention for such empirical analysis are reviewed, from the perspective of both live game attendance and television audience analysis. Special emphasis is put on the recent debate over the role played by uncertainty of outcome in consumer behavior, and on the possible reasons for the apparently contradictory findings observed in literature, on the basis of the contributions made by behavioral economics. Furthermore, the most recent contributions to the study of the role played by suspense and surprise in the development of a sporting event and its impact on audience levels are presented, and two empirical works are moreover included, respectively analyzing game attendance in LaLiga and television audience levels of the matches played by Spain national football team, analyses which enable to explain the role of different variables in both kinds of demand.

Sports betting may be considered a sports consumption-related product, insofar as its raison d'être depends on the existence of sporting events. In their article, **David Forrest** and **Levi Pérez** review the evolution of sports betting over the past few years as a result of technological progress. The benefits and costs for sport implied in bets are also examined. The former notably include the complementarity of this product with consumption of sporting events (attendance and audience), which favors not only pre-match bets, but also in-play betting. Bets are moreover a source of revenue for professional clubs, obtained through the sale of data and sponsorship and advertising by sports betting agencies. Regarding costs, the authors focus on the close association between betting and match-fixing, both in individual and team sports. In the final part of their contribution, they discuss measures to be adopted in sport in order to safeguard its integrity.

The second market existing in professional sports, the market for labor, is analyzed in detail in the article by **David Berri** and **Rob Simmons**, who focus on four aspects: labor market institutions, monopsonistic exploitation, efficiency of labor market, and wage discrimination. In the case of American professional sport, restrictions to labor mobility, imposed for instance through reserve clauses, favor monopsonistic exploitation. In this regard, the comparison with sports in Europe, where there is a free market, is especially relevant. Moreover, the article provides an alternative interpretation of the *Moneyball* story[26] in terms of efficiency of decision-makers, instead of inefficiency as suggested in the book, though other inefficiencies in the labor market for professional sports are also mentioned. Finally, the authors underscore the importance of analyzing wage discrimination in empirical research, although they also point at the limitations of findings resulting from problems in identifying causal effects and biases due to the omission of certain variables, a usual problem in this kind of analysis.

The usual approach to talent recruitment is based on the achievement of results. In their article, **Pedro García-del Barrio** and **Juan de Dios Tena Horrillo** propose an alternative approach whereby talent recruitment is also justified as part of a strategy to increase media visibility of clubs in order to maximize revenues. Specifically, the authors carry out an empirical analysis, using data from four of the five major European football leagues, in which the explanatory variable is the media visibility of a club, measured through a media exposure index estimated for the different agents operating in the football market. The quality of competition and the relative quality of a club within a competition are relevant factors when it comes to explaining visibility. On the other hand, the authors conclude that differences in media visibility may partly owe to factors initially beyond the control of clubs, such as the quality of the competition in which they participate.

From the perspective of production, professional clubs not only produce a single output, but they are engaged in a multi-product process also entailing multiple inputs. In the article by **Manuel Espitia-Escuer, Lucía Isabel García-Cebrián** and **Ramón Sala-Garrido** analysis of the productivity of clubs participating in the UEFA Champions League is conducted, on the understanding that changes in productivity result from changes in efficiency (gap between produced and production frontier output), plus technical change (production frontier shifts). In their empirical analysis, the output variables used are number of games won, economic value of such games, goals scored and conceded, as

[26] *Moneyball* is the tittle of a book by Michael Lewis (2004) where he tells the story of a Major League Baseball (MLB) club, Oakland Athletics, which between 1999 and 2002, under the direction of Billy Beane, succeeded in qualifying for the final series and achieving the second-highest number of wins in the regular season, in spite of having the second-lowest budget of the MLB.

well as number of games lost as undesirable output measure to be included in analysis. Inputs are defined on the basis of the kind of strategy (attack or defense) devised by teams. Based on their findings, the authors conclude that efficient performances do not seem to be associated with future permanence in the competition, but indeed with technical progress, while no clear effect of the role played by coaches is observed.

The last article from this section dealing with professional sports markets focuses on finances in the sphere of football. **Luis Carlos Sánchez, Ángel Barajas** and **Patricio Sánchez-Fernández** analyze the relatively recent changes which have taken place in the football industry in Europe, observing substantial changes in club revenue sources and volume, as well as unsustainable financial situations. The authors also analyze the consequences of the economic liberalization process, the increase in revenue, and the appearance of financial controls in European football. Three economic consequences stand out: inflation in the market for players, though limited in relative terms with respect to revenues of major clubs; a similar effect on the volume of debt; and an overall increase in profitability over sales. At the same time, according to the authors, clubs from major leagues have consolidated their dominance in European competitions, while competitive balance has worsened in national leagues.

The fourth section, devoted to the economic relevance of sport in our society, includes five articles; the first two analyze the role of sports practice, while the remaining three address the economic relevance of the sports industry and the immediate expectations on its future. In the first work, **Fernando Lera López** and **María José Suárez Fernández** examine the recent evolution of sports practice in Spain and provide empirical analysis of the variables that characterize such practice, based on the standard specifications used in literature and the information included in the last four sporting habits surveys conducted in Spain. The authors furthermore describe public policies promoting sport, with special emphasis on the evolution and the role of sport-related public expenditure. In this regard, they underscore the differences in public regional expenditure, the responsiveness of expenditure to global economic developments, and the especial importance of expenditure incurred by local administrations as opposed to other levels of public administration.

The impact that sports practice might have on different dimensions related to the well-being of individuals is analyzed in the article by **Cristina Muñiz** and **Paul Downward**. Specifically, they provide evidence on the effects of physical activity on the perceived health of individuals or on more objective health-related indicators (obesity, heart diseases, diabetes, etc.). Specific reference is also made to the impact on social capital through social interactions favored by sports practice, with special attention to the role played by practice in mitigating problems affecting vulnerable groups. Finally, the effects on labor market-related indicators are analyzed by means of mediating elements such as health, physical appearance, soft skills, or human capital, with special emphasis on the impact on academic performance through enhancement of cognitive abilities.

The article by **Júlia Bosch, Carles Murillo** and **Josep Maria Raya** addresses the economic dimension of sport both from a sector-wide perspective, in terms of economic importance of the sports industry, and from a more microeconomic perspective, like that adopted for impact analysis of the organization of sporting events. In the former case, two methodological approaches are presented; one consists in identification of producers and products, both characteristic and related, of the sports sector, on the basis of a definition of sport as economic sector, namely, the Vilnius Definition of Sport; the second approach is based on the elaboration of satellite accounts for the sports industry. In the case of economic impact analysis of the organization of sporting events, the three usual methodological alternatives proposed in literature are presented, according to the size of the event and the available information: applied general equilibrium models, calculation of multipliers on the basis of an input-output model, and cost-benefit analysis.

In fact, the aforementioned studies on economic impact have sometimes served to justify state funding for the construction of stadiums or sporting facilities for professional sport, or else the preferential treatment consisting in subsidies or other public administration interventions. In their article, **Pablo Castellanos-García** and **José Manuel Sánchez-Santos** review the different arguments used in literature to provide the rationale for this kind of public interventions, discussing the tangible effects of the construction and operation of such facilities on employment, income, and tax collection, as well as the intangible effects produced through improvement in the standard of living in those areas enjoying the presence of a professional club (consumer surplus, externalities, and public goods). The authors provide empirical evidence for the case of Spain on the basis of two surveys, one of a more local nature on the disappearance of a professional football club in a town, and a more general survey on how the enjoyment of public goods generated by professional sport affects the happiness of individuals.

This last section on the economic and social importance of sport, and thus the monograph itself, closes with a consideration of the impact that new leisure habits favored by the new technologies might have on the sports sector, essentially through *eSports*, which is discussed in the article by **Yulia Chikish, Miquel Carreras** and **Jaume García**. The authors analyze the economic importance of the *eSports* sector and its organizational peculiarities in comparison with traditional sport, also contributing to the debate on whether *eSports* are really sport. They furthermore provide empirical evidence of the complementarity between *eSports* and traditional sport. Finally, from an academic perspective and establishing a connection with the opening article of the monograph, they review the *eSports*-related scholarly contributions, and suggest possible lines of future research on the basis of the peculiarities of this young sector, and of data availability.

By way of conclusion, and paraphrasing the terms of the debate on which is the objective function of professional clubs, sport economists, in particular the younger generations, should adopt a research "behavior" seeking to maximize creativity in their contributions rather than chances of getting published in a top-5 (T5) academic journal, as Heckman and Moktan (2018) conclude in their excellent article on the publication of papers and academic promotion: "Emphasis on the T5 in sorting talent creates a culture where vitae length rather than the development of a body of coherent and original ideas is most valued. It incentivizes careerism rather than creative scholarship".

In a way, this commitment to creativity as opposed to the exclusive concern with publishing in T5 journals correlates with the different ways of understanding decision-making in sport: tactical intelligence versus tactical creativity, according to the distinction proposed by Daniel Memmert, who has authored numerous scholarly papers on the subject,[27] in the interview mentioned in Andy West's book (2018). Tactical intelligence consists in finding the best solution among the obvious options (which is closer to the idea of publishing in T5 journals), whereas tactical creativity seeks to make decisions different from those appearing as obvious. According to Memmert, a creative action (decision) is original, rare, supple, and useful, this latter aspect being key for the advancement of the different disciplines. Adopting an approach similar to that implied in "sportometrics", Memmert emphasizes the applicability of studies on sportsmen behavior to other spheres of human activity.

To the extent possible, developments in sports economics should not only serve the specific purposes of the discipline, but also contribute to the development of economic research overall by means of creative proposals.

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[27] See, for instance, Memmert and Roth (2007), Memmert (2015), or Kempe and Memmert (2018), among many other studies on the subject.

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THE STONES OF GALILEO: SPORTS AS ECONOMICS

Ignacio PALACIOS-HUERTA[1]

Abstract

The general applicability of the economic approach to human behavior means that any data about human activity is potentially useful to evaluate economic theories, including sports.

And sports are in many ways the perfect laboratory to try to obtain novel insights into human decision-making. There is an abundance of data, the goals of the participants are often uncomplicated, the outcomes extremely clear, the stakes high, and the subjects professionals with experience.

This is a novel field in Economics that is gaining substantial attention in the literature. This chapter reviews recent research that uses sports data to help Economics from this perspective.

Keywords: human behavior, economic approach, sports, methodology.

JEL classification: A10, A12, Z00, Z20.

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[1] The descriptions of some articles in this survey follow in some parts those in my book *Beautiful Game Theory* (Princeton University Press, 2014). Although they differ, sometimes markedly, from the original ones, there are a few places where text has been borrowed. I want to thank Oscar Volij, Canice Prendergast, Jose Apesteguia, Karen Croxson, J. James Reade, Stefan Szymanski, and Thomas Peeters for their comments, and especially Jaume García Villar for his invitation to write this survey. Financial support from the Departamento de Educación, Política Lingüística y Cultura del Gobierno Vasco (project IT-869-13) and the Ministerio Español de Economía y Competitividad (project ECO2015-66027-P) is gratefully acknowledged.

Economics is the art of making the most of life.

—George Bernard Shaw

I. INTRODUCTION

The nature of the relationship between economics and sports surveyed here may not be entirely obvious at first. Over recent decades, economics has extended across many fields and conquered areas previously considered to belong to sociology, law, political science, history, biology, and other sciences. Economics can also conquer the analysis of sports and, indeed, research has shown that economics can say many things about sports. But this is not the motivating idea behind this survey. It is not about what economics can do for sports. The idea is precisely the opposite: It is about what sports can do for economics.

In the 16th and 17th centuries, stones falling from towers in Pisa and Florence sparked fundamental insights for Galileo Galilei (1564–1642) in his tests of the theory of gravity. Sir Isaac Newton (1642–1727) followed the same concept in the 17th and 18th centuries but worked with data from apples falling from trees. Apples or stones contributed to providing the empirical evidence necessary to evaluate a number of theories of physics for the first time. Just as data involving stones and apples were useful in physics, data from sports are useful for economics. Sport replaces apples and stones, and economics replaces physics. Using sports, this survey presents important research that has allowed economists to obtain novel insights into human behavior in recent years. This is what distinguishes it from other economics surveys.

Talking about distinctions, "what most distinguishes economics as a discipline from other disciplines is not its subject matter but its approach. … The economic approach is applicable to all human behavior" (Becker, 1976). In other words, because it is an approach applicable to all forms of human behavior, any type of data about human activity is potentially useful to evaluate economic theories. In fact, sports are in many ways the perfect laboratory for testing economic theories for a number of reasons. There is an abundance of readily available data, the goals of the participants are often uncomplicated (score, win, enforce the rules), and the outcomes are extremely clear. The stakes are typically high, and the subjects are often professionals with experience. And so, "if one of the attractions of spectator sports is to see occasionally universal aspects of the human struggle in stark and dramatic forms, their attraction to economists is to illustrate universal economic principles in interesting and tractable ways" (Rosen and Sanderson, 2001). More importantly, if economists are sufficiently lucky, sports may provide not just one illustration but the very first empirical test of an economic theory.

Perhaps the clearest instance of what motivates this survey and what it sets out to accomplish can be found in the movie *A Beautiful Mind,* Oscar recipient for Best Picture in 2001. It portrays the life and work of John F. Nash Jr., who received the Nobel Prize in Economics in 1994. Perhaps you would think that after a movie and a Nobel Prize, the theories of Mr. Nash must have been solidly established and empirically validated on countless occasions. Right? Well, not quite. A class of his theories deals with how people should behave in strategic situations that involve what are known as "mixed strategies," that is, choosing among various possible strategies when no single one is always the best when you face a rational opponent. The first article I will briefly review uses data from a specific play in soccer (a penalty kick) with professional players to provide the first complete test of a fundamental theorem in game theory: the Minimax theorem. This theorem can be regarded as a special case of the more general theory of Nash (1950, 1951) as it applies only to two-person, zero-sum or constant-sum games, whereas the Nash equilibrium concept can be used with any number of players and any mixture of conflict and common interest in the game.

This survey is divided into the following main sections:

1. Game Theory
2. Experimental Economics
3. Labor Economics
4. Finance
5. Crime
6. Behavioral Economics and Human Preferences

II. LITERATURE REVIEW

1. Game Theory

1.1. The Minimax Theorem

I thought there was nothing worth publishing until the Minimax Theorem was proved. As far as I can see, there could be no theory of games without that theorem.

—John von Neumann, 1953

As Kreps (1991) notes, "the point of game theory is to help economists understand and predict what will happen in economic, social and political contexts." But if von Neumann considered, as the initial quotation suggests, that there could be no theory of games without first proving the Minimax theorem, then it seems appropriate to think that he would have considered that there could be no empirical applicability of the theory of games without first having verified empirically that theorem. As will be noted below, the Minimax theorem was not empirically verified until 2003.

A likely reason is that the empirical verification of strategic models of behavior is often difficult and problematic. In fact, testing the implications of any game theoretical model in a real-life setting has proven extremely difficult in the economics literature for a number of reasons. A primary reason is that many predictions often hinge on properties of the utility functions and the values of the rewards used. Furthermore, even when predictions are invariant over classes of preferences, data on rewards are seldom available in natural settings. Moreover, there is often great difficulty in determining the actual strategies available to the individuals involved, as well as in measuring these individuals' choices, effort levels, and the incentive structures they face. As a result, even the most fundamental predictions of game-theoretical models have not yet been supported empirically in real situations.

Von Neumann published the Minimax theorem in his 1928 article *Zur Theorie der Gesellschaftsspiele.* The theorem essentially says:

For every two-person, zero-sum game with finitely many strategies, there exists a value V and a mixed strategy for each player, such that:

(a) Given player 2's strategy, the best payoff possible for player 1 is V, and

(b) Given player 1's strategy, the best payoff possible for player 2 is –V.

Equivalently, Player 1's strategy guarantees him a payoff of V regardless of Player 2's strategy, and similarly Player 2 can guarantee himself a payoff of –V.

A mixed strategy is a strategy consisting of possible moves and a probability distribution (collection of weights) that corresponds to how frequently each move is to be played. A game is called zero-sum or, more generally, constant-sum, if the two players' payoffs always sum to a constant, the idea being that the payoff of one player is always exactly the negative of that of the other player. The name Minimax arises because each player minimizes the maximum payoff possible for the other. Since the game is zero-sum, he or she also minimizes his or her own maximum loss (*i.e.,* maximizes his or her minimum payoff).

Most games or strategic situations in reality involve a mixture of conflict and common interest. Sometimes everyone wins, such as when players engage in voluntary trade for mutual benefit. In other situations, everyone can lose, as the well-known prisoner's dilemma situations illustrate. Thus, the case of pure conflict (or zero-sum or constant-sum or strictly competitive) games represents the extreme case of conflict situations that involve no common interest. As such, and as Aumann (1987) puts it, zero-sum games are a "vital cornerstone of game theory." It is not a surprise that they were the first to be studied theoretically.

In Palacios-Huerta (2003) I noted that a penalty kick in soccer was the ideal setting to test for the first time the Minimax theorem. Its clear and simple structure presents notable advantages over other plays in professional sports and other real-world settings.[2]

Minimax play yields two sharp testable predictions about the behavior of kickers and goalkeepers:

- Success probabilities–the probability that a goal will be scored (not scored) for the kicker (goalkeeper)—should be the same across strategies for each player;

- Each player's choices must be serially independent given constant payoffs across games (penalty kicks). That is, individuals must be concerned only with instantaneous payoffs, and intertemporal links between penalty kicks must be absent. Hence, players' choices must be independent draws from a random process. Therefore, they should not depend on one's own previous play, on the opponent's previous play, on their interaction, or on any other previous actions.

I initially tested these implications in Palacios-Huerta (2003) with 1,417 penalty kicks, and again in Palacios-Huerta (2014a) with 9,017 penalty kicks. The empirical evidence in both cases indicates that the hypothesis that scoring probabilities are identical across strategies cannot be rejected at the individual level for most players at conventional significance levels; the number of rejections is in fact essentially identical to the theoretical predictions. Further, runs tests and regression-based tests also show that the hypothesis of randomization cannot be rejected for the majority of players: professional subjects neither appear to switch strategies too often nor too infrequently, but just about the right amount.

[2] See the discussion in Palacios-Huerta (2014) about the limitations and shortcomings of other plays in other sports such as serves in tennis and pitches in baseball (for example, by ignoring the role of risk, Ely, Gauriot, and Page [2017].)

These results represent the first time that both implications of von Neumann's Minimax theorem are supported under natural conditions.[3]

1.2. Backward Induction

Backward induction, as a process of reasoning backwards in time, from the end of a problem or situation, to determine a sequence of optimal actions is used to compute subgame perfect Nash equilibria in sequential games. This is an important refinement of Nash equilibria of dynamic strategic situations.

A key question, therefore, is the following: Is backward induction implied by rationality? It turns out that it is not rationality, nor even mutual knowledge of rationality, but common knowledge of rationality that implies backward induction outcomes. Aumann (1995) notes that common knowledge of rationality "is an ideal condition that is rarely met in practice," and further contends that if this condition is absent, backward induction outcomes need not emerge.

But, can humans, any humans, satisfy common knowledge of rationality?

The empirical evidence from a number of experimental lab studies conducted with college students documents systematic departures from the backward induction outcome in various games. Studies often conjecture that various forms of social preferences, limited cognition, or even simply failures of backward induction reasoning play an important role in explaining why the equilibrium outcome is rarely observed in the lab.

Palacios-Huerta and Volij (2009) depart from previous experimental studies in the subject pool they consider: subjects who are very likely characterized by a high degree of rationality, namely expert chess players. These players devote a large part of their life to finding optimal strategies for innumerable chess positions using backward induction reasoning. More important, one can safely say that it is common knowledge among most humans that chess players are highly familiar with backward induction reasoning. The purpose in this study is to use these subjects to study the extent to which knowledge of an opponent's rationality is a key determinant of the predictive power of subgame-perfect equilibrium in the classic centipede game. By varying the "closeness" to common knowledge of rationality across different experimental treatments, it is also possible to separate the hypothesis of the epistemic literature on rationality from that of social preferences.

[3] In a neuroeconomics study, Palacios-Huerta *et al.* (2014) "locate" Minimax in the brain.

The main findings are that both in the field and in the lab, when chess players play against chess players, the outcome is very close to the subgame-perfect equilibrium prediction. Further, in the lab experiments more than 70 percent of the games ended at the first node, and every chess player converges fully to equilibrium play already at the fifth repetition.

These results suggest that the ideal condition of common knowledge of rationality seems to be approached closely when chess players play the centipede game. Also, when students play against chess players the outcome is much closer to the subgame-perfect equilibrium than when students play against students. These findings are also highly consistent with the predictions of the theoretical literature in that the predictive power of subgame-perfect equilibrium hinges mainly on knowledge of players' rationality, and not on altruism or social preferences. In an interesting paper, Baghestanian and Frey (2016) replicate these findings with GO players.

Hence, the results offer novel support for standard approaches to economic modeling based on the principle of self-interested rational economic agents whose behavior is in turn based on their assessments of the behavior of their opponents in a game.

2. Experimental Economics: Field and Lab

Although Vernon Smith received the 2002 Nobel Prize in Economic Sciences "for having established laboratory experiments as a tool in empirical economic analysis," this tool has become under severe attacks in recent years. A main critique is that the data generated in laboratory experiments are not "realistic," and hence to obtain more realistic data we should pursue experiments not in the lab but in the field.

From a theoretical perspective, Falk and Heckman (2009) explain in some detail why this critique is not only misguided but plain wrong.

From an empirical perspective, Camerer (2015) reviews the available studies on markets, student donations, fishing, grading, sports cards and restaurant spending that provide the closest matches of lab and field settings, protocols and subjects and confirms these predictions. He concludes that "no replicated evidence that experimental lab data fail to generalize to central empirical features of field data when the lab features are deliberately closely matched to the field features." In Palacios-Huerta and Volij (2008) we performed exactly the same type of exercise but in situations that involve game-theoretical strategic interaction. This is an exercise that would appear to be particularly relevant in game theory because this is in fact one of the areas where laboratory data are often used to inform theory, but where no joint field-lab evidence exists.

In particular, we study the same strategies with the same professional subjects playing the same penalty kick game not in real life with a soccer ball but in a laboratory setting with cards. The idea is to evaluate the extent to which experimental lab data generalize to central empirical features of field data when the lab features are deliberately closely matched to the field features.

We find that the behavior of professional soccer players contrasts sharply with the overwhelming experimental evidence from the psychological and economics literatures. Years of field experience appear to be quite valuable for generating randomness in strategically similar laboratory games. In fact, this is the first time that subjects have been found to display statistically significant serial independence in a strategic laboratory game. Further, subjects equate payoffs across strategies and to the equilibrium success rates. In other words, they behave in the lab essentially as they do in the field.

These two pieces of evidence represent the first time that a pool of subjects satisfy the equilibrium conditions in the laboratory in games requiring probabilistic mixtures. Experience transfers from the field to the lab, consistent with the review in Camerer (2015) in non-strategic settings.

3. Labor Economics

3.1. Taxation

Tax-induced international mobility of talent is an important public policy issue. For instance, high tax rates may induce highly paid workers to migrate to countries where the tax burden is lower, hence limiting the redistribution effects of progressive taxation. There are vast empirical literatures on labor supply and taxable income responses to taxation within countries. There are also many studies on the effects of capital taxation on multinational corporations and international capital mobility that find substantial mobility effects. But there is very little empirical work on the effect of taxation on the spatial mobility of individuals, especially among high-skilled workers. This is partly due to a lack of micro data with citizenship information and various challenges to identify causal tax effects on migration.

Kleven, Landais and Saez (2013) takes an important step to fill this gap in the literature by taking advantage of the specific labor market for professional football players in Europe. This market offers three important advantages for the study of mobility and taxation. First, international mobility is high. Second, extensive data on the careers and mobility of professional football players can be gathered for most countries over long time periods. Third, it is possible to exploit many sources of variation in both tax policy and labor market regulation to identify the effect of taxation on mobility in the football market: (i) Top tax rates vary across countries and over time; (ii) Some countries have introduced preferential tax schemes to immigrant workers; (iii) The so-called Bosman ruling by the European Court of Justice in 1995 lifted preexisting restrictions on player mobility, facilitating an analysis of the interaction between taxes and regulation on mobility.

The authors find evidence of strong mobility responses to tax rates, with an elasticity of the number of foreign (domestic) players to the net-of-tax rate around 1 (around 0.15). They also find evidence of sorting effects (low taxes attract high ability players who displace low-ability players) and displacement effects (low taxes on foreigners displace domestic players). These results, which can be rationalized in a simple model of migration and taxation with rigid labor demand, represent the first causal evidence of taxation on location choice and mobility in the literature.

3.2. Human Capital: Pay, Performance, and Schooling Returns

Two important papers fall within the category of the "human capital returns" literature. The first one, Scully (1974), is essentially the first paper that calculates subjects' marginal revenue products. The purpose of this paper is to measure the economic loss to the players due to the restrictions of the reserve clause in baseball. To do so, he estimates the relationships between player performance and salary, and the predicted salary is compared to the predicted player marginal revenue product. The approach has substantial advantages over much of the literature: 1) data on individual subjects is available; 2) salary functions can be estimated in labor market characterized by extensive bargaining; 3) it is posible to estimate marginal revenue products of the factors of production; and 4) rates of monopsonistic exploitation can be obtained by comparing salary and marginal revenue products.

The second paper, Stevenson (2010), nicely starts as follows: "While economists have spent decades estimating the returns to an additional year of schooling, less is known about how *what* young people *do* in school contributes to these returns. One presumption is that classroom learning is the source of these returns, yet academic research has simultaneously had little success connecting the returns to schooling to high school curriculum and found large associations between labor market returns and nonclassroom oriented activities such as sports participation." In particular, the author follows a long debate in both economics and sociology about the merits of high school sports. As with other aspects of the curriculum, "what remains elusive is whether benefits associated with athletics are treatment effects (caused by participation) or merely selection effects (associated with the type of student who chooses to participate in athletics)." In order to avoid this critical difficulty, Stevenson notes that between 1972 and 1978 U.S. high schools rapidly increased their female athletic participation rates in order to comply with Title IX. This allows her to examine the causal implications of this expansion by using variation in the level of boys' athletic participation across states before Title IX to instrument for change in girls' athletic participation. Importantly, she finds that a 10 percentage point rise in state-level female sports participation generates a 1 percentage point increase in female college attendance and a 1 to 2 percentage point rise in female labor force participation.

3.3. Discrimination

In the past two decades, substantial progress has been made in the development of theoretical frameworks to study different aspects of racial differentials in wages, employment, and other labor market outcomes, including in professional sports (see Kahn, 1991). Gary S. Becker's (1957) classic model of discrimination differs from almost all other major models of discrimination in that it departs from the standard assumption that firms maximize profits. As long as discrimination persists in equilibrium, prejudiced firms will earn lower profits. Similarly, if workers engage in prejudice (*e.g.,* by refusing to work with certain groups of workers) or consumers do (*e.g.,* boycotting products supplied by those groups) then they will forego earnings or pay higher prices because of their prejudice.

A common empirical approach to test models of discrimination is to test directly whether the wage equals the value of marginal product as predicted by profit maximization. We can test, for instance, whether subjects with similar statistical measures of performance receive equal wages. Such studies, however, are always subject to the criticism that the statistical measures we observe may not capture productivity exactly. It is possible to think of estimating a production function and ask whether wage differentials are proportional to marginal productivity differences. This approach, however, requires strong and implausible assumptions to identify the marginal product.

Szymanski (2000) suggests a novel test using soccer. Assume soccer fans care only about winning and team owners care only about pleasing the fans and therefore increasing profits. Then, for a given salary bill, the teams' win/loss records should be *independent* of the racial composition of the team. If, among teams with the same total salary bill, those with more black players have better records, then a team could improve its performance by hiring more black players. Either the team owners must not be maximizing profits, or consumers must care about the racial composition of the team.

Thus Szymanski found a clever way out of the many problems that plague the empirical analysis of discrimination. Instead of worrying fruitlessly about the standard omitted variable bias, he argued for a market-based test of racial discrimination. And it could in principle be possible to perform such test if we could find a setting where performance is easily measurable, workers' ability is a very important source of firm performance, and the labor market is efficient. This is precisely what Szymansi does. He studies a dataset of 39 clubs over the 16-year period 1978-1993 in the professional English soccer leagues to analyze how the proportion of black players employed impacts the success of soccer clubs after controlling for wage expenditure.

Intuitively, in this model an owner's preference for discrimination can be simply seen as a tax on the success of his team. For a given level of talent, the club will have to pay more than a non-discriminating club. This yields a testable hypothesis: the expected performance (in terms of team position in the league), given any level of wage expenditure, should be worse for teams of discriminating than non-discriminating owners.

Consistent with the hypothesis that a taste for discrimination is behind the observed shares of black professional soccer players in some clubs, Szymanski finds that a regression of league position on the race variable, controlling for the wage bill, is statistically significant. If factors completely uncorrelated with racial discrimination were responsible for the distribution of black soccer players, the coefficient of the race measure should not have been statistically different from zero.

How did the situation evolve since the end of the sample period 1978-1993 in Szymanzki, say over the *following* 16-year period 1993-2008? Specifically, is there any evidence that competition alleviates this form of racial discrimination over time?

There are reasons to think that the situation, in fact, may not have been sustainable. Arrow (1973) contends that if the market in question were efficient then non-discriminating profit-maximizers, taking advantage of the underpriced asset, would be able to drive the discriminating firms out of the market over time. In other words, in a competitive market, this type of discrimination would be competed away since non-discriminatory clubs would employ black players, given their lower cost (at any given level of talent).

In the sample period examined by Szymanski, the market for corporate control of English professional soccer clubs was still very limited and management policies were extremely conservative. However, since the early 1980s, a market for corporate control has emerged, English soccer has become both more competitive and more open to new ideas. Besides an even more competitive labor market, the shares of black players have continued to increase relentlessly during the past three decades.

For these reasons, the theory suggests that the wage premium for white players should shrink over the years, and perhaps even disappear. In Palacios-Huerta (2014c) I find evidence that confirms this hypothesis: the impact of the race variable has disappeared, to the point that the coefficient is statistically insignificant and identical to zero (see also Goff, McCormick and Tollison, 2002.)

Besides studying *conscious* forms of discrimination, it is also possible to study *unconscious* or *implicit* forms of discrimination (an unconscious mental association between members of a social group and a given negative attribute) for the first time in this sports setting. This type of discrimination has received a lot of attention from psychologists, while economists have tended to focus on conscious forms of discrimination. Gallo, Grund and Reade (2013) use a large dataset on soccer matches in England to investigate discrimination by referees against players belonging to specific social groups, in particular against players of *oppositional identity* (defined as players who are foreign, non-white and who are from the same background as the most sizable minorities in the United Kingdom). The empirical evidence shows that white referees award significantly *more* yellow cards against non-white players of oppositional identity, controlling for several player, team, referee and match characteristics.

Finally, Parsons *et al.* (2013) note an important issue: discrimination alters discriminated groups' behavior generally, and biases in measured productivity must be accounted for in generating measures of wage discrimination. In particular, they study Major League Baseball umpires and find that they do express their racial and ethnic preferences when they evaluate pitchers. Pitchers understand the incentives and throw pitches that allow umpires less subjective judgment. This is a very important aspect first noted in this study because these direct and indirect effects bias performance measures of minorities downward. They also find support for Price and Wolfers' (2010) results on racial discrimination among NBA referees.

3.4. Talent Discovery and Assortative Matching in Labor Markets

The option value of employment relationships is critical for efficient turnover decisions in labor markets. Hiring a run-of-the-mill worker, whose ability is well known, is socially inefficient if it is possible to hire someone else, who is equally able in expectation, but could turn out better or worse. In this case, upside risk is more valuable than downside risk, because successful workers tend to have longer careers than unsuccessful ones. Hence, it would be socially efficient if firms preferred riskier over safer job candidates. A problem arises when worker performance is readily observable to competing employers, *e.g.,* in creative industries such as music and sports. Here the finders do not get to keep the stars they discover, at least not at a wage that would leave enough rents to compensate employers for their initial investment. When differences in ability entail large differences in economic value, it is also unrealistic to expect entry-level workers to compensate firms for the full value of the chance to be discovered. In this case, employers rationally adopt a lenient threshold for retaining experienced workers. This allows "mediocrities", workers whose ability is already revealed to be below the threshold for efficient retention, to survive in the labor market. As a result, average worker ability in the industry is inefficiently low (Terviö, 2009).

Peeters, Szymanski, and Terviö (2018) test this reasoning using 38 years of high frequency data on worker performance in the labor market of English soccer managers. In this industry, winning games is a commonly acknowledged and universal benchmark of worker performance. While soccer is a classic example of team production, the manager's distinct role allows to separate his contribution from the contribution of other inputs, which the authors assess using the audited financial statements of the clubs. A unique feature of this setting is that the exact timing of each performance (*i.e.,* each game) is known. The authors can therefore (re-)estimate each active worker's ability after each calendar month, based solely on contemporaneously available performance information.

The authors then study each instance where an employer hires an experienced worker, *i.e.,* a manager who had previously been employed by another club. They compare the estimated ability of the selected experienced manager to recently hired "entrant" workers without prior experience. For more than forty percent of these hires, the revealed ability of the rehired experienced manager lies below the threshold, which would maximize the average ability of the active workforce in the sample. For around one fifth of these hires the revealed ability of the experienced manager even lies *below* the expected ability of recent entrants. This implies that, in the language Terviö (2009), many "mediocre" incumbent workers are being retained in the labor market.

The analysis also shows that it is extremely difficult to predict a manager's ability before he enters his first employment spell. However, as managers gain experience, their ability is quickly revealed to the market as a whole. In combination with the inability of managers to either finance their own entry into the labor market or credibly commit to long-term contracts with their initial employer, these unique circumstances closely resemble the setting of Terviö (2009). This is an important paper which overcomes the difficulties found even in experiments designed with a similar purpose (Pallais, 2014).

Related to the issues just discussed is that fact that firms can use hiring and separations through layoffs, quits, or retirement as tools to increase productivity and profits. Firms may hire young, inexperienced workers who have just entered the labor market or more experienced workers who have quit or been let go from another job. Positive assortative matching, whereby better workers tend to move to better firms, is a natural consequence. Interestingly enough, this fact is not well established in an important theoretical and empirical literature as several problems persist both on the theoretical and empirical sides. For instance, with the data available to researchers it is extremely difficult, if not impossible, to properly measure workers' and firms' type, productivity is typically reported at the level of the firm, and measures of individual productivity are usually not available. Filippin and Van Ours (2015), however, manage to investigate the existence, the direction, and the intensity of assortative matching free from most of these difficulties by exploiting the unique features of a dataset based on the 24-hour relay marathon "San Martino" held in Belluno (Italy), in which runners perform in teams.

3.5. Tournaments and Competition

Much attention has been devoted to studying models of tournaments or situations in which an individual's payment depends only on his or her output or rank relative to that of other competitors. Academic interest derives from the fact that under certain sets of assumptions, tournaments have desirable normative properties because of the incentive structures they provide. Importantly, tournament competitions are pervasive in organizations, and often characterize situations such as competitions for promotion in internal labor markets in firms and organizations, patent races, political elections, and many others. As a framework of analysis, over the last couple of decades a large literature has studied a number of important aspects of this incentive scheme both theoretically and empirically. Some of these aspects have been first documented in a sports setting: incentives, dysfunctional consequences, relative abilities and career prospects. They are discussed next.

3.5.1. Tournaments and Incentives

Ehrenberg and Bognanno (1990) uses nonexperimental data to test whether tournaments actually elicit effort responses. This is the first and most critical testable implication of the model. The authors focus on professional golf tournaments because information on the incentive structure (prize distribution) and measures of individual output (players' scores) are both available. They find strong support for the proposition that the level and structure of prizes in PGA tournaments influence players' performance.

3.5.2. Tournaments and Dysfunctional Responses

Strong incentives may have dysfunctional consequences. CIA field agents rewarded on the number of spies recruited fail to invest in developing high quality spies. Civil servants rewarded on outcomes in training programs screen out those who may most need the program. Training agencies manipulate the timing of their trainees' performance outcomes to maximize their incentive awards. Teachers cheat when schools are rewarded on student test scores. A theoretical literature going back at least thirty years has studied the possibility of dysfunctional responses to incentives in different settings as strong incentives may be particularly damaging if agents can devote resources not only to productive activities but also to depressing each other's output.

However, while anecdotal accounts of "back-stabbing," bad-mouthing and other sabotage activities are easy to find, there does not exist any systematic work documenting such responses. An obvious reason why such actions are usually *impossible* to document is that workers who sabotage their fellow workers' performance typically go to great lengths to conceal their actions.

These critical difficulties are overcome in Garicano, and Palacios-Huerta (2014) who study an incentive change where both productive and sabotage activities can be directly observed.

Football teams that engage in league competition (round-robin tournaments) have historically been rewarded with 2 points for winning a match, 1 point for tying, and no points for losing. In the run up to the football World Cup that was to take place in the US in 1994, the governing body of the game FIFA, decided to change the reward for the winning team from 2 points to 3 points while leaving the reward for ties and losses unchanged.

This change subsequently became part of the Laws of the Game and was applied after 1995 to all league competitions worldwide. Garicano and Palacios-

Huerta use a detailed data set on football matches in Spain before and after the change to study the impact of this change in rewards along a number of dimensions.

This setting has two unique advantages. First, negative activities (or sabotage or "dirty play" intended to reduce the performance of the competitor) are *observable.* Second, the very same teams that engage in league play were playing at the same time in a different tournament that experienced no changes in incentives. Using their behavior in this tournament, it is possible to eliminate the effect of any changes in styles of play or other time trends unrelated to the incentive change.

Consistent with the theoretical implications, measures of offensive effort ("good effort") such as shot attempts on goal and corner kicks increased. Interestingly enough, indicators of sabotage activity such as fouls and unsporting or dirty behavior punished with yellow cards also increased following the change. It turns out that the net result of these opposing forces was that the number of goals scored (the main desirable outcome) did not change.

3.5.3 Tournaments and Relative Abilities

Brown (2011) notes that internal competition may motivate worker effort, yet the benefits of competition may depend critically on workers' relative abilities: as such large skill differences may reduce efforts. Brown uses panel data from professional golf tournaments and find that the presence of a superstar is associated with lower performance. In particular, on average golfers' first-round scores are approximately 0.2 strokes worse when, for example, Tiger Woods (the superstar in her database) participates relative to when Woods is absent. The overall tournament effect is 0.8 strokes, and there is variation in this adverse superstar effect depending on the quality of Woods's play. This is an important paper that nicely complements the empirical literature on competition in tournaments.

3.5.4. Career Prospects

Career prospects create implicit effort incentives. This is a fundamental proposition in labor markets both in the sense of within-firm promotions and external career opportunities. But this fundamental proposition is difficult to test because researchers cannot randomly "assign" career prospects to economic agents. To overcome this challenge, Miklos-Thal and Ulrich (2016) use data from professional soccer, where employees of the same club face different external career opportunities depending on their nationality. More precisely, they test whether the career prospect of being selected to a Euro Cup national team affects players' pre-cup performances, using nationals of countries that did not participate in the Euro Cup as a control group. Interestingly, they find that the Euro Cup career prospects have *positive* effects on the performances of players with intermediate chances of being selected to their national team, but *negative* effects on the performances of players whose selection is very probable.

4. Finance

The efficient markets hypothesis is perhaps the most important hypothesis in financial economics. It is most commonly associated with Eugene Fama and its early origins can be traced back to Louis Bachelier who studied the dynamics of stock price behavior. If the theory is correct, that is if observed changes in stock prices are unpredictable, there is not much we can do to gain an advantage over other traders, except perhaps to try to identify the news that causes stock prices to rise and fall and understand the size of any likely price jump. Even this is difficult, often impossible.

This theory implies that the price of an asset should jump up or down discretely when news breaks and then remain flat until further new arrives. Thus we would need to isolate a news event–finding a meaningful window of time after it in which we could be certain that no further news has arrived. But how can we ascertain that no more news have occurred when there is the potential for news to arrive continually? It does not appear to be possible to stop the time for news but let the time for trading continue (and then test that the price is not changing). Time is the same for everyone.

Actually, it is even worse, much worse: no news can be very informative, and we do not know how many news are contained in the absence of news and the simple passage of time.

Thus, the situation seems hopeless. But sports provide a unique setting were none of these crucial difficulties exist. Croxson, and Reade (2014) study market efficiency using high-frequency data extracted from live and heavily-traded soccer betting markets. The major news in soccer betting concerns the arrival of a goal. Thus, if betting markets are efficient then prices should respond *immediately* and *completely* to goal arrival.

The authors further address the many identification challenges very cleverly by exploiting the existence of the half-time interval. In fact, this break in play provides a golden opportunity because the playing clock stops but the betting clock continues. Hence, any drift in half-time prices can be interpreted unambiguously as evidence for market inefficiency since efficient prices should *not* drift during the newsless interval. This is a testable hypothesis. Further, it is possible to apply a test for statistical efficiency to half-time prices in games in which a goal arrives just before the start of the break ("cusp goals"), as well as a test for economic efficiency which would ask whether a hypothetical trader could make money during the interval by exploiting any potential over- or under-reaction to cusp goals.

The results of this fascinating paper provide strong support for the hypothesis of market efficiency.

5. Crime

In McCormick and Tollison's (1984) classic paper, the authors note that they could study the addition of a third referee to conference basketball games in 1978 to test Gary Becker's (1968) model of the economics of crime and punishment, using fouls called on basketball players. The added referee increased the probability that a foul would be detected. Hence, if behavior didn't change, the number of fouls called in a game would rise. But player behavior is likely to adapt to the larger probability of being called for a foul, and the number of actual fouls would decline as a result. McCormick and Tollison found that the number of foul calls fell by more than 30% with the addition of the third referee, in line with a key implication of Becker's model, a cornerstone in the study of the economics of crime.

6. Behavioral Economics and Human Preferences

6.1. The Resolution of Uncertainty

Experimental evidence suggests that individuals are more risk averse when they perceive risk that is gradually resolved over time. However, despite the evidence and the intuitive appeal of this proposition, until recently this essential insight has not been formalized in the economics literature. Dillenberger (2010) studies a decision maker who has recursive, non-expected utility preferences over compound lotteries. The decision maker has preferences for one-shot resolution of uncertainty if he always prefers any compound lottery to be resolved in a single stage. He also establishes an equivalence between dynamic preferences for one-shot resolution of uncertainty and static preferences that are identified with commonly observed behavior in Allais-type experiments.

The notion that Dillenberger formalizes is an idea first raised by Palacios-Huerta (1999), which I described with a simple example as follows: "On a given day in June 1994, in Los Angeles, the national soccer teams from Brazil and Italy played in the World Cup final. As most people in the world did, a well-known Brazilian professor of economics in the United States watched the game. After the regulation time the game was tied. After an extra thirty minutes the game remained tied. The soccer champion of the world for the next four years then had to be decided in a five-penalty-kick shoot-out. The professor then switched off his television set, as perhaps did many other people, especially Brazilians and Italians. He also made sure he could not get any information about the sequential resolution of the penalty kicks from the radio or from other people. Why did he do it?"

As Dillenberger (2019) shows the formalization of the answer to this question, however, is not trivial. To begin with, note that the expected utility model of preferences, cannot explain this behavior: if the opportunity cost of time is zero, if no actions can be taken to affect the final outcome and, obviously, if there is no disutility attached to watching any one player kick a soccer ball, then the professor should be indifferent ex ante between watching the penalty shoot-out and not watching it. In other words, the process of the resolution of the uncertainty itself should not provide any disutility. But it does. This is a phenomenon which started from an observation in a sports setting.

6.2. Psychological Pressure in Dynamic Competitive Environments

Motivated by evidence from new and richer datasets, during the last couple of decades, an important body of research has attempted to incorporate psychological motives into standard economic models. A great deal of laboratory evidence has been accumulated demonstrating circumstances under which strict rationality considerations break down and other patterns of behavior, including psychological considerations, emerge. Nature, however, is less willing to contribute with empirical evidence. In fact, it rarely creates the circumstances that allow a clear view of the psychological principles at work. And when it does, the phenomena are typically too complex to be empirically tractable in a way that allows psychological elements to be discerned within the characteristically complex behavior exhibited by humans.

In Apesteguia and Palacios-Huerta (2010) we noted that a *penalty shoot-out* (a sequence of penalty kicks by two teams) provides an ideal, clean opportunity in a real-world environment to discern the presence of psychological elements. Among others, and in addition to the virtues of a penalty kick described in Palacios-Huerta (2003), a penalty shoot-out is a randomized natural experiment in a tournament in which the treatment and control groups are determined via explicit randomization. In this case the treatment given to one team is the *order* of play: one team goes first in the sequence of tasks (penalty kicks) and the other second. As is well known, randomized experiments provide researchers with the critical advantage that they guarantee that the conditions for causal inference are satisfied.

We studied 269 shoot-outs (and in Chapter 5 of Palacios-Huerta [2014a] the sample was extended to 1,001 shoot-outs) and found that a penalty shoot-out is not a 50-50 lottery. It turns out that is more like a 60-40 lottery where the first-kicking team has 20 percent more tickets. The order of play is strongly significant and there is a sizeable advantage to the team that is first to kick. The leading/lagging asymmetry that is imposed by the randomly determined order of competition appears to cause psychological differences that impact performance. We also find that individuals are aware of this effect and rationally respond to it when given the chance by choosing to kick first. This means that research on dynamic competitive settings that incorporate psychological elements associated with the state of the competition may offer valuable insights that otherwise would be lost.

Gonzalez-Diaz, and Palacios-Huerta (2016) extend the same idea to study cognitive performance in a high-stakes competitive environment also in a tournament framework. The setting is a chess match where two players play an even number of chess games against each other alternating the color of the pieces. White pieces confer an advantage for winning a chess game and who starts the match with these pieces is randomly decided. The theoretical analysis shows that in this setting there is no rational reason why winning frequencies should be better than 50-50 in favor of the player drawing the white pieces in the first game. Yet, we find that observed frequencies are again about 60-40.

We conclude from these two articles that the evidence is consistent with the hypothesis that psychological elements affect cognitive and non-cognitive performance in dynamic competitions in the face of experience, competition, and high stakes. Morillo (2011) also confirms these findings on leading/lagging asymmetries in performance among NBA players in free-throws.

Just as a corollary, when the order of actions generates psychological effects that may influence performance, there may be policy recommendations to design an ex ante fairer order. In Palacios-Huerta (2012) I have proposed the order in the Prouhet-Thue-Morse (PTM) sequence as a way to mitigate and perhaps eliminate any advantage inherent in the playing order. I am not aware of any sports that follow this sequence (or those suggested in Brams and Ismail, 2018; and Anbarci, Sun, and Ünver, 2018) although a version of it has been trialled in Cup competitions in England and Holland during the past two years. The closest sequence found in real-life competitions is that followed in tennis tiebreaks in which the order of the first two serves (AB) is reversed in the next two serves (BA), so the first four serves are ABBA, and then this is repeated until one player wins the tiebreaker: ABBA-ABBA- etc. The experiments in Chapter 5 in Palacios-Huerta (2014a) confirm that both the PTM and ABBA sequences improve the fairness of the competition. Similarly, Cohen-Zada, Krumer, and Shapi (2018) have recently found that serving first or second in ABBA tiebreaks in tennis does not have any significant effect on the winning probabilities of the two players.

Disentangling psychological advantage from strategic advantage is no simple matter, and these articles are the first to show that psychological elements associated with the dynamics of competition can be highly relevant to determine performance regardless of strategic considerations.

Relatedly, Genakos, and Pagliero (2012) study the impact of interim rank on risk taking and performance using data on professionals competing in tournaments for large rewards. An excellent, unique feature of their setting (weightlifting competitions) is that they observe both the intended action and the performance of each participant, and so they can measure risk taking and performance separately. They present two key findings. First, risk taking exhibits an inverted-U relationship with interim rank. Hence, revealing information on relative performance induces individuals trailing just behind the interim leaders to take greater risks. Second, competitors systematically *underperform* when ranked closer to the top, despite higher incentives to perform well. Consistent with the previous findings, performance pressure on those leading the competition is likely different from the pressure on those lagging behind. In a follow-up paper, Genakos, Pagliero, and Garbi (2015) again focus on how interim ranking in a dynamic tournament affects performance. The nice aspect in this new setting is that they can focus on how performance varies depending on interim ranking, while holding constant the type of task being performed. They can do this by exploiting a unique feature of diving competitions: an athlete's entire dive list is announced before the competition begins. Athletes must perform the exact movements required for the announced dives. No changes are allowed. Thus, the full list of movements to be performed within each competition is completely predetermined. This feature greatly simplifies the analysis of the impact of interim rank on performance, since athletes' strategies cannot respond to events during the competition. Although the skill sets required by competitive diving and weightlifting are completely different (agility vs. strength), they still find consistent evidence that professional divers, like weightlifters, underperform when close to the top of the interim ranking.[4]

[4] Consistent with the research reviewed in this subsection, Krumer, and Lechner (2017) examine the role of schedule in round-robin tournaments between three and four contestants in FIFA World Cups, UEFA European Championships and in Olympic wrestling events. They find a substantial advantage to the contestant who competes in the first and third matches.

6.3. Experience, Competition and Incentives

Psychologists and others in recent yers have place great emphasis on limits on individual rationality, but people train themselves to reduce and sometimes more than fully overcome their emotions.

—Gary Becker, 1996

As we have just seen, pressure associated with the state of the competition may cause significant differences in the performance of the competitors. In Apesteguia and Palacios-Huerta (2010) the effect was found among professionals in a high stakes competitive setting. Thus, professionalism, high stakes and competition did not appear to eliminate their emotional responses. Nevertheless, the vast majority of professionals players in that study rarely encountered the situation they faced (a penalty shoot-out). Hence, it is not known what would happen if they had to face that situation much more frequently. If subjects have some capacity to control their emotions and if the incentives to do so become sufficiently greater, then, through training, practice and other forms of investment, they could become less sensitive to psychological pressure. This is a testable implication. In Palacios-Huerta (2014b) I take advantage of a unique natural experiment in Argentina which was only run for one season to study this hypothesis in exactly the same setting (a penalty shoot-out).

In the season 1988-89, the Argentine league championship decided to experiment with an unusual points system: after each drawn match there will be a penalty shoot-out to determine which team got a bonus point. That is, the modified point system just for that season was as follows: 3 points if a team wins the match, 2 points if a team draws the match and wins the penalty shoot-out, 1 point if a team draws the match and loses the penalty shoot-out, and 0 points if a team loses the match.

Most professional players in most countries are involved in no more than one or two penalty shoot-outs in their *lifetime.* The natural experiment in Argentina meant that in that season every team was expected to be involved in roughly one shoot-out every *three weeks.* Players were going to be exposed to a situation much more frequently and in a much shorter period of time than ever in the history of soccer. No team, country, league or tournament has ever before or after featured such a high chance to be in that specific situation (a penalty shoot-out) for such a long period of time (a weekly league competition for 38 weeks). Thus this situation provides a unique opportunity to study if the increased in incentives was sufficiently large to induce subjects, through training, practice and other forms of investment in "mental capital", overcome their psychological pressure. The answer is that they did: Winning probabilities for the two teams was statistically no different from 50-50 in Argentina 1988-1989.

A related question is not whether psychological effects but whether *psychological biases* found in judgment and decision-making research remain present in contexts in which experienced participants face strong economic incentives.

Massey, and Thaler (2013) analyze the decision making of National Football League teams during their annual player draft. This is a setting in which monetary stakes are high and the opportunities for learning are rich. Using archival data on draft-day trades, player performance, and compensation, they compare the market value of draft picks with the surplus value to teams provided by the drafted players. They find that top draft picks are significantly overvalued. Similarly, Pope and Schweitzer (2011) test for the presence of a fundamental bias, loss aversion, in a high-stakes context: professional golfers' performance on the PGA Tour. In this natural setting golfers have a salient reference point at each hole, par, and yet they are rewarded for the total number of strokes they take during a tournament. Evidence from over 2.5 million putts shows that even the best golfers are subject to loss aversion.

Loss aversion relative to a reference point is an important concept in the behavioral economics literature. But knowledge of where reference points come from is limited. Anderson and Green (2015) propose that one's *personal best,* or past peak performance, acts as a reference point by inducing effort when current performance would otherwise fall short. Analyzing a massive dataset of online chess games, these authors find that players exert effort to set new personal best ratings and quit once they have done so. Individuals do compete with their past selves.

6.4. Social Effects and Endogenous Preference Formation

Social environments influence individual behavior. This is an important aspect which has long been the focus of the literature on endogenous preference formation but where convincing empirical tests are difficult to find.

Miguel, Saiegh, and Satyanath (2011) exploit the presence of hundreds of international soccer players with different exposures to civil conflict in the European professional leagues, and find a strong relationship between the extent of civil conflict in a player's home country and his propensity to behave violently on the soccer field, as measured by yellow and red cards.

Garicano, Palacios-Huerta and Prendergast (2001, 2005) is concerned with the effect of nonmonetary incentives on behavior, in particular with the study of social pressure as a determinant of corruption. The analysis differs from extensive work in the literature on corruption both in the origin of the incentives to deviate from honest behavior (social pressure) and in the agent whose behavior is studied (a judge).

For obvious reasons, however, it is very difficult to test empirically theories that incorporate the impact of social influences on individual decision-making. Social forces are difficult to quantify or even to observe accurately, and the influence on behavior cannot be ascertained unless it is clear how the individual would have acted in the absence of such forces. These difficulties increase an order of magnitude if we consider situations where the individual is interested in *hiding* his own behavior, such as corruption. It is no surprise that until recently, there simply was not even a single empirical study of the effects of social pressure on corruption. Garicano, Palacios-Huerta and Prendergast (2001, 2005) provide such first study.

The setting concerns the impact of the preferences of a group (namely, the spectators attending a soccer game) on the behavior of the judge of the game. Professional soccer games are attended by huge crowds of up to 100,000 people in the top European and South American leagues, very often overwhelmingly and loudly rooting for the home team. Does the referee "internalize" the social preferences in the stadium? Do these forces push him to rule in favor of one team over the other?

The authors note that there is one specific decision that a soccer referee takes that allows for a clean testing of the importance of social pressure in decision-making: the amount of *injury time* added at the end of the game. Because the outcome is easily quantified (extra time in minutes), and the decision should depend on events that are observable (the amount of yellow and red cards, substitutions, etc), it is possible to use this decision to test for the influence of social pressure. They do precisely this. The results are quite stark: referees on average add *more* injury time (controlling for a number of factors) when the home team is *behind* in a close game than when it is ahead in an equally close game. When the game is not close, and extra injury time is less likely to change the outcome, no such bias is found. Moreover, using an exogenous change in the rewards for winning a game, they find that the higher the rewards the greater the referees' bias.

III. CONCLUSION

I have reviewed an excellent set of articles, often published in some of the most prestigious academic journals, which demonstrate that *Sports as Economics* can be genuinely defined as a field.

Progress has accelerated in the last couple of decades and we have seen how sports provide a unique data-rich, lab-like setting that informs economics in very important matters. This setting can in many ways be even better than the typical lab setting as there is an abundance of readily available data, the goals of the participants are often uncomplicated, the outcomes extremely clear, the stakes high, and the subjects professionals with experience.

Sauers (2017) rightly remarks how Robert Tollison first laid the foundations for the enterprise of sports as economics (rather than the economics of sports which, as Szymanski (2009) correctly notes, started with Rottenberg (1956)). I believe that in a few years from now this survey will merely scratch the surface of the work in a new field of economics that he helped to create.

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PART I

Sports Economics: Its Peculiarity

HOW CAN THE COMPETITIVE BALANCE BE IMPROVED?

Stefan KESENNE

Abstract

In this contribution we present an overview of the most important policies and regulations by team sports leagues to improve the competitive balance, such as revenue sharing, salary caps and restrictions on player mobility, The impact of revenue sharing on competitive balance turn out to be rather complicated, depending mainly on the objectives of team owners and on the inclusion of absolute league quality in the teams' revenue functions. We also consider different types of salary caps and restrictions on player mobility including the transfer system.

Keywords: competitive balance, revenue sharing, salary caps, transfer market.

JEL classification: D21, L21 Z21 Z28.

I. INTRODUCTION

It is a widely held belief that a sporting competition such as football or any other professional team sport will be more successful if the competition is less unbalanced, because this enhances the uncertain of outcome which attracts more spectators. This so-called Uncertainty of Output Hypothesis (UOH) states that spectators prefer to attend tense games and follow a thrilling championship. However, the empirical evidence supporting the UOH is not very convincing; tests of the UOH do not present a very clear picture (see Borland and Macdonald, 2003; Garcia and Rodriguez, 2002). It is also well-known that the preferences of television viewers differ from the preferences of stadium spectators who are more hard-core supporters of their home team and just want to see their team win. (see Buraimo and Simmons, 2009). Moreover, in an interesting theoretical model, based on reference-dependent preferences, and its empirical test, Coates and Humphreys (2012) reject the UOH. Only long-term uncertainty of outcome, or the emergence of dynasties, that is: the same teams winning the league championships year after year, turn out to have a negative impact on attendances (see Krautmann and Hadley 2006; Kesenne, 2018a).

In this paper, we present an overview of the important measures that have been proposed or applied in sports leagues, and their impact on competitive balance. In section II, the complicated impact of revenue sharing is analysed; section III presents the impact of salary caps and of caps on the wage-turnover ratio. In section IV, the impact of restrictions on player mobility, and the transfer system, will be discussed. Section V concludes.

II. REVENUE SHARING

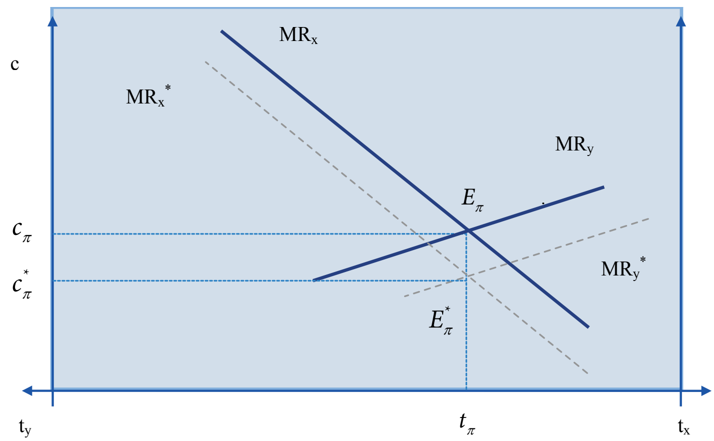
In general, the intuitive feeling is that the sharing of revenues among rich and poor teams will improve the competitive balance in a league, but the impact of revenue sharing turns out to be more complicated. The complications are caused by the fact that there are not only different sharing arrangements, such as gate sharing, pool sharing, prize-fund sharing and many other. The impact also depends on the objectives of the teams, which can be profit- or win maximization, as well as on the type of model that is used to analyse the impact; the Walras– or the Nash equilibrium model. (see Kesenne, 2000; Szymanski and Kesenne, 2004). It follows that there are at least eight different scenarios to be investigated. Further complications are caused by the specification of the team revenue functions; do also absolute team– and league quality appear in the revenue function or not?

- The best-known case is gate revenue sharing under profit-maximisation in the constant-supply Walras-equilibrium model. This model assumes that a talent increase in one team implies a talent loss in at least one other team. Under these assumptions, and without absolute team quality in the teams' revenue functions, the famous Invariance Proposition holds which states that revenue sharing does not affect the competitive balance. (see Rottenberg, 1956). This has been shown theoretically by many sports economists (see *e.g.* Quirk, and El-Hodiri, 1974; Quirk and Fort, 1992). The explanation is that in this gate sharing scenario, all teams, large and small, have to share gate revenue with the visiting teams. It follows that all teams will reduce their demand for talent, leaving the distribution of talent among the teams unchanged, but lowering the average player salary. This result for a 2-team league can be seen graphically in Figure 1, where the talent market equilibrium before and after sharing is illustrated with large-market team x and small market team y. If all teams are profit-maximisers, the demand curves for talent are given by the downward sloping marginal revenue curves (MR). If the small-team's origin is on the right side of the diagram, and if the distance between the two origins equals the constant talent supply, the point of intersection between the two demand curves is the market equilibrium (E_π).

The sharing arrangement reduces the demand for talent of both teams, the dotted lines being the demands curves after sharing. Because the shifts are the same at the initial equilibrium point, the new equilibrium is given by the point of intersection E^*_π.Compared with the equilibrium before

FIGURE 1

REVENUE SHARING UNDER PROFIT MAXIMIZATION IN A WALRASIAN FIXED-SUPPLY MODEL



Source: Own elaboration.

sharing, the distribution of playing talent between both teams stays the same. However, if teams receive other revenues that are not shared, such as local tv-rights in the North-American major leagues, the haring of gate receipts can improve the CB (see Ford and Quirk, 1995; Kesenne, 2000).

The league that comes closest to this scenario is the North-American National Football League (NFL), where gate revenue is shared 60-40 between the home and the visiting team, but where also the federal broadcast rights are equally shared.

However, it is worth mentioning here that gate revenue sharing improves the competitive balance if team revenue is (also) affected by the absolute quality of the visiting team (see Marburger, 1997; Kesenne, 2000). So, the famous Invariance Proposition, stating that gate revenue sharing does not change the competitive balance under profit maximization in a fixed-supply Walras model, only holds if absolute team- or league quality has no impact on team revenue.

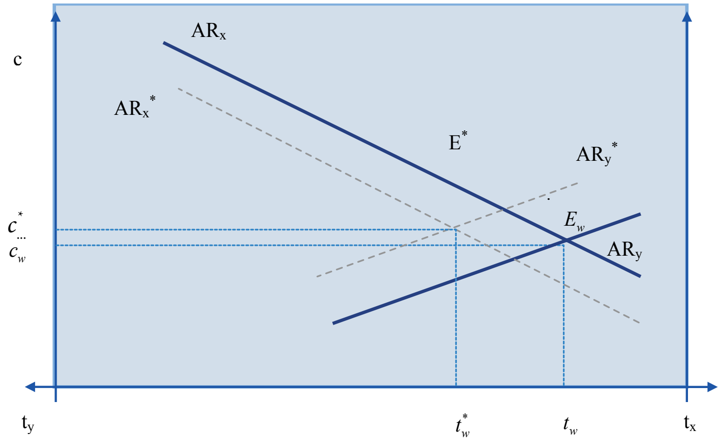
- A second case is pool sharing in the fixed-supply Walras model under profit maximization. Pool sharing applies to the sharing of broadcast rights in most sports leagues. As distinct from gate sharing, Kesenne (2014) has shown, starting from the most general team revenue functions, that pool sharing does not change the competitive balance. So, in general, the Invariance Proposition holds for pool sharing rather than for gate sharing. The formal proof of this proposition is presented in Appendix 1.

- A third and fourth scenario is gate and pool sharing in the Walras model under win maximisation. Utility– or win maximisation seems to be the most realistic objective of European football teams (see Sloane, 1971; Garcia-del-Barrio and Szymanski, 2009). Under this assumption, it has been shown that gate revenue sharing improves the competitive balance (see Kesenne, 1996 and 2000). Under win-maximization and the breakeven constraint, teams are assumed to spend all their available revenue on playing talent, after paying for capital, Because both gate and pool sharing increases the after-sharing revenue of small-market teams and reduces the after-sharing revenue of large-market teams, competitive balance improves. This is shown graphically in Figure 2.

Under win-maximization and the breakeven constraint, the teams' demand curves for talent, with zero capital cost, are given by the average revenue curves (AR), or by the net average curves (NAR) with

FIGURE 2

REVENUE SHARING UNDER WIN MAXIMIZATION IN A WALRASIAN FIXED-SUPPLY MODEL



Source: Own elaboration.

non-zero capital cost. By sharing revenue, the large-market team, will reduce, and the small-market team will increase, its demand for talent, which improves the competitive balance. So, the after-sharing market equilibrium is found in E^* at the intersection of the dotted AR-curves.

- The impact of revenue sharing is strikingly different in the Nash equilibrium model, where it is assumed that, in their hiring decisions, teams take account of the strategies of the other teams. Under the Nash conjecture, $\frac{\partial t_j}{\partial t_i} = 0$ for all $i \neq j$, which holds under flexible talent supply conditions, gate or pool revenue sharing among profit-maximizing teams worsens the competitive balance (see Szymanski and Kesenne, 2004). This counter-intuitive result can be explained by considering the external effects of talent hiring; talent hiring by small teams have a stronger dulling effect on large teams than the other way around. It follows that, by revenue sharing, small-market teams will reduce their demand for talent more than large teams.

  However, if teams are win maximisers, revenue sharing improves the competitive balance, also in the Nash equilibrium model. This result is not different from the Walras model because win-maximizing teams spend all their available budget on talent, regardless the strategies of their opponents in the league.

- A different sharing system, using a prize fund, imposes all teams to contribute the same amount of money to a fund v, and the money of the fund is distributed among all teams in accordance with their winning percentage. So, the after-sharing budget of a team (R_i^*) in an n-team league can be written as: $R_i^* = R_i - v/n + w_i v$. This sharing system turns out to improve the competitive balance in a profit-maximization league (see Szymanski, 2003), but obviously worsens the competitive balance in a win-maximization league, because winning large-market teams receive more money from the fund than they have contributed to the fund.

  Another possible revenue sharing system is a simple market-based sharing system, where the sharing is based on the size of the teams' market size: $R_i^* = R_i - \mu t_i(m_i - \overline{m})$, μ is a positive share parameter and $\overline{m}$ is the average market size in the league.

  In both a profit- and a win-maximization league, this arrangement not only improves the competitive balance, but also avoids the possible perverse outcome from the former budget-based sharing systems, where a poor-performing large-market team, with therefore a lower budget, can be better off after sharing, and where a well-performing small-market team, with a higher budget, can be worse off.

- Finally, we should refer to an important publication by Fees, and Stähler (2009), who start from revenue functions of n heterogeneous profit-maximizing teams that include, beside relative and absolute quality, also the competitive balance itself as an explanatory variable. Starting from the Nash equilibrium model, they derived that revenue sharing always improves the competitive balance if profit-maximizing-teams differ only w.r.t. the impact of absolute quality on revenue, and revenue sharing worsens competitive balance if only teams' relative quality plays a role for revenue.

  Their conclusions confirm the results in Szymanski and Kesenne (2004), regarding the impact of revenue sharing, and in Marburger (1997) and in Kesenne (2000), regarding the impact of absolute team quality.

Remark

One of the negative side effects of revenue sharing is that the incentive of teams to invest in playing talent and youth training diminishes. Teams are more reluctant to invest in talent if they have to share the return from their investment with opponents. However, this negative effect can be countered by a sharing arrangement that depends on the teams' efforts in youth training. The following proposal can serve as an example.

Assume that there are n win-maximizing teams in a league and that all teams have a different budget Ri. Each team contributes the same percentage μ of its budget to a youth-training fund. Here, a higher value of μ means more sharing. The collected money of the fund, which then equals $\mu\sum_{j}^{n} R_j$, is redistributed in accordance with the teams' relative effort in youth training. Under these sharing conditions, teams will compete to have the best youth-training system, and the negative effect of revenue sharing on talent investment is countered. Appendix 2 presents a formal proof of these positive effects.

III. SALARY CAPS

In a review article on cross-subsidisation in team sports, Fort, and Quirk (1995) conclude that, under profit maximization, a salary cap is the only cross-subsidization scheme currently in use that can be expected to accomplish both the financial viability of small-market teams and a better competitive balance in a league. The salary cap these authors have in mind is the typical payroll cap that is imposed in the North American major leagues, such as the NBA. It is a maximum amount that teams are allowed to spend on player salaries in one season. After the abolition of the Reserve Clause and the end of the monopsonist exploitation of players in the North American major leagues in the mid-seventies, player salaries went up dramatically, and, consequently, team owner profits took a nose dive. Reacting to this profit squeeze, league administrators and team owners looked for an alternative regulation to guarantee a reasonable profit rate. The main motivation for imposing salary caps was not to improve the competitive balance but rather to restore team-owner profits.

The North American salary cap is calculated as a percentage (α) of average team revenue in the league during the previous season, *i.e.*

$$cap = \alpha \frac{\sum R_{i,-1}}{n} \qquad \text{with } \alpha < 1$$

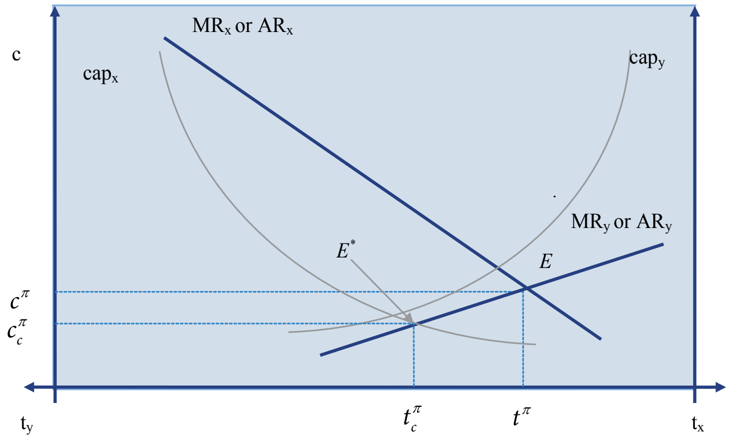
An important characteristic of this cap is that the amount of the cap is the same for each team. The percentage α is determined in collective bargaining agreements between team owners and players associations. Disagreements about this percentage has led to several player strikes and owner lockouts in the North-American major leagues.

The impact of a salary on competitive balance can be seen in a simple graphical presentation of the talent market. The salary cap, states that the product of the unit cost of talent c and the number of talents t_i has to stay below the value of the cap, *i.e.* $ct_i \leq cap$.

This can also be written as $c \leq cap/t_i$. For rich teams that spend more on player salaries than the cap, it holds that $c = cap/t_i$ which is a simple hyperbolic function in the graphical presentation of the talent market. This function then also represents the demand for talent of the rich large-market team. If the cap is not a floor, the small-budget teams' demand is not affected by the cap, and its demand function is still the MR-function in a profit-maximization league and the AR-function in a win-maximization league. The impact on the competitive balance can be seen in Figure 3.

FIGURE 3

SALARY CAP AN COMPETITIVE BALANCE



Source: Own elaboration.

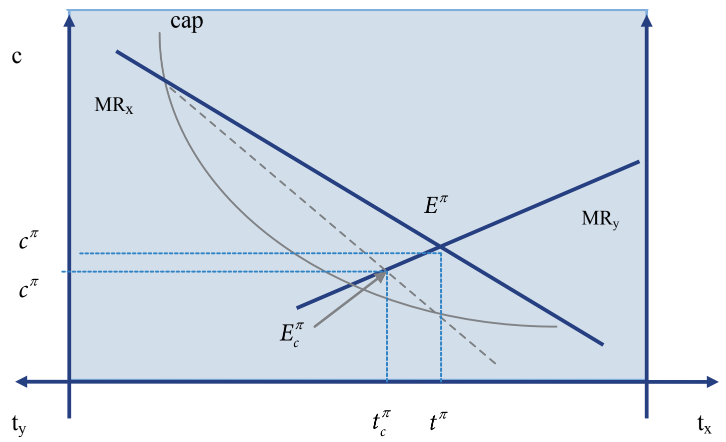
The new talent market equilibrium is given by the point of intersection E^* of the small team's demand curve (MRy or ARy) and the cap-line. Compared with the equilibrium E without the cap, the competitive balance has improved.

In NBA, the salary cap has not only been a cap on the total payroll, it has also been a floor. So, low-budget teams are forced to pay the amount of the salary cap, with the implication that some cross-subsidisation or revenue sharing among teams was required to accommodate the financial losses of the low-budget teams. In theory, an equal spending on talent by all teams creates an equal distribution of talent in the league. The main problem with salary caps is the enforcement of the cap, because there are many hidden ways to compensate players besides their regular salary.

The salary cap is not always a hard cap but can also be a soft cap, which implies that a team, which spends more on player salaries than the amount of the cap, has to pay a luxury tax. A soft cap with luxury tax will also improve the competitive balance as can be seen in Figure 4.

FIGURE 4

SOFT SALARY CAP



Source: Own elaboration.

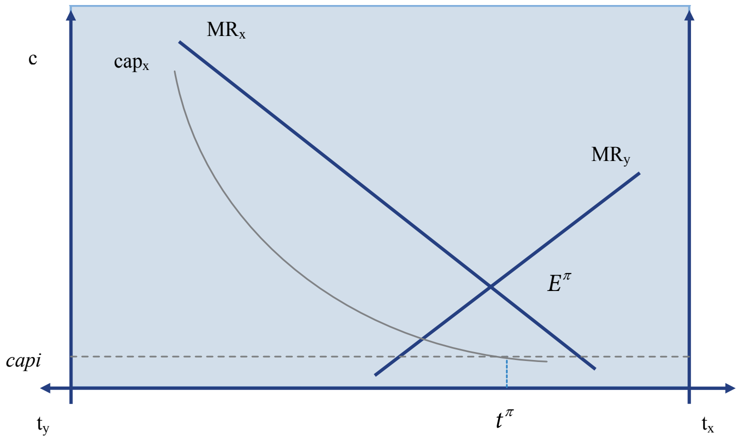
A luxury cap can be presented by the dotted curve starting where the demand-for-talent curve of the large team passes above the cap line. The market-equilibrium point is then given by the point of intersection E_c^{π} of the dotted line and the small team's demand curve. This improves the competitive balance from t^{π} to t_c^{π}, which is less than the improvement from a hard salary cap.

If a salary (payroll) cap is combined with an individual player salary cap, the competitive balance will most likely worsen, because an individual cap causes excess demand in the player market; and a player who can choose between playing in a rich large-market team or in a poor small-market team, will most likely move to the rich team. So the competitive balance worsens as can be seen in Figure 5. If the individual cap is represented by the horizontal line *capi* and the players in excess demand will move to the rich large-market team x, the new market equilibrium is t^{π}, which is more unbalanced compared to the equilibrium with only the payroll cap, as well as compared to the equilibrium with no cap at all.

An alternative to the North-American salary cap is a cap on the wage-turnover ratio of teams, as has been proposed in a gentleman's agreement

FIGURE 5

INDIVIDUAL SALARY CAP



Source: Own elaboration.

among the G-14 (now called the ECA) in European football. This cap comes down to a maximum percentage ε of player remuneration in total team revenue *i.e.* $ct_i < \varepsilon R_i$.

The fundamental difference with the North-American cap is that European cap is different for every team; 70% of a large-team's budget is a lot of money compared with 70% of a small-team's budget. Given that small-budget teams mostly have a larger wage-turnover ratio than large-budget teams, this cap on the wage- turnover ratio of teams can be expected to worsen the competitive balance in both the profit- and the win-maximization scenario. (see Kesenne, 2014). An important implication of this result is that also the Financial Fair Play regulations by UEFA, forcing teams, among other rules, to break even, will worsen the competitive balance (see Peeters and Szymanski, 2014).

IV. RESTRICTIONS ON PLAYER MOBILITY, AND THE TRANSFER MARKET

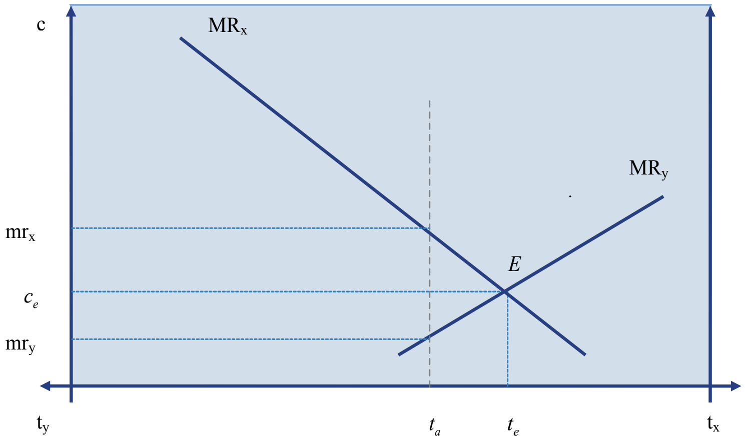
Team-sports leagues have also been trying to improve competitive balance by imposing restrictions on player mobility. If rich large-market teams have the financial strength to pay higher player salaries, they can attract the best players, leaving the small teams behind with only average players, which would obviously worsen the competitive balance. One of the best-known restrictions on player mobility has been the Reserve Clause in the North–American major-leagues and the Retain and Transfer System in European football.

Basically, these regulations imply that players, even at the end of their contract, are not free to move to another team. Under specific conditions in the Reserve Clause, players can become free agents. In European football, the transfer system has created a transfer market where teams can buy and sell players for cash like cows in a cattle market. Apart from the ethical problems, the question is if these restrictions improve competitive balance.

It can be shown that, with or without the transfer system, the allocation of players among teams will be the same if teams are profit maximizers. In a free market, the best players will freely move to the richest teams, in a transfer market, the best players will be sold for cash to the richest teams. This can be shown graphically in Figure 6.

FIGURE 6

TRANSFER MARKET IN A PROFIT-MAXIMIZATION LEAGUE



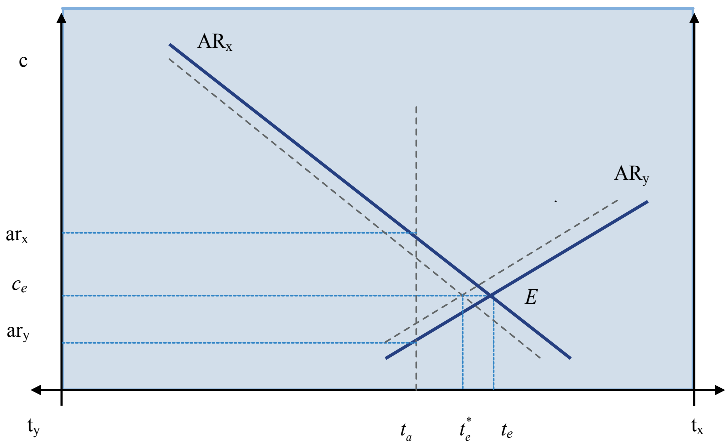
Source: Own elaboration.

Starting from any initial distribution of talent (t_a), which is different from the free-market equilibrium (t_e), the talent distribution (t_a) will not be stable because both profit-maximizing teams can increase their profit by trading players. Given the unit cost of talent (c_e), the MR of talent in the large team (mr_x) is higher than the marginal cost, and profits can be increased by buying more talent. The opposite is true for the small team which can increase its profits by selling players. Given the difference in marginal revenue, both teams will easily agree on a transfer fee to trade players in the transfer market, and playing talent moves from the small team to the large team. This trade of player talent will continue until the difference between the teams' marginal revenues of talent is eliminated, and for both teams holds that $MR_i = c_e$. It follows that the distribution of talent will be the same with or without the transfer system. Profit-maximizing teams will not use the received transfer fees to hire more talent, they will pocket the money as profit. This is an illustration of the well-known *Invariance Proposition* of Simon Rottenberg (1956).

If teams are win maximizers, the result is similar, but not completely the same. If teams maximize their winning percentage under the breakeven constraint, it can be shown that the transfer system will only have a very small positive effect on competitive balance. Figure 7 below illustrates this possible improvement of the competitive balance. The demand curves for talent of win-maximizing teams, assuming for simplicity reasons a zero capital cost, are given by the average revenue (AR_i) with free-market equilibrium E.

FIGURE 7

TRANSFER MARKET IN A WIN-MAXIMIZATION LEAGUE



Source: Own elaboration.

Starting again from a distribution of talent (t_a) that deviates from the free-market equilibrium (t_e), we can see that the AR of talent in the large-market team is higher than the average cost ($ar_x > c_e$). It follows that team x is profitable. But a win-maximizing team is not interested in profits; the team prefers to use its profit to buy more talents. In the small-market team, the opposite is true, the AR of talent is lower than the average cost ($ar_y < c_e$), and the team is making a loss. In order to break even, it will try to sell talent. Again, both teams will easily reach an agreement to trade players in the transfer market, and players are sold by the small team y to the large team x until they both reach the point E where average revenue equals average cost ($AR_i = c_e$). The difference with the profit-maximization case is that the win-maximizing small team will not pocket the received transfer fees but invest the extra money in new talent. The demand for talent of small teams will increase, and the talent demand of large teams will be reduced because they have to pay the transfer fees. The result is an improvement of the competitive balance. However, this improvement can only be very small because teams in small market have a limited drawing potential for top players that can be sold to large-market team. Moreover, the players that large teams will buy from small teams in the transfer market will be top players, whereas the players that small teams can buy with the transfer fees will be average players. Even if small teams can afford to pay the high salary of a top player on a short-term contract, they cannot, on top of the high salary, pay a very high transfer fee that is, in most cases, a multiple of the salary. Only a handful of large and rich teams can afford to pay the total costs of top players. It follows that the transfer system does not improve but worsens the competitive balance (see Kesenne, 2018b).

One of the important recent observations in the transfer market is that, even if the number of transfer deals has increased, as well as total transfer spending, the top teams' net transfer spending, paid transfer fees minus received transfer fee, did not increase. Transfer spending has become a quasi-closed money circuit among a few rich teams with very little money trickling down to small teams. In order to avoid player agents' corruption in trading player contracts, player exploitation and child trade, money laundering and tax fraud, and match fixing (see Buschmann and Wulzinger, 2017), the transfer system should be abolished completely, for end-of-contract as well as in-contract players. This would not only improve the competitive balance, but also keep more money in the football business which disappears now in the deep pockets player agents (an estimated 500 million euro per year). This money should rather be used for youth development and player salaries, improving stadium quality or lowering ticket prices.

IV. CONCLUSION

The competitive balance in a team sports league can be improved, if necessary, by imposing salary caps, as a cap on the total payroll of a team, and by revenue sharing but only under certain conditions. In general, revenue sharing will improve the competitive balance in a win-maximization league, because most sharing arrangements will increase the revenue of small teams and reduce the revenue of large teams. In a profit-maximization league, revenue sharing will only improve the competitive balance if teams' revenue is affected, among other variables, by the absolute quality in the league, which is, in my opinion, a realistic assumption. The competitive balance cannot be improved by a transfer system as a policy to limit player mobility. Only the complete abolition of the existing transfer market in European football, for end-of-contract as well as in-contract players, can stop the growing competitive imbalance in European football.

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APPENDIX 1

POOL REVENUE SHARING SHARING IN THE FIXED-SUPPLY WALRAS MODEL

The pool sharing system that is considered here implies that all teams in a n-team league contribute a fixed percentage (1-μ) of their season revenue to a pool or a league fund, and that the money is redistributed equally among all clubs, *i.e.:*

$$R_i^* = \mu R_i + \frac{(1-\mu)}{n}\sum_{j=1}^{n} R_j = \mu R_i + (1-\mu)\overline{R} \qquad \text{with} \qquad 0 \le \mu < 1 \qquad [1]$$

Where R^* is the after-sharing revenue, $\overline{R}$ is the average revenue in the league and μ is the share parameter. A higher value of the share parameter means less sharing; a value of zero means equal sharing.

In order to investigate the impact of revenue sharing on the distribution of talent, we look at the partial derivatives of the clubs' demand curves for talent with respect to the share parameter μ.

This methodology is based on the reasonable assumption that the competitive balance improves (worsens) if the downward shift of the demand curves for talent of the large-market teams is larger (smaller) than the downward shift of the demand curves for talent of the small-market teams. So, we need to compare the partial derivatives of the teams' demand curves after sharing with respect to the share parameter at the initial market equilibrium point.

If clubs are profit maximisers, the demand curves for talent after sharing are the marginal revenue curves after sharing, *i.e.:*

$$\frac{\partial R_i^*}{\partial t_i} = \mu \frac{\partial R_i}{\partial t_i} + \frac{(1-\mu)}{n}\sum_{j=1}^{n} \frac{\partial R_j}{\partial t_j}\frac{\partial t_j}{\partial t_i} \qquad [2]$$

Given the constant supply of talent in the Walras model, one more talent for team i implies a loss of one talent in another team, say team k, so that $\frac{\partial t_k}{\partial t_i} = -1$ and

$$\frac{\partial R_i^*}{\partial t_i} = \mu \frac{\partial R_i}{\partial t_i} + \frac{(1-\mu)}{n}\frac{\partial R_i}{\partial t_i} - \frac{(1-\mu)}{n}\frac{\partial R_k}{\partial t_k} \qquad [3]$$

APPENDIX 1 *(continued)*

POOL REVENUE SHARING SHARING IN THE FIXED-SUPPLY WALRAS MODEL

After taking the partial derivative of these demand curves with respect to μ, we find that:

$$\frac{\partial(\partial R_i^* / \partial t_i)}{\partial \mu} = \frac{\partial R_i}{\partial t_i} - \frac{1}{n}\frac{\partial R_i}{\partial t_i} + \frac{1}{n}\frac{\partial R_k}{\partial t_k} \qquad [4]$$

Because we have to compare the shifts of the demand curves at the profit maximising equilibrium point where, in a competitive market, each team's marginal revenue equals the market clearing unit cost of talent, we can write that:

$$\frac{\partial(\partial R_i^* / \partial t_i)}{\partial \mu} = c_\pi (1 - \frac{1}{n} + \frac{1}{n}) = c_\pi \qquad [5]$$

Because these partial derivatives are clearly positive and independent of i, , revenue sharing causes an equal downward shift of all teams' demand curves for talent at the equilibrium point. As a consequence, the unit cost of talent, or the average player salary, will come down. The new market clearing salary level can be derived as follows:

$$c_\pi^* = \frac{\partial R_i^*}{\partial t_i} = c_\pi (\mu + \frac{(1-\mu)}{n} - \frac{(1-\mu)}{n}) = \mu c_\pi \qquad [6]$$

This result holds regardless the specification of the revenue function.

APPENDIX 2

REVENUE SHARING AND YOUTH TRAINING INVESTMENT

Assuming that there are n win-maximizing teams in a league with a different budget R_i, each team contributes the same percentage μ of its budget to a youth-training fund. The collected money of the fund, which then equals $\mu\sum_j^n R_j$, is redistributed in accordance with the teams' relative effort in youth training. Each team receiving a different share (s_i) from the fund, the after-sharing team revenue (R_i^*) can be written as:

$$R_i^* = (1-\mu)R_i + s_i\mu\sum_j^n R_j \text{ or } R_i^* = R_i + \mu(ns_i\overline{R} - R_i) \text{ with } \sum_j^n s_j = 1 \qquad [1]$$

In general, the budgets of small and large teams, before and after the youth training compensation, will be unchanged if $ns_i\overline{R} = R_i$ or $s_i = \frac{R_i}{n\overline{R}}$ that is: if their relative effort in youth training will be the same as their relative budget in the league. So, a team's revenue will increase if its relative effort in youth training will be higher than its relative budget; if $s_i > \frac{R_i}{n\overline{R}}$.

In the particular case that s_i=1/n and ns_i=1, that is: each team puts the same effort in youth training and receives the same amount of money $\mu\overline{R}$ from the fund, so:

$$R_i^* = R_i + \mu(\overline{R} - R_i) \qquad [2]$$

The budget of a small team with $R_i < \overline{R}$, will increase because it receives more money from the fund than it has contributed, and the budget of the large team will decrease. The competitive balance improves without discouraging the investment in talent, because teams will fight and compete to have the best youth training program.

A PRACTICAL GUIDE TO MEASURING COMPETITIVE BALANCE

Brad R. HUMPHREYS

Abstract

Competitive balance (CB) represents a core concept in sports economics. Measuring competitive balance constitutes a key aspect of empirical research. Researchers face many choices when analyzing competitive balance. This paper summarizes several commonly used CB measures, their calculation, and strengths and weaknesses. I argue that static CB measures display sensitivity to league characteristics and an inability to reflect relative changes in standings over time. Less commonly used dynamic CB measures can reflect relative changes in standings, but can be analytically more difficult to implement and applied only to outcomes over time, not to individual seasons. Application of these CB measures to Major League Baseball 1906-2015 illustrates key differences between static and dynamic measures that researchers should take into account when choosing a CB balance measure.

Keywords: competitive balance, HHI, standard deviation of winning percentage, sports leagues.

JEL classification: L11, Z21.

I. THE IMPORTANCE OF MEASURING COMPETITIVE BALANCE

Competitive balance refers to the equality of strength of teams in a sports league. The importance of measuring competitive balance emerges from the standard two team model of sports leagues (Fort and Quirk, 1995). This model shows the importance of competitive balance in sports leagues under the assumption that winning the regular season represents an important goal for sports teams and fans, predicts that competitive imbalance may be a persistent feature of closed leagues like those in North America, and provides a framework for analyzing policies that sports leagues employ to improve competitive balance. Assessing the amount of competitive balance in sports leagues represents a key empirical question, and in order to answer questions like "is there competitive imbalance in league X" requires the development of measures of competitive balance that can be compared across time and across leagues. Moreover, the concept of competitive balance encompasses subjective aspects, complicating measurement (Sanderson, 2002). Sports economists devoted considerable time and effort developing measures of competitive balance and using these measures to analyze outcomes in sports leagues.

Sports economic research focuses on competitive balance because of the existence of a long intellectual history of interest in the topic and a large amount of data on outcomes in professional sports leagues. Professional baseball has existed for more than 150 years, and other professional sports leagues have existed for nearly as long, many for more than 60 years. This rich data provides an ideal environment for research on competitive balance, as league outcomes are measured and leagues have changed important institutional characteristics over time that can be interpreted as "natural experiments" that might be expected to change competitive balance. For example, the adoption of the designated hitter rule in the Major League Baseball's American League but not in the National League has been used as a natural experiment to see how rule changes affect competitive balance.

Fans clearly care about competitive balance. Almost every sports fan on earth has an opinion about the current level of competitive balance in his or her favorite sport, both compared to other leagues and compared to past history. Sports talk radio fixates on the level of competitive balance in professional sports leagues. Given these elements, competitive balance research holds considerable interest for sports economists and sports fans.

This paper surveys the topic of measuring competitive balance in sports leagues based on end-of-season outcomes. It does not address related concepts like the *Uncertainty of Outcome Hypothesis,* which refers to how competitive balance affects consumer decision making. It does not address the large and growing theoretical literature on competitive balance. It does not address the related topic of measuring the distribution of championships in sports leagues. The paper is not intended to be a comprehensive survey of all measures of competitive balance and analyses of competitive balance; that literature has grown too large for a comprehensive survey of less than book length. The paper contributes to the literature by focusing on key competitive balance measurement issues faced by researchers analyzing competitive balance, highlighting choices faced by researchers, and providing details about the strengths and weaknesses of common measures of competitive balance. The paper also applies these methods to outcomes in Major League Baseball (MLB) over the 1906 to 2015 seasons.

Measures of competitive balance can be divided into static and dynamic types (Szymanski *et al.,* 2002). Both types have strengths and weaknesses. The paper points out that static measures based on the standard deviation of wins or win percent and the Herfindahl–Hirschman Index are in fact functionally related, a fact that appears repeatedly in the literature yet seems to be widely ignored in practice, calling into question the general perception that these represent alternative measures of competitive balance. These static measures also exhibit sensitivity to the number of teams and games played by teams in leagues, and do not adequately reflect relative changes in league standings over time. Dynamic measures like the Competitive Balance Ratio and the Markov Transition Probability approach are computationally more difficult to estimate, require an arbitrary, researcher-determined time period to implement, and often generate multiple values characterizing competitive balance for a single time period. The paper develops a new interpretation of the values generated by the Markov Transition Probability approach. These dynamic measures better capture changes in relative standings over time, an important aspect of competitive balance.

The dynamic competitive balance measures tell a different story about changes in MLB over the sample period than the static measures. The dynamic measures show that MLB competitive balance was generally good in the 1906-1930 period, declined in the 1931-1960 period, and then improved after the early 1960s. The static measures indicate continual improvement in MLB competitive balance over time since the formation of MLB. The difference likely lies in the inability of static measures to capture changes in relative standings, turnover on the final table from top to bottom over different seasons, relative to dynamic measures.

II. MEASURING COMPETITIVE BALANCE

Measures of competitive balance based on regular season outcomes in sports leagues can be grouped into two broad classifications: static measures and dynamic measures (Szymanski *et al.,* 2002). Each has strengths and weaknesses. Researchers analyzing competitive balance must decide which measure to use when confronted with data on league outcomes over time. Each is discussed in turn below, with an emphasis on the methods use to calculate each methods and their relative strengths and weaknesses.

1. Static Measures of Competitive Balance

Static competitive balance measures reflect dispersion of winning percentages in sports leagues. The calculation of winning percentages involves one complication. Ties represent common outcomes in sports like ice hockey and football (called soccer in some quarters). Even (professional) American football games can end in a tie. In leagues with no ties, winning percentage is simple to calculate. If w_i is the number of wins, l_i the number of losses, and $G_i=w_i+l_i$ the number of games played by team i, then winning percentage for team i is,

$$WPCT_i = \frac{w_i}{w_i + l_i} = \frac{w_i}{G_i}.$$

However, if ties can occur in a sport, then winning percentage must be adjusted to reflect the presence of ties in league outcomes. There is no standard way to empirically handle ties. Suppose that t_i is the number of ties by a team. Two common approaches to accounting for ties in the calculation of winning percentage are,

$$WPCT_{T1,i} = \frac{w_i}{w_i + l_i + t_i} = \frac{w_i}{G_i}$$

and

$$WPCT_{T2,i} = \frac{w_i + 0.5t_i}{w_i + l_i + t_i} = \frac{w_i + 0.5t_i}{G_i}$$

which treats each tie as half a loss and half a win. In football, where wins count 3 points and ties count 1 point, the weight on t_i can be adjusted to 0.33, since a tie is worth one third of a win under that point system.

Static measures were the first to emerge in the literature, and these measures still constitute the "workhorse" methods of measuring competitive balance. The simplest static measures focus on measuring competitive balance within a single season in a sports league. The basic concept behind static measures of competitive balance is that in leagues with more competitive balance, winning percentages will be less dispersed and in leagues with less competitive balance winning percentages will be more dispersed. Most static measures of competitive balance use the standard deviation as the basic measure.

1.1. Standard Deviation Based Measures

Early measures of competitive balance focused on describing the dispersion of winning percentages in a sports league in one or more seasons. I call these σ-measures of competitive balance. The most basic σ-measure of competitive balance is the standard deviation of winning percentage of all teams in a league at the end of the season. Given data on end-of-season winning percentages, $WPCT_i$, for a league with $i=1, \ldots, N$ teams, the standard deviation of winning percentage for the league is simply

$$\sigma_{W1} = \sqrt{\frac{\sum_{i=1}^{N}\left(WPCT_i - \overline{WPCT}\right)^2}{N}} \qquad [1]$$

where $\overline{WPCT}$ is the average winning percent in the league in a single season. In leagues playing a balanced schedule and no ties, $\overline{WPCT}$ must equal 0.500, and the denominator of the standard deviation is N. In leagues with unbalanced schedules or ties, $\overline{WPCT}$ must be estimated, and the denominator must use the degrees of freedom correction N-1 to calculate σ_{w1}. This distinction can have an important effect on calculating σ_{w1} if the number of teams in the league is small.

A clear relationship exists between σ_{w1} and competitive balance. A degenerate distribution with a standard deviation of zero represents perfect competitive balance, since every team finishes the season with the same winning percentage, 0.500. Leagues with a higher σ_{w1} have more variability in winning percentages around the mean and less competitive balance; the higher σ_{w1}, the worse the competitive balance is in a league in a given season. Leagues with smaller σ_{w1} have less variation in winning percentages around the mean and more competitive balance in a season. Note that σ_{w1} declines with the number of teams int he league, and thus with the number of games played in the league. This means that σ_{w1} will be lower in leagues with more games, like MLB, and higher in leagues with fewer games like the NFL.

The primary advantage of σ-measures is simplicity and intuitive appeal. σ_{w1} provides a snapshot of the level of competitive balance in a league in a single season.

Note that in general, σ-measures of competitive balance depend on institutional details of leagues, including the number of teams in the league and the number of games played by each team. To see this, Equation [1] can be rewritten in terms of the number of teams in a league ($i=1, \ldots, N$) the number of games played by each team in each season in the league ($g=1, \ldots, G$), and the number of games won by each team in the league (w_i) as:

$$\sigma_{W1} = \sqrt{\frac{\sum_{i=1}^{N}\left(\frac{W_i}{G_g} - \frac{\sum_{i=1}^{N}\frac{W_i}{G_g}}{N_i}\right)^2}{N_i}} \qquad [2]$$

since $WPCT_i = \frac{w_i}{G_g}$. Single, within-season analysis of competitive balance pose no problems for this measure. But for an analysis of a league like Major League Baseball, which has expanded both the number of teams in the league and the number of games played by teams in the league over time, Equation [2] presents complications. Even with an identical distribution of wins in each season, changes in N and G will change σ_{w1} over time.

Note that under a balanced schedule, where each team plays the other teams in the league the same number of times each season, the total number of wins in each season is $\frac{N_i G_G}{2}$ and Equation [2] reduces to,

$$\sigma_{W1} = \sqrt{\frac{\sum_{i=1}^{N}\left(\frac{w_i}{G_g} - \frac{1}{2}\right)^2}{N_i}} \qquad [3]$$

A σ-measure can also be calculated over multiple seasons. Consider a league with N teams over a period of $t=1, \ldots, T$ seasons. Let $WPCT_{i,t}$ represent the winning percentage of team i, in season t. The standard deviation of winning percentage for the league over all T seasons is:

$$\sigma_{W2} = \sqrt{\frac{\sum_{i=1}^{N}\sum_{t=1}^{T}\left(WPCT_{i,t} - \overline{WPCT}\right)^2}{NT}}$$

The interpretation of σ_{w2} is the same as σ_{w1}. Note that σ_{w2} is also decreasing in the number of teams in the league and games played. While σ_{w1} is a reasonable measure of competitive balance in a single season, σ_{w2} has some shortcomings when applied over multiple seasons. In particular, σ_{w2} can not capture changes in the relative standings of teams within a sports league over time. To illustrate this point, consider the records for teams in two hypothetical five team leagues shown on Table 1, which shows the end-of-season winning percentages for each team in the league in each of five seasons.

Each league has the same σ_{w2} over this five season period, 0.35. Also, σ_{w1}=0.35 in each season in each league. These two leagues have identical levels

TABLE 1

WON-LOSS RECORDS AND WIN % IN TWO LEAGUES

League 1						*League 2*					
Team	1	2	3	4	5	Team	1	2	3	4	5
A	4-0	4-0	4-0	4-0	4-0	F	8-0	6-2	4-4	2-6	0-8
B	3-1	3-1	3-1	3-1	3-1	G	6-2	4-4	2-6	0-8	8-0
C	2-2	2-2	2-2	2-2	2-2	H	4-4	2-6	0-8	8-0	6-2
D	1-3	1-3	1-3	1-3	1-3	I	2-6	0-8	8-0	6-2	4-4
E	0-4	0-4	0-4	0-4	0-4	J	0-8	8-0	6-2	4-4	2-6
A	1.00	1.00	1.00	1.00	1.00	F	1.00	0.75	0.50	0.25	0.00
B	0.75	0.75	0.75	0.75	0.75	G	0.75	0.50	0.25	0.00	1.00
C	0.50	0.50	0.50	0.50	0.50	H	0.50	0.25	0.00	1.00	0.75
D	0.25	0.25	0.25	0.25	0.25	I	0.25	0.00	1.00	0.75	0.50
E	0.00	0.00	0.00	0.00	0.00	J	0.00	1.00	0.75	0.50	0.25

of competitive balance over this period, based on σ_{w1} and σ_{w2}. However, the relative standings over time in these two leagues differ substantially. League 1 experiences identical end-of-season order of finish in each season. Team A dominated the league, winning the championship in every season; there is no variation in relative standings over these five seasons in League 1. League 2 has much more variation in relative standings. Each of the five league championships were won by a different team, and each team also finished last once over the five seasons. League 2 exhibits more competitive balance over time than League 1 because of the turnover in relative standings. But σ_{w1} and σ_{w2} do not reflect any information about changes in relative standings – they simply measures dispersion of winning percentages in each league, which are the same. Clearly, an alternative measure of competitive balance which could distinguish between these two cases would be a useful complement to a σ-measure of competitive balance.

1.2. Idealized Standard Deviations

σ_{w2} depends on N and T and cannot be used to compare competitive balance across leagues with different numbers of teams or schedules, or competitive balance within leagues with changes in the number of games in the regular season over time. Sports economists developed the idealized standard deviation of winning percentage (ISDWP) ratio in order to compare competitive balance across leagues and within leagues with variable schedules. To calculate the ratio, we first need to standardize variation in winning percentages to control for the number of games played. The standardization is based on an idealized standard deviation

$$\sigma_I = \frac{0.500}{\sqrt{G}}$$

Where G is the number of games played in the league. σ_I is the predicted variation in a league where each team has a 50% chance of winning each game played ($WPCT$=0.500) corrected for the number of games played. The ISDWP ratio is simply the ratio of actual to ideal standard deviation of winning percentage

$$\sigma_{WI} = \frac{\sigma_{W2}}{\sigma_I}$$

This metric is sometimes called the Noll-Scully ratio in the literature, to recognize that Gerald Scully (1989) and Roger Noll (1988) developed this measure at about the same time in the late 1980s. σ_{WI} is a standardized measure of competitive balance in that the actual variability of winning percentage is scaled or standardized by an idealized value. The closer the ratio is to 1, the more competitive balance in the league over that period. The farther the ratio is from 1, the less competitive balance in the league over that period.

σ_{WI} is a one-dimensional measure of competitive balance. Its power lies in the ability to compare one period's level of competitive balance to another period's level of competitive balance, controlling for the number of teams and games played. The idealized standard deviation of winning percentage ratio's main function is to compare competitive balance across professional sports leagues by correcting for differences in the number of regular season games ($\sqrt{G}$) in each professional sports league. This is important because professional sports leagues play different regular season schedules. For example, each team in Major League Baseball plays 162 games, the each team in the National Football League plays 16 games, and each team in the English Premier League plays 38 games. Since σ_{W2} would be lower in MLB than in the NFL even if the dispersion of winning percents was the same, σ_{W2} must be corrected to make a comparison.

The importance of using σ_{WI} to measure competitive balance can be better illustrated with an example drawn from actual professional sports league outcomes. Table 2 shows the actual values of σ_{W1}, σ_I and σ_{WI} for the NFL, NBA and MLB for the 2016 regular seasons in each league. Note the large differences between the value of σ_I across these three leagues. The larger is G, the smaller σ_{WI}. σ_{WI} for the NFL is more than four times σ_{WI} for MLB because of the difference in season length in these two leagues.

TABLE 2					
σ_{WI}, σ_I AND σ_{WI}, 2016					
League	σ_{W1}	Games		σ_I	σ_{WI}
NFL	0.200	16	$\frac{0.5}{\sqrt{16}}=$	0.125	1.60
MLB	0.066	162	$\frac{0.5}{\sqrt{162}}=$	0.039	1.68
NBA	0.136	82	$\frac{0.5}{\sqrt{82}}=$	0.055	2.47

Based solely on σ_{W1}, one would conclude that MLB had the most competitive balance in 2016, since σ_{W1} was much smaller in MLB than in the other two leagues. But the longer baseball season makes a direct comparison of σ_{W1} inappropriate in this setting. Instead, after adjusting σ_{W1} with σ_I, competitive balance in baseball was about 1.68 times the idealized value, while competitive balance in the NFL was just 1.60 times its idealized value. Competitive balance in the NFL appears to have been better than in MLB, when the length of the season is accounted for.

Recent research calls into question the usefulness of the idealized standard deviation as a measure of competitive balance in sports leagues. Owen and King, 2015 show σ_{WI} reflects competitive balance while controlling for season length only in the limiting case where all teams in the league have the same strength and generates biased estimates of competitive balance as the underlying distribution of team strength becomes more unequal. Lee *et al.*, 2018 show substantial bias in σ_{WI} when the number of games is very small, like in the NFL, and very large, like in MLB, and develop a bias correction for σ_{WI}. Taken together, these paper suggest that researchers should rely less on σ_{WI} when comparing competitive balance across leagues and within leagues with different schedule lengths over time.

1.3. The Record Test

Van Scyoc and McGee (2016) propose a σ-measure that explicitly accounts for the number of games in a season (G):

$$\sigma_R = 4G\sum_{i=1}^{N}\left(\frac{w_i}{G}-\frac{1}{2}\right)^2 \text{ or in terms of wins } \sigma_R = 4G\sum_{i=1}^{N}\frac{\left(2\cdot w_i - G\right)^2}{G}$$

which is clearly related to σ_{W1}. Van Scyoc and McGee (2016) call this the *Record Test.* This σ-measure is derived from the assumption that all teams have equal strength, in other words has a 50% chance of winning each game, which means game outcomes are distributed according to a binomial distribution with mean G and variance 0.5. This distribution-based derivation allows for an explicit derivation of the distribution of σ_R and formal hypothesis tests against specific null hypotheses.

1.4. The Herfindahl-Hirschman Index Approach

The Herfindahl-Hirschman Index (commonly known as HHI) is a concentration measure widely used in industrial organization to assess the extent of competition in a market. Common uses of the HHI in sports economics include both competitive balance measurement and measurement of the concentration of championships. The HHI measure of competitive balance is simple to calculate: take the share of the outcome for each team (whether share is first place finishes, championships, wins, or points) over some period of time (one season or multiple seasons), square that number, and then sum the values across all teams to get the HHI. The higher the HHI, the higher the concentration of outcomes, and the less competitive balance in the league. In general, the HHI can be expressed:

$$HHI = \sum_{i=1}^{N} s_i^2$$

where s_i is team i's share of some league outcome and the league contains N teams. The outcome share, s_i, can be expressed in a number of ways. Competitive balance measures generally focus on the distribution of wins across teams in a league, so a natural outcome share is each team's share of the total number of wins in a league in a given season

$$HHI = \sum_{i=1}^{N} \left(\frac{w_i}{\sum_{i=1}^{N} w_i} \right)^2 \qquad [4]$$

for a league with i = 1, ..., N teams. Depken (1999) points out that in a league with a balanced schedule, where each team plays the same number of games and plays every other team in the league the same number of times (K), the total number of wins – the denominator of the fraction in Equation (4) – equals $\frac{NG}{2}$ so the HHI can be rewritten as:

$$HHI = \sum_{i=1}^{N} \left(\frac{2 \cdot w_i}{NG} \right)^2 \qquad [5]$$

for a league in season t with N teams each playing G games and winning w_i games in a season. This transformation works for leagues very regular schedules like European football leagues. However, North American leagues have unbalanced schedules that may preclude this substitution. For example, MLB teams may or may not all play 162 games each season because of games postponed due to rain and not made up, and also do not generally play every team in the league the same number of times each season. The NFL, NBA, and NHL also play unbalanced schedules.

In terms of the two simple leagues shown on Table 1, the HHI is 0.3 in each season in each league. Based on the HHI there is no change in competitive balance in these leagues over time. The HHI also indicates that the two leagues have the same level of competitive balance.

1.5. HHI-based Measures

Like σ-measures, HHI has notable limitations as a measure of competitive balance. Many of these limitations arise from changes in league structure and institutional characteristics over time. These limitations give rise to a number of HHI-based measures of competitive balance.

Depken (1999) first proposed HHI as a competitive balance measure and showed that the HHI depends on the number of firms in an industry, or in the sports league context, the number of teams in a league. Since North American sports leagues periodically expand, this can complicate the use of HHIs to measure competitive balance in sports leagues. Depken (1999) proposed the dHHI as a measure of competitive balance in leagues that expand over time.

$$dHHI = \sum_{i=1}^{N} \left(\frac{2 \cdot w_i}{N_i G_i} \right)^2 - \frac{1}{N} = HHI - \frac{1}{N}$$

where N is, again, the number of teams in the league. The $\frac{1}{N}$ in dHHI is the lower bound of the HHI. If teams in a league all have equal strength, the HHI equals $\frac{1}{N}$.

Michie and Oughton (2004) a related HHI-based measure of competitive balance:

$$mHHI = \left(\frac{1}{N} \right) HHI$$

which uses a multiplicative adjustment for the lower bound on the HHI rather than the additive adjustment used by Depken (1999).

Owen, and Owen (2007) show that the upper bound of the HHI also depends on league characteristics like the number of games and teams. Owen, Ryan, and Weatherston (2007) derive an upper bound on the HHI,

$$HHI^{UB} = \frac{2(2N-1)}{3N(N-1)}$$

where N is the number of teams in the league and propose an adjusted HHI that accounts for changes to the HHI upper and lower bounds. This HHI-based measure is:

$$HHI^{*} = \frac{HHI - HHI^{LB}}{HHI^{UB} - HHI^{LB}}$$

where $HHI^{LB} = \frac{1}{N}$.

In terms of the two simple leagues shown on Table 1, the dHHI is 0.1 in each season in each league, mHHI is 0.06 in each season in each league, and HHI* is 0.99 in each season in each league. The HHI-based measures of competitive balance indicate no change in competitive balance in these leagues over time. These measures also indicate that the two leagues have the same level of competitive balance.

1.6. The HHI and σ_{W1}

The HHI of the distribution of wins in a single season and σ_{W1} are functionally related.[1] The IO literature repeatedly notes this relationship. The earliest mention of a relationship between the HHI and the variance of the industry outcome being analyzed appears to be in Hay and Morris (1979). Laderman (1995) also notes this relationship and Depken (1999) clearly derives it in Equation [5]. Gayant and Le Pape (2015)contains a similar derivation to the one below. Van Scyoc and McGee (2016) also note this relationship in a paper on competitive balance. Despite the fact that the literature repeatedly identifies a functional relationship between HHI and σ_{W1}, applied papers continue to treat these two measures as separate, alternative measures of competitive balance.

In the notation used here, straightforward algebraic manipulation of Equation [2], imposition of the condition that all teams in the league play the

[1] I thank Moshe Lander for first pointing this out to me.

same number of games and all other teams in the league the same number of times, and substituting the definition of HHI from Equation [4] shows,

$$\sigma_{W1} = \sqrt{\frac{\sum_{i=1}^{N}\left(WPCT_i - \overline{WPCT}\right)^2}{N}}$$

$$\sigma_{W1} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(\frac{w_i}{G_i}\right)^2 - \left(\overline{WPCT}\right)^2}$$

$$\sigma_{W1} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(\frac{w_i}{G_i}\right)^2 - \left(\frac{1}{2}\right)^2}$$

$$\sigma_{W1} = \sqrt{N\sum_{i=1}^{N}\left(\frac{2\cdot w_i}{NG}\right)^2 - \frac{1}{4}}$$

$$\sigma_{W1} = \sqrt{N\cdot HHI - \frac{1}{4}}.$$

Note that Equation [5] in Depken (1999) contains G while the equation above does not because Depken (1999) shows the relationship between the variance of wins and HHI while the equation above shows the relationship between the standard deviation of winning percentage and the HHI.

While this relationship is nonlinear and depends on the number of teams in the league (N) and implicitly on the number of games played by each team, which affects σ_{W1}, the fact that σ_{W1} and the HHI are related has not been widely recognized in the literature. Instead, the two measures are typically depicted as alternative measures and not as functionally related measures of competitive balance. Given this clear, albeit non-linear relationship, the continued use of both σ-measures and HHI-based measures of competitive balance in the literature is puzzling.

1.7. Summary of Static Measures

Two primary static measures of competitive balance, σ-measures and HHI-based measures, exist in the literature. A clear functional relationship exists between these two measures, yet much of the literature treats them as distinct alternative measures that convey different information about competitive balance. Both types of measures appear sensitive to differences in league structure and institutional features which reduces their usefulness for comparing competitive balance across leagues, and over time in leagues with variable characteristics. Owen and King (2015) develop convincing simulation that σ-measures exhibit bias when N and G change. Owen and Owen (2017) develop similar evidence for HHI. Recent research suggests that even σ_{WI} does not represent a reasonable measure for comparisons across leagues and over time.

Both σ-measures and HHI-based measures have another significant limitation: none of these measures reflect changes in the relative standings in leagues over time. This limitation has been recognized for a long time in the literature (Eckard, 1998; Humphreys, 2002). However, σ-measures and HHI-based measures continue to be used extensively in the literature. Owen and Owen (2017) contains a thorough review of recent use of σ-measures and HHI-based measures in the literature. Dynamic measures of competitive balance address this limitation of σ-measures and HHI-based measures, yet these measures are not widely used in the literature.

2. Dynamic Measures of Competitive Balance

Sports economists long ago noticed that relative standings could be an important component of competitive balance, and developed a number of alternative measures of competitive balance to address this limitation of the static measures discussed above (Eckard, 1998; Humphreys, 2002). These alternative measures are called dynamic measures of competitive balance in the literature, because they capture changes in competitive balance over time.

2.1. The Competitive Balance Ratio

Again, variation in relative standings over time cannot be captured by σ-measures of competitive balance. Humphreys (2002) developed a dynamic measure of competitive balance, the competitive balance ratio (CBR), to address this limitation. The CBR uses an approach like Eckard (1998) but expresses competitive balance as a single number comparing within-team and within-league variation in winning percentages. Variation in winning percentages can be decomposed into two parts: within-team variation in winning percentages, capturing team-specific variation over seasons, and within-league variation in winning percentages, capturing within league variation at one point in time. The standard deviation of a team's winning percentage across seasons is one measure of within-team variation:

$$\sigma_{T,i} = \sqrt{\frac{\sum \left(WPCT_{i,t} - \overline{WPCT}_i \right)^2}{T}} \qquad [6]$$

where $\overline{WPCT_i}$ is each team's average won-loss percentage over T seasons. The smaller the value of $\sigma_{T,i}$, the less the variation in team i's winning percentage over time. For the hypothetical leagues shown on Table 1, each team in League 1 has $\sigma_{T,i} = 0.0$ and each team in League 2 has $\sigma_{T,i} = 0.35$.

Within-season variation in won-loss percentages can be measured by the standard deviation of the won-loss percentage in each season across all teams in a league,

$$\sigma_{N,t} = \sqrt{\frac{\sum \left(WPCT_{i,t} - 0.500\right)^2}{N}}. \qquad [7]$$

In this case $\sigma_{N,t}$ is a vector with one value for each season. For each year, $\sigma_{N,t}$ is identical to σ_{W1}.

The CBR averages these two types of variation in winning percentage to arrive at league-wide measures of each type of variation over any period. A measure of the average variation in teams' won-loss percentages can be found by averaging the $\sigma_{T,i}$s across teams in the league,

$$\bar{\sigma}_T = \frac{\sum \sigma_{T,i}}{N}. \qquad [8]$$

Similarly, the average variation in won-loss percentages in each season can be found by averaging the $\sigma_{N,t}$s across each season:

$$\bar{\sigma}_N = \frac{\sum \sigma_{N,t}}{T}. \qquad [9]$$

Note that if the same N teams play an identical number of games in each season, then $\bar{\sigma}_N$ equals σ_{W2}. League expansion, schedule adjustment, strikes, and postponed games that are not played reduce the periods over which this condition holds.

Using these two values, the Competitive Balance Ratio (CBR) can be defined as:

$$CBR = \frac{\bar{\sigma}_T}{\bar{\sigma}_N}. \qquad [10]$$

Expressing these two types of variation as a ratio has a number of appealing intuitive properties. First, unlike σ_{W2}, the CBR is easier to compare over different time periods because it does not have to be compared to an idealized value that depends on the number of games played in each season. In Major League

Baseball, σ_I changes as the schedule expanded from 154 games to 162 games. This makes it difficult to compare the σ_L from the 1980s to that from the 1930s. Because it is a ratio, the CBR also has intuitively appealing upper and lower bounds of zero and one.

This can be seen from the CBR for the two leagues shown on Table 1, which also illustrates the two bounding cases of the CBR. League 1 has no team-specific variation in won-loss percentage over these five seasons; each team in the league finishes in the same place in each season. The CBR for League 1 is zero. In league 2, the team-specific variation in won-loss percentage is equal to the within season variation over these five seasons; the for League 2 is one. In a league with a CBR of 0.5 the team-specific variation is half the size of the within season variation over the period.

Because the denominator of the Competitive Balance Ratio reflects σ_{W2}, these two metrics are inversely related; the CBR reflects some of the same information as the standard deviation of winning percentage. However, the CBR is a useful complement to σ_{W2} because it also reflects the average amount of team-specific variation in won-loss percentage that will not be reflected in $\sigma_{W,2}$.

2.2 Markov Transition Probabilities

Markov Transition Probability (MTP) approach also captures variation in team success across seasons. Hadley, Ciecka, and Krautmann (2005) first proposed MTP measures of competitive balance. This approach assumes that what happened in the past determines what will happen in the future. This measure of competitive balance has several benefits. First, transitional probabilities track teams' performance from one season to the next which static competitive balance measures fail to do. They also capture cyclical aspects of performance in sports.

Transition probabilities also show how difficult it can be for a bad team to "jump the curve" and win after a period of losing or how reluctant teams are to choose to hire the talent required to gain additional wins because of the effect of hiring additional talent on profits. A negative aspect to transitional probabilities is they do not take into account how close a winning team is to the successful state. This might help more accurately predict a team's chances from one season to the next since not all losers are equal at the end of a given season. A team that finishes two games away from making the playoffs or one win from a winning record is more likely to qualify for the postseason or have a winning record next season than a team that finishes at the bottom of the table, thirty games out of the playoffs.

At the heart of this measure of competitive balance is a Markov process. A Markov process describes a state-dependent model in which outcomes at time (t+1) depend on the state at time (t). The probability that a given team makes the transition from state to state b, P_{ab}, is called the "transitional probability." State a and b are defined by the researcher, depending on the research question being examined. Hadley, Ciecka and Krautmann (2005) defined state a as not making the playoffs at the end of the season and state b as making the playoffs. An alternative, relevant pair of states for sports would be wining and non-winning seasons. The transition probabilities are calculated by comparing end of season outcomes across two seasons.

For example, consider defining states as finishing the season with a winning (greater than 0.500) record and b finishing the season with a non-winning record (0.500 or worse). There are 4 season-to-season transitional probabilities in this Markov state model. Table 3 describes the four transition probabilities for these two states.

TABLE 3

MARKOV TRANSITION PROBABILITIES – WINNING TO NON-WINNING RECORD

Probability	*Transition Outcome*
P_{wl}	Probability team with winning record in t has non-winning record in t+1
P_{ww}	Probability team with winning record in t has winning record in t+1
P_{lw}	Probability team with non-winning record in t has winning record in t+1
P_{wl}	Probability team with non-winning record in t has non-winning record in t+1

P_{ww} measures persistence in winning records from season to season; it reflects the probability that a team with a winning record this season will continue to be successful in the following season. P_{ll} measures persistence in losing records; it reflects the probability that a team with a losing record will continue to be unsuccessful next season. The other two transitional probabilities are measures of changes in state. P_{wl} is a measure of switching from the unsuccessful state to the successful state; it reflects the probability that a losing team improves significantly in the following season. P_{lw} is a measure of switching from the successful state to the unsuccessful state; it reflects the probability that a successful team gets significantly worse in the next season. In leagues with little turnover in standings, P_{ww} and P_{ll} will be large and P_{lw} and P_{wl} will be small.

In terms of the two simple hypothetical league outcomes shown on Table 1, for League 1 P_{lw}= P_{wl} = 0.0, P_{ll} = 0.6 and *Pww*. League 1 has complete persistence in winning and losing teams, and no turnover in relative standings from year to year. Teams with winning records continue to win and team with non-winning records continue to lose. For League 2, $P_{lw} = P_{ww} = 0.2$ and $P_{ll} = 0.4$. League 2 has very high turnover, as the transition probabilities P_{lw} and P_{lw} are relatively large.

Hadley, Ciecka and Krautmann (2005) also proposed a statistical test of competitive balance using Markov transition probabilities. The test is based on the null hypothesis H_o: $P_{ww} = P_{lw}$. The intuition behind the test is that in a league with balanced competition, all teams should have an equal chance of having a winning season in season $t+1$ no matter what the outcome was in season t. In other words, the transition process should not be state-dependent. This null hypothesis is a test of state independence. While little used in the literature, this test represents a useful extension to other commonly used competitive balance assessments. For the two hypothetical league outcomes shown on Table 1, $P_{ww} > P_{lw}$ in League 1 and $P_{ww} = P_{lw}$ in League 2.

III. APPLICATION: COMPETITIVE BALANCE IN MLB

In order to illustrate the measures of competitive balance discussed above, and to highlight their various strengths, weaknesses, and applications, this section analyzes competitive balance in MLB over the 1906 through 2015 seasons using the competitive balance measures developed above. MLB formed in 1903 with the merger of the National League (founded in 1976) and American League (founded in 1901) and the first championship game between the two leagues, the "World Series" was played in 1905. Data from MLB over this period have been extensively analyzed in the competitive balance literature (Depken, 1999; Eckard, 2001; Schmidt and Berri, 2002; Hadley, Ciecka and Krautmann, 2005; Krautmann and Hadley, 2006; Owen, Ryan and Weatherston, 2007; Lee and Fort, 2008; Owen and King, 2015; Van Scyoc and McGee, 2016) so I do not provide summary statistics for the data.[2]

1. Static Measures

1.1. σ-measures

The first measure of competitive balance developed is σ_{W1}. Figure 1 plots σ_{W1} for the American League (AL) and National League (NL) over the 1906-2015

[2] The entire data set in usable form can be easily downloaded at http://www.seanlahman.com/baseball-archive/statistics/

seasons for single seasons (left panel) and half-Decades (right panel). The light gray line is the American League and the black line is the National League on both graphs. Both graphs also include a semi-parametric trend line based on a fifth-degree polynomial function to represent the general trend in competitive balance over time. MLB contains two leagues. A single "major" league was formed in 1903 when the incumbent National League merged completely with the rival American League. The two leagues have slightly different rules, and teams from the two leagues did not play each other in the regular season until 1997; until then, the champion of each league played in the "World Series" for the MLB championship at the end of each season. Research on MLB competitive balance typically treats the two leagues separately.

FIGURE 1

AL AND NL σ-MEASURES, 1906-2015

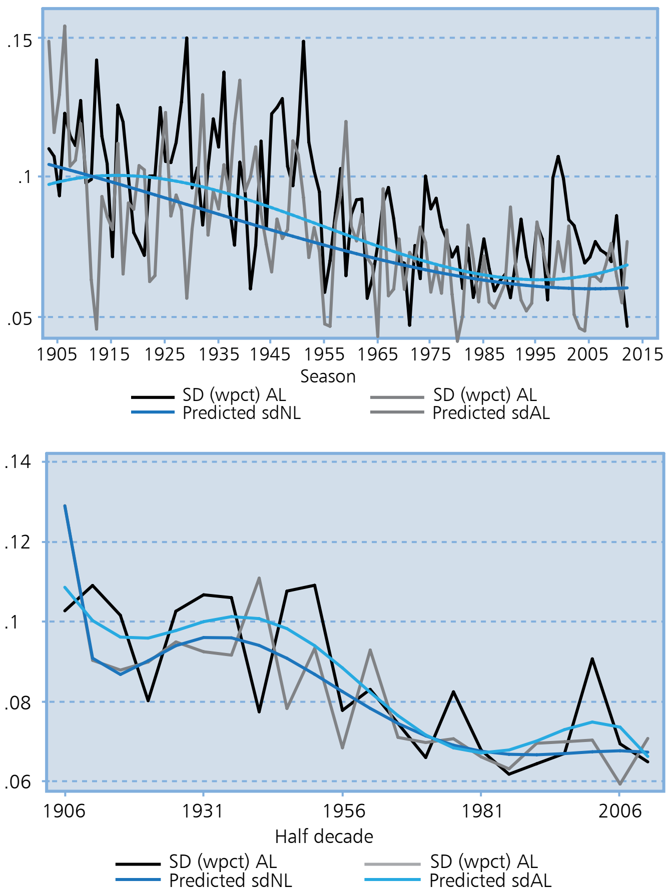


Figure 1 shows substantial noise in terms of season-to-season changes in σ_{W1}. The large amount of season-to-season variation in σ_{W1} makes a direct visual comparison of the two leagues difficult. Figure 1 also shows a steady decline in σ_{W1} in both leagues over the sample period. This downward trend in σ_{W1} indicates that competitive balance improved in MLB over this period. In addition, σ_{W1} in the two leagues track each other relatively closely. No prolonged divergences exist between the two leagues. Whatever factors lead to the increase in competitive balance, they affected both leagues in a similar way.

Since there were many institutional changes in MLB over this period, in terms of rules of play, number of teams, games in a season, length of the postseason, and other factors, and because of the substantial season-to-season noise evident on Figure 1, I divide MLB history into five season periods beginning with the period 1906-1910. Dividing this period up into half decades is somewhat arbitrary, but it provides one way of examining changes in the level of competitive balance over time. I start the sample in 1906 and group seasons into 5 year half-decades so that the year when the schedule changed from 154 games per season, 1961, falls in the first year of a half-decade. The right panel of Figure 1 shows σ_{W2} for the NL and AL for half-decades beginning with 1906-1910 to 2011-2015.

From the left panel of Figure 1, σ_{W2} declines relatively steadily from the early 1900s on in both leagues, with a few exceptions. This indicates that variation in winning percentages was declining in MLB over the past 110 years. Competitive balance, as measured by σ_{W2}, was better in the latter half of the 20th century than in the first half of the century. This downward trend in σ_{W2} mirrors the downward trend in σ_{W1} shown on the left panel of Figure 1. A notable exceptions is the AL in the 2001-2005, when σ_{W2} increased to roughly the same level of competitive balance as in the 1950s.

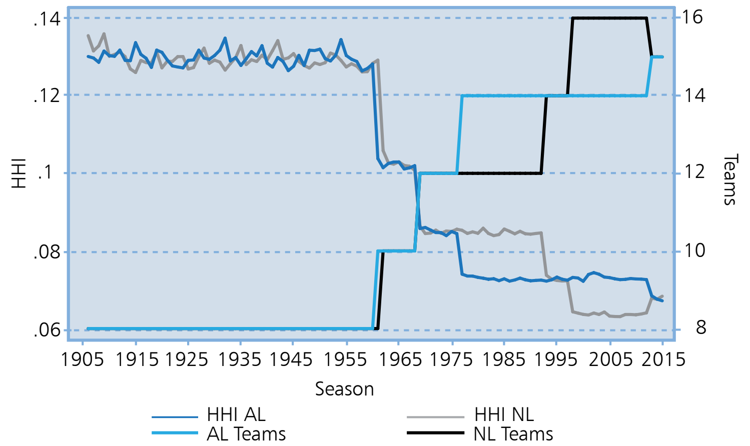
The length of the MLB season increased from 154 games in 1903 to 162 games in 1961 and after. The Noll-Scully ratio, σ_{WI}, represents a method for adjusting σ-measures for changes in the number of games played. σ_I for the 1906-1960 period is 0.040 and 0.039 for the 1961-2015 period. Given the small difference in these values, σ_{WI} will not be discussed here.

1.2. HHI-based Measures

HHI-based measures represent a major alternative to σ-measures of competitive balance in the literature. The most common outcome share analyzed in the literature is the share of wins earned by each team in each season. Figure 2 shows the HHI for the American League (black line) and National League (grey line) over the 1906-2015 seasons. The HHIs on Figure 2 should be read on the left axis scale.

FIGURE 2

AL & NL HHI AND # OF TEAMS 1906-2015



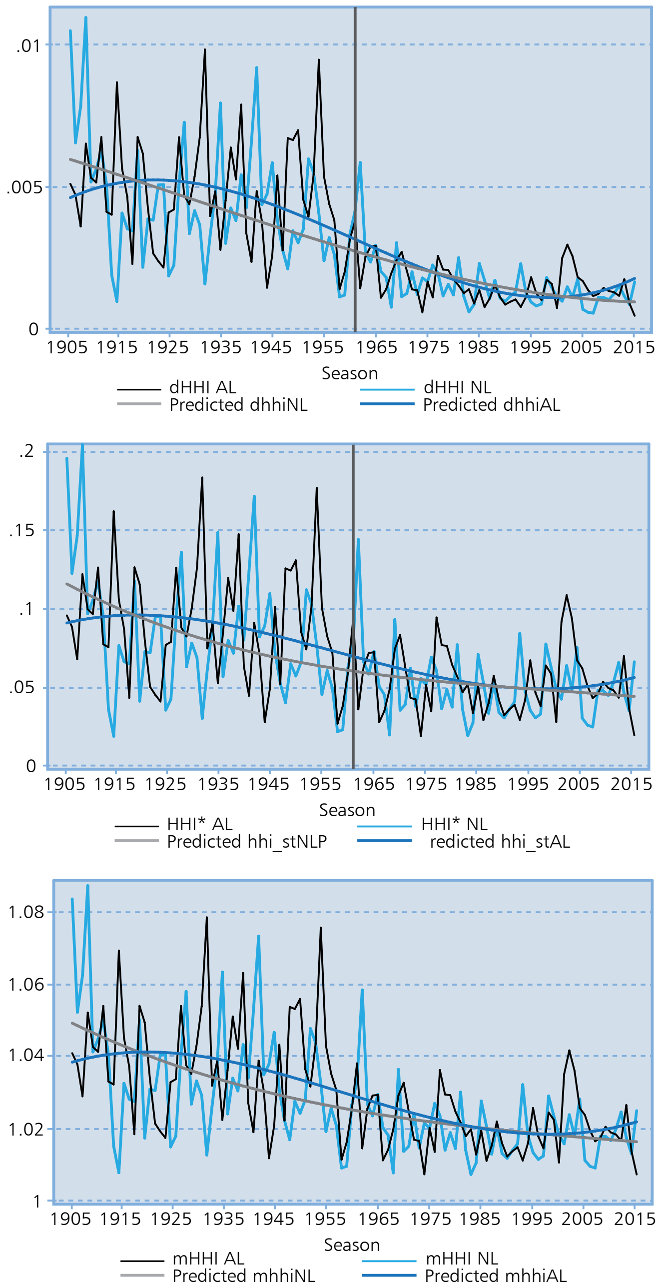
Depken (1999), pointed out that the HHI depends strongly on the number of teams in the league. Owen, Ryan and Weatherston, (2007) contains similar figures and Figure 2 and Figure 3 simply extend graphs in that paper by 20 seasons. Figure 2 clearly shows dependence between HHI and the number of teams in MLB. Both the NL and AL expanded steadily over the sample period. The stair-step lines on Figure 2 show the number of teams in each league over the period and should be read from the right axis scale. From 1906 through 1960, both leagues contained 8 teams. The AL added 2 teams in 1960 and the NL followed suit, adding 2 teams in 1961. Expansion continued throughout the restof the sample period. Note that in 2013 a team switched leagues from the NL to the AL, which gave both leagues 15 teams.

The stair-step form of the HHI for each league moves in lock-step with the league expansions; HHI uniformly declines with the number of teams in each league. Figure 2 clearly shows the limitations of the HHI as a competitive balance measure in leagues where the number of teams changes substantially in the analysis period. This occurs regularly in all North American leagues, but not in leagues in other parts of the world.

The discussion above describes a number of corrections to the HHI to account for differences in the number of teams in a league and the number of

FIGURE 3

AL & NL CORRECTED HHIs 1906-2015



games played by teams. These include the dHHI (Depken, 1999), HHI* (Owen, Ryan and Weatherston, 2007), and mHHI (Michie and Oughton, 2004). Figure 3 shows the values each of these adjusted HHI measures for each season in the sample. The left graph shows the dHHI, the center HHI* and the right graph mHHI. Again, all three graphs also include a semi-parametric trend line based on a fifth-degree polynomial function to represent the general trend in competitive balance over time.

dHHI, HHI*, and mHHI all show similar patterns in terms of changes in MLB competitive balance over time and the AL and NL values track each other closely. All three measures show a clear downward trend over time, indicating a general improvement in competitive balance in MLB over the period. The polynomial trend lines are a bit flatter for HHI* and mHHI than for dHHI. At a glance, the pattern of changes in competitive balance on Figure 3 resembles the pattern for σ_{W1} shown on Figure 1. This is to be expected, given the functional relationship between HHI and σ_{W1} derived above.

The variance of dHHI and HHI* appear to decline after the schedule expanded to 162 games in 1961. The grey vertical line on Figure 3 identifies the 1961 MLB season. This decline in variance appears to be consistent with the simulation results shown on Figure 4 and 5 in Owen and Owen (2017) which shows a decline in the spread of HHI-based density functions as the number of games played increases. However, Owen and Owen (2017) do not report measures of variation of density functions. This topic needs more attention.

2. Dynamic Measures

Dynamic measures of competitive balance must be calculated over a period of time, since they incorporate both between-season and within-season measures of competitive balance. Competitive balance in MLB will be analyzed using dynamic measures of competitive balance over five year (half-decade) periods. This represents an arbitrary, but convenient, choice of time periods for the purpose of analysis in this case.

Dynamic measures of competitive balance, including the CBR and MTP approach, address an important limitation of static competitive balance measures like σ-measures and HHI-based measures – their inability to reflect relative changes in standings in leagues over time. The CBR partitions variability in league outcomes into within-season and between-season components. The MTP approach shows the likelihood that a team transitions or does not transition between two specific state related to team success from one season to the next. Also, recall that the CBR expresses dynamic competitive balance as a single number, reflecting the amount of within-team variation in winning percentage relative to the within-season variation in winning percentage.

Despite this distinction, the CBR and MTP have not been used much in the literature. Krautmann and Hadley (2006); Schokkaert and Swinnen (2016), and Pawlowski, Breuer and Hovemann (2010) used the MTP approach to analyze competitive balance in baseball and European football. The CBR has been used to analyze competitive balance a few more times. Lee and Fort (2008); Lee (2009), Pawlowski, Breuer and Hovemann (2010); Jane (2014); Cha, Chang and Kim (2015); and Carroll and Humphreys (2016) use the CBR. Carroll and Humphreys (2016) was actually the first paper to use the CBR as a working paper, applied to American college football, even though this paper was published long after the original Humphreys (2002) paper that introduced the CBR.

On reason the MTP approach has not been widely adopted is the lack of easy implementation of this competitive balance measure. The MTP approach generates four different values to describe outcomes in a sports league. Most other competitive balance measures generate a single value.[3] Four different values reflecting competitive balance poses problems displaying the information and analyzing changes over time or across leagues.

Recall, from the discussion above, that Hadley, Ciecka, and Krautmann (2005) propose a statistical test for competitive balance based on a null hypothesis of state-independence: H_o:P_{ww}=P_{lw}. Implicitly, this tests the assumption that a successful season in $t+1$ is independent of outcomes in season t. This test also suggests a single value, the ratio of P_{ww} to P_{lw}, which can provide useful information about competitive balance. P_{ww} reflects the probability that a winning team in season t repeats as a winning team in season $t+1$. P_{lw} reflects the probability that a losing team in season t becomes a winning team in season $t+1$. P_{ww} is large in most leagues. The ratio (P_{ww} / P_{lw}) reflects how much more likely it is that a winning team keeps winning relative to the likelihood that a losing team becomes a winning team; it conveys information about both the persistence of winning and the likelihood of improvement. I call this the *Transition Ratio.*

The Transition Ratio has a natural interpretation. If equal to one, the outcome in that league is state independent. The probability that a team is successful next season does not depend on this season's outcome. This league has high competitive balance. As the Transition Ratio gets larger, the league gets

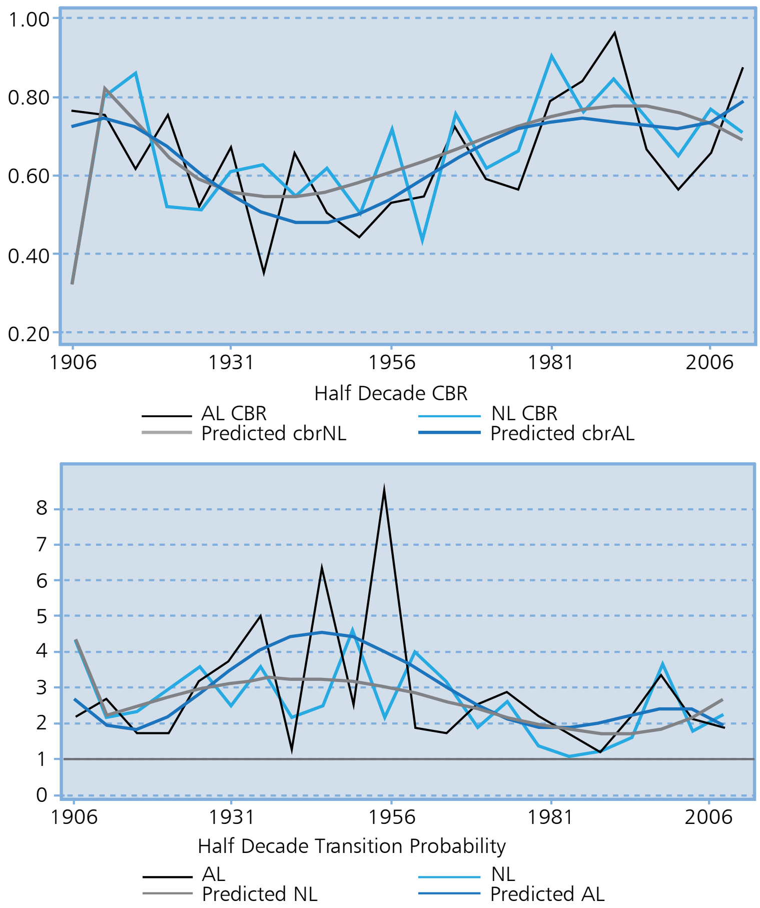
[3] This may also explain why the variance decomposition developed by Eckard (1998) has not been widely used in the literature. That measure generates two values.

more state-dependent. Winning teams are more likely to continue winning and losing teams are less likely to improve.

Figure 4 shows the CBR (top panel) and the Transition Ratio (bottom panel) for the AL and NL over 5 year periods from 1906 to 2015. As on the other graphs above, the grey line represents the AL and the black line the NL. Recall that larger CBR values indicate more competitive balance. Both graphs also include a semi-parametric trend line based on a fifth-degree polynomial function to represent the general trend in competitive balance over time.

FIGURE 4

DYNAMIC MEASURES BY HALF-DECADE, 1906-2015



First, notice that the first half-decade in the sample, 1906-1910, shows a striking difference in competitive balance between the AL and NL for both measures. Competitive balance was much lower in the NL than in the AL over this period. The Transition ratio shows that NL turnover was much lower than AL turnover. This difference can also be seen on Figure 1 for σ-measures and on Figure 3 for HHI-based measures. The 1906-1910 period was the first half decade after the AL-NL merger that created MLB. During the period when the AL was a new, rival league, AL teams signed many players from NL rosters. This likely impacted the level of competitive balance in the NL in the following years.

Based on the CBR results shown on the left panel of Figure 4, competitive balance in both leagues was relatively high early in the period, declined during the 1930s through 1950s, and increased after about 1960. MLB instituted an entry draft in 1965 that likely contributed to this increase. There was also a decline in the CBR in the 2001-2005 period in both leagues.

The Transition Ratio shows a similar pattern. Note that the Transition Ratio was generally over two throughout the period. The average for both leagues is about 2.7, indicating that, on average, winning teams were 2.7 times more likely to continue winning in the following season than losing teams are to improve to a winning record in the following season. Like the CBR, the Transition Ratio was highest in the 1930s to the 1950s, although this period showed some variability. The Transition Ratio was as high as 6-8 in the AL in the 1940s and 1950s, and as high as 4 in the NL.

The Transition Ratio was lowest in both leagues in the 1980s, where both leagues moved toward state-independence, or maximum competitive balance. The AL transition Ratio in the 1980s is quite close to one, suggesting that the probability a losing team “jumped the curve” to a winning season was as high as the probability that a winning team in one season was a winning team in the following season. That represents substantial turnover in relative standings from season to season.

IV. CONCLUSIONS

Researchers analyzing competitive balance face choices among different measures developed and used in the literature. This paper discusses several commonly used measures. I have not exhaustively surveyed all existing methods, but instead focus on a few very commonly ones.

Which measure should be used? Note the important difference between the level of competitive balance in MLB impled by the dynamic measures on

Figure 4 and the static measures on Figure 1 and Figure 3. The static measures imply that competitive balance increased continuously in MLB over the sample period. The dynamic measures imply that competitive balance was high in the early days of MLB, declined in the 1930s to 1950s, and then improved after the early 1960s. A number of key institutional changes occurred in MLB after the mid-1960s, including the imposition of an entry draft in 1965, the advent of free agency in 1975, and the imposition of a "competitive balance tax" on total team payroll in 1997. These changes likely explain much of the increase in competitive balance after the early 1960s shown on 4.

However, there were no such restrictions in the early part of the 1900s. During that period, static measures indicate relatively low competitive balance and dynamic measures suggest high competitive balance. Again, the likely reason for this difference comes from the fact that static measures cannot capture changes in relative standings over time while dynamic measures can.

Also, the sensitivity of static measures to changes in the number of teams in the league and games played by teams represents an important factor influencing the choice of a measures of competitive balance. In relatively stable leagues with few changes in the number of teams and games played, for example most European football leagues, such changes represent a minor problem. The changing composition of the league due to promotion and relegation probably affects competitive balance more in these settings. But changes in these factors represent important features in North American leagues, and researchers should take this into account.

The difference in changes in competitive balance implied by the static and dynamic measures of competitive balance should give pause to researchers studying competitive balance. These two alternative measures do not give identical indications of changes in competitive balance over time within the same sports league. The differences reflect the inability of static measures to accurately reflect changes in relative standings over time. This also represents an important limitation that researchers analyzing competitive balance need to understand. The relatively small number of papers using dynamic measures in the literature suggests that this point is not widely appreciated.

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EUROPEAN AND NORTH AMERICAN SPORTS DIFFERENCES (?): A RETROSPECTIVE

Rodney FORT

Abstract

I take a retrospective look at my earlier paper (Fort, 2000) that argued the differences between North American and European sports leagues (and some elements of sport in general) are overblown. I stick to my guns, primarily on "objective functions are different" but subsequent work in sports economics clearly shows that "fans are different" and "organizations are different". As a result, further comparative work on differences between North American and European sports leagues is certainly in order.

Keywords: European leagues, North American leagues, comparative sports economics.

JEL classification: Z20.

I. INTRODUCTION

In my Google Scholar list, "European and North American Sports Differences (?)" (Fort, 2000, henceforth, *Fort00*) ranks third in total citations. While the impact of any of my work is debatable, *Fort00* is, at least relatively speaking, one of my most important papers. From my present vantage point, the hutzpah displayed by someone so young and inexperienced even daring to take on the task of comparing North American Leagues (NALs) and European leagues (ELs) is a bit embarrassing. There were plenty of things that I didn't know, or that hadn't been analyzed to my knowledge at that time.

However, whatever one thinks of the answers in *Fort00,* the questions posed were good ones because they provided a basic outline of comparative sports economics issues of the time. Indeed, shortly after *Fort00* appeared, so did two edited collections on international sports economics comparisons – Barros, Ibrhaimo and Szymanski (2003) and Fort and Fizel (2004). I know for a fact that the latter was spurred entirely by *Fort00.*

I've learned quite a bit in the intervening nearly 20 years. Some of that learning came from my own work but the vast majority of it came with the incredible growth in the sports economics field. Remember that the *Journal of Sports Economics* inaugural year coincided with *Fort00.* And it is only just recently that sports economics received its own *Journal of Economic Literature* code (Z2 Sports Economics, with Z20-Z29 subheadings).

In this brief retrospective, the questions posed in *Fort00* are revisited in order to see which still hold water and to identify those that I would take back. As Harcourt (1986) cites Joan Robinson on Keynes oft-quoted remark, "When someone persuades me that I am wrong, I change my mind. What do you do?." The goal of this retrospective is still the same as in *Fort00* (p. 431), "Perhaps as I lay out these puzzles, it will spur further communication and scholarly development and comparative sports lines."

This retrospective is more of a reflection than a standard "journal article". It will fail as a bibliography (although I try to do my best where I can). It will also fail by omission of sports economics areas not covered in *Fort00.* The subsidy relationship between government and the sports business, the problems of administrative corruption, plus labor-management relations come to mind. I assume responsibility for both failures at the outset, especially apologizing for all of the work I will surely fail to cite, but hope the contribution is interesting anyway.

The contribution proceeds as follows. *Fort00* was built around three categories of "difference" – Fans, Sports Organizations, and Team Objectives.

In the next three sections, I give a quick review of each of these original categories, specify where I still stick to my guns, and admit those claims that are taken back in light of subsequent thinking, interaction with colleagues, and, of course, work to the contrary. Section V concludes the contribution.

II. FANS ARE DIFFERENT

1. Synopsis of the category from *Fort00*

In Europe, so *Fort00* observed, preferences follow local, national, and international dimensions. The last is of overriding importance in ELs, but not NALs. Major League Baseball (MLB), the National Basketball Association (NBA), National Football League (NFL), and National Hockey League (NHL) do not produce true "world champions."

Fort00 countered that North American fans wrap themselves in their respective flags with the best fans in Europe when they did have to confront true international outcomes, say, during the Olympics or FIFA World Cup (when NALs occasionally make successful appearances). Thus, a focus on the existence of international federation "world" outcomes could only discover (p. 432) "… how fans (and possibly different fans) feel differently about differently types of competition, national versus international." But such a focus on international federation world outcomes could not inform us about how major NAL fans felt about a type of competition that is never presented to them in the first place.

Fort00 went on to cite works at the time showing the similarities in the economic elements of demand. Demand curves slope down. Income effects are typically negative. Travel cost matters. Demand is less elastic for higher-level play. TV didn't substitute much for live attendance. Changes in league structure that impacted competitiveness also impacted attendance.

Somewhat brash, and wrapping in the idea that those claiming such differences may have motives for doing so, *Fort00* posed the suggestion that future work focus on actual theoretical and empirical justification for fan differences, the motivations of those arguing preference differences, and the implications for policy makers.

2. Retrospective

The observation concerning the absence of international federation "world" outcomes are justifiable today on the same grounds as in *Fort00.* One can only wonder why the major NALs did not develop and evolve a similar federation approach, not that fans have different preferences about such an approach. It could be true, but it could be just as true that different political and economic institutions are responsible, regardless of fan preferences.

However, it is quite plain that the empirical identification of differences in fan preferences has rendered the second surmise in *Fort00* simply incorrect (although it did follow from the limited work done at the time). The reversal occurs as a result of all of my colleagues' work on what has come to be named the "uncertainty of outcome hypothesis" (UOH) following Rottenberg (1956).

Essentially, the UOH goes as follows. If fans care about outcome uncertainty, then management of competitive balance becomes a league task. If analysis fails to reject the UOH for some league, and the league members ignore the result, they run the risk the demise of economically viable but competitively weaker teams and lower revenues for the remaining owners as fans abandon the sport in general. In a model of attendance (A), including outcome uncertainty (OU), Rottenberg's UOH is rejected if $\frac{\partial A}{\partial OU} \leq 0$. Or, the fans of a given team or league *fail to reject* the UOH iff $\frac{\partial A}{\partial OU} > 0$.

Shortly after *Fort00,* Szymanski (2003) surveyed all of the work on the UOH and found that it provided no compelling result, one way or the other, regarding fan preferences for outcome uncertainty. In unrelated work, I pointed out much of the demand analysis did not even incorporate the UOH and the rest had other specification issues (Fort, 2006a). Be that as it may, Szymanski's finding allowed for the idea that fans of NALs and ELs clearly did not universally adhere to the UOH. Put another way, there were plenty of examples that found $\frac{\partial A}{\partial OU} \leq 0$.

Szymanski used the case of the English Premier League to make the basic point. The league is nearly completely competitively unbalanced but revenues just keep growing. An example from across the ocean might be the highest level of college football. Football Bowl Subdivision (FBS) conference and national championship results are completely dominated by the so-called "Power 5" conferences but revenues across the FBS just keep growing.

There really is no use trying to go back through the literature to see if Szymanski's non-compelling outcome might divide differently across the ocean. Jespersen, and Pedersen (2018) show significant variation on the UOH, just for Europe. In their review, $\frac{\partial A}{\partial OU} > 0$ happened in 1 of 5 papers on the English Premier League, the only paper on the French premier league, and 1 of 2 papers on the Spanish premier league. All of the rest of the work they review found $\frac{\partial A}{\partial OU} \leq 0$ in the highest level ELs (Austria: 1 paper; England: the other 4 papers; Germany:

all 3 papers; Italy: 1 paper; Portugal: 1 paper; Spain: 1 other paper; Switzerland: 1 paper).

One of the reasons for the variety of results, I'm sure, is the variation of measures and approaches across all of these works (my earlier warning from Fort, 2006a). But that said, it is difficult to argue with a score of 12 papers to 3 against the UOH.

Further, much of my own work also finds variation in support of the UOH in time series analysis of attendance in NALs (Lee and Fort, 2008; Fort and Lee, 2013; Mills and Fort, 2014). And it can also matter what level of competition one analyzes. Mills and Fort (2018) find dramatic variation in the explanatory power of the UOH in team-level time series analysis of attendance in major NALs.

In another international league, Lee, Jang and Fort (2016) find consistent evidence at both the individual team level and the league-aggregate level that balance effects attendance in the Korean Professional Baseball League (KPBL). Our conclusion was that KPBL fans are interested in close games across the league, and not necessarily just for their favorite team.

Finally, work on TV viewing also provides mixed results on fan preferences toward outcome uncertainty in both Europe and North America. This is a rapidly growing area of work and references to Nalbantis and Pawlowski (2018) and Sung, Mills and Mondello (2018) are offered as the most recent examples of work on soccer in Europe and North America. It is left to the interested reader to delve into the extensive and complete references contained therein.

To further that "fans are different", here is an anecdotal riddle posed to me by my colleague Stefan Szymanski. NAL post-season championships are mini-tournaments seeded according to regular season outcomes. Suppose four teams win their respective divisions in a given league, and their winning percentages are ranked 1 through 4. In the first round of an NAL-style championship, 1 plays 4, and 2 plays 3. The winners then play for the championship. In Europe, the seeding is handled by random draw. The riddle: Why this difference in the seeding process?

The conclusion, my esteemed colleague convinces me, is that NAL and EL fans simply have different definitions of "fairness". EL fans, it would seem, find the allocation of resources, itself, that led to regular season dominance a matter of luck. Pairings by random draw, then, offset that base-level luck with the chance that good teams will be force to face each other earlier in the tournament.

Comparatively, NAL fans are different in one of two ways. On the one hand, their sense of fairness may require lower-seeded teams to prove they deserve a championship slot. On the other hand, NAL fans may implicitly believe that teams with higher regular season winning percentages are deserving of their deserved regular season success and higher seeding. The point of relating the anecdote is to point out that fan preferences are a many-splendored thing, beyond just outcome uncertainty.

All in all, one still can continue to wonder about the relationship between fan preferences and the organizational forms that pro sports have taken across the ocean. But subsequent work clearly points out that fan demand is different in fundamental preferences toward outcome uncertainty, both across sports and across nations.

III. SPORTS ORGANIZATIONS ARE DIFFERENT

1. Synopsis of the category from *Fort00*

Fort00 based conclusions on NAL and EL sports organization differences on three different facts. First, hierarchical organizational structure exists to design and administer true international play for ELs. Examples are the Union of European Football Associations (UEFA) for Europe and Fédération Internationale de Football Association (FIFA), worldwide. Second, as a sports league feature, there is no promotion and relegation (P&R) in NALs. Third, "training" funds do not cascade from high revenue, highest level of play to the lower levels of sport in NALs like they do in ELs.

Evaluation of the first fact in *Fort00* followed simple organization theory. Sports organizations exist to fill the cooperation needs that individual owners, or leagues themselves, cannot fulfill on their own. These include both single-entity needs (just to make play happen) and joint-venture desires (to make more money, rather than less, from the play that is made to happen).

This led to the *Fort00* observation that major NALs were the equivalent of national associations and UEFA in terms of function for their domestic team owners/clubs. Further, UEFA was judged remarkably similar to the National Collegiate Athletic Association (NCAA) if the comparison were extended to North American college sports.

The defining organizational difference, then, appeared to be a world body like FIFA. *Fort00* turned to the fact that the North American sports world outside of the four major NALs is organized precisely along the same lines–world governing body (under Global Association of International Sports Federations, or GSIAF, *e.g.,* FIFA), intercontinental governing body (if needed, *e.g.,* Confederation of North, Central American and Caribbean Association Football, or CONCACAF), national affiliates (*e.g.,* U.S. Soccer), and on down to club sports. A current, rising example is eSports, currently working its way toward this precise model of world governance under the World eSports Association (WESA).

On P&R, *Fort00* suggested that some of the history of NALs and the process crowning a national champion in college football mimicked this feature of ELs. *Fort00* also suggested that the presence or absence of P&R probably didn't matter anyway. Both NALs and ELs put the highest quality level of competition in front of those willing to pay the most to see it.

Which brings us to the absence of training money trickle down in NALs. *Fort00* observed that the minor leagues feeding MLB and the NHL were either vertically integrated via ownership, or via player development contracts, so the trickle down for talent development in those two NALS would be similar that in ELs. The NBA and NFL, on the other hand, were different. The value of play at the college level was so large for these sports there was no need for the major NALs to cover any sort of development cost. *Fort00* also noted that the trickle down of big post-season money occurred from stronger to weaker teams in college conferences.

2. Retrospective

I stick to my guns on the first issue and the reason is similar to my earlier stand on "fans are different." The difference in organizations is just an artifact of the different needs of the team owners. In the major NALs, without any avenue at all to an international level of play, there is no need for a world governing body. And all of the other sports are, in fact, organized just like the rest of the sports in the world.

On the other hand, I would take back my earlier claims on P&R. Ross (1989); Szymanski and Ross (2001); Ross and Szymanski (2002, 2008); and Szymanski and Valletti, (2010) have made two things abundantly clear. First, P&R leagues make different talent decisions. Second, P&R could bring fan value to leagues that adopt it.

Despite these strong arguments, and despite fan-voiced demand for it in the popular press, NALs have devoutly ignored P&R. Indeed, even Major League

Soccer (MLS) shuns P&R. That league has had the chance to embrace P&R since there are second division possibilities like the United Soccer League (USL) and the North American Soccer League (NASL). While MLS has actually been the subject of a law suit to just determine which of the two is the official second division, it has officially rejected P&R.

Noll (2002) listed the reasons why P&R will not be a feature of NALs. First, speaking generally beyond MLS, a second division would have to be identified and granted access to the major league. In essence, if a team in the highest level of minor league baseball finished with a better winning percentage than the worst MLB team, it would join MLB. Second, player pay rises with the implementation of P&R. Finally, quoting Noll directly (p. 199), "On the negative side, teams that are relegated do worse financially than they would if they finished in the bottom group of teams in the higher league."

Current members of a major NAL would never agree to P&R. Despite the overall improvement that might occur from the fan perspective, the original value placed on membership by the owners joining the league was predicated on it remaining closed. If the league were then later "opened" via P&R, the subsequent value of ownership would be below their entering estimate.

Fort00 noted that the distribution of talent should be similar in NALs and ELs if, indeed, both organizational forms put the highest quality of play in front of those willing to pay the most to see it. But this claim is undone by my own empirical work. The distribution of talent is dramatically different in NALs and ELs (Lee and Fort, 2005, 2012; Fort and Lee, 2007). This is especially telling in our most recent analysis of the higher moments of the talent distribution which shows significantly different skew and kurtosis for NALs, compared to ELs (Jang, Lee and Fort, 2018). We go so far as to suggest that organizational and revenue sharing differences are behind this variation.

Another *Fort00* claim was that if talent were being distributed similarly, then Rottenberg's (1956) other "invariance principle" (IP) should be as powerful in ELs as in NALs (excluding labor mobility and location preferences of players, to which I turn in the conclusion). The IP simply states that the distribution of talent is invariant with respect to whether owners/clubs or players keep the value produced by the latter. However, Fort, Maxcy and Diehl (2016) review the IP literature and find that sometimes the IP holds, and sometimes it doesn't, regardless of whether NALs or ELs were under analysis.

Finally, on revenue trickle down, intervening events have further muddied the water. At the outset, it is the case that the revenues of the strongest teams have grown faster than the rest, both in NALs and ELs. The same is true in college football and men's basketball. Both continue to be dominated mainly by the same Power conferences. A similar result occurs in ELs with the rise of the value of post-season tournaments like Champion's League.

But the question originally posed in *Fort00* had to do with trickle down for training, a very controversial topic at the time. It is unclear whether larger amounts are also trickling down to the training level. In one NAL, MLB, a lawsuit by minor league players seeking higher pay were heard and rejected by the courts. But that was about an increase in spending, not its level. And in the college-supplied leagues, the money is bigger than ever but appears to be managed to benefit of a few conferences rather than all in general.

IV. TEAM OBJECTIVES ARE DIFFERENT

1. Synopsis of the category from *Fort00*

In *Fort00,* discussion of objectives concerned owners in NALs maximizing profit while European clubs/owners maximized something else. Again, going all the way back to Sloane (1971), there has always been the underlying observation that clubs/owners might be utility maximizers. In my upcoming review (Fort, 2019; see also Fort 2015), the lineage after that, and at the time of *Fort00,* also included Quirk and El Hodiri (1974) and then up to Vrooman (1995). But analysts of the European scene focused on wins, instead.

Winning takes center stage in Europe, according to the story at that time, because teams move "up the ladder", based on wins. This is true both via P&R within a league and into championship participation within a league and internationally. In addition, analysts at the time found no profits in the accounting information on European teams. Indeed, there was some evidence that European teams priced tickets in the inelastic portion of demand, claimed at the time a violation of profit maximization. Thus, and again I stress at that time, theoretical treatments of ELs were all about maximizing wins.

On "ladder climbing" and winning, the same argument about P&R being over-rated was extended in *Fort00.* If the characteristics of the distribution of talent didn't depend on P&R (as argued in "organizational differences"), then why would clubs/owners forsake profits? It just didn't follow.

Fort00 went on to suggest the pitfalls associated with any search for profits in individual team or league accounts. In the NAL case, tax law allowed true economic profits to be concealed under various deductions like the roster depreciation allowance. In North American college sports, without any residual claimant, profits might be pursued but plowed back into the athletic department. In addition, there are numerous other values to ownership not found on the team accounts. All the way back to Heilmann and Wendling (1976), *ticket prices* can be in the inelastic region for any number of reasons. Finally, as in the North American case, European team values were rising and individually owned teams, as opposed to fan-owned clubs, had already made the scene.

Based on a working paper cited then (eventually, Fort and Quirk, 2004, 2007), I offered an empirical observation and logical reasoning against win maximization. Extant empirical work at the time had talent move between teams according to marginal contributions to team revenues. But win maximization would have talent chosen where winning percentage equals the ratio of the team's total revenue to the league's total revenue. The perfectly reasonable logic concerned how an equilibrium of win maximizing clubs/owners could not survive competitively against an organization of profit maximizing owners, both serving the same fans.

2. Retrospective

As presented in the last section, subsequent empirical work simply rejects the *Fort00* belief that the distribution of talent would be the same in both NALs and ELs. So, of course, I take back my claim that different objective functions are an overblown explanation of team objective function differences. It could well be that different objective functions, as well as different organizational structures, are part of the answer to different talent distributions.

Turning to the failure to find profits empirically, I still stand by my original claim. There has been subsequent work on the insolvency problem of EL teams. Lago, Simmons and Szymanski (2006) provide a comprehensive introduction to an entire volume of the *Journal of Sports Economics* devoted to that topic. However, all of these simply take the bottom line of team financial statements as given. I have yet to see anybody undertake a full tax-policy-inclusive analysis of the profitability of European football. And the same goes for the analysis of ownership values not found on the team accounts (since formalized and analyzed for MLB in Fort, 2006c).

This may be a daunting task given that teams play under different tax laws across all of Europe. But I don't see any other way to answer the crucial question from *Fort00* (p. 441), "Why, given that the object of analysis should be economic profit rather than accounting profit would any analyst take any sports team accounting sheet at face value?"

I take back the part of my argument based on college sports. It is clear that universities are not profit-maximizers and so neither are their college athletic departments (Fort, 2010, 2016, 2018). I sincerely regret sending anybody down that rabbit hole, including a similar mistake in Fort and Quirk (1999).

On inelastic demand, I also still stand on my original claims. Profit maximizers can certainly price tickets in the region of inelastic demand. As noted in *Fort00,* this goes all the way back to Heilmann and Wendling (1976). *Fort00* also pointed readers to a working paper on NALs available at the time that eventually led to Fort (2004, 2006b). I am unaware of any similar work on ELs.

Before proceeding directly to tests and data on win maximization, it is worth noting the debt we owe to Professor Stefan Kesenne in fully developing that theory. The papers are numerous. Thankfully he has compiled everything into his treatise on sports league theory (Kesenne, 2014).

I also think it is worth noting that nowhere have the separate approaches of trans-Atlantic analysts made a greater contribution than in the area of sports league theory. There were much earlier treatments listed above (*e.g.,* Sloane, 1971; Quirk and El Hodiri, 1974) but modern treatments follow Fort and Quirk (1995). Szymanski (2004) and Szymanski and Kesenne (2004) demonstrated the deficiencies associated with modeling choices in Fort and Quirk (1995): 1) choosing only closed talent markets, 2) subsuming the talent market and ignoring Nash conjectures in talent, and 3) assuming talent measured in units such that winning percentage increase by one unit with one more unit of talent. Responses all cited in the interchange between Winfree and Fort (2012, 2013) and Szymanski (2013), plus additional work by Dietl, Franck and Lang (2008), Dietl, Lang and Werner (2009), Madden (2012, 2015), and Madden and Robinson (2012), have greatly enhanced understanding of owner/club behavior and league outcomes.

All in all, in my opinion, subsequent work points overwhelmingly (but not quite definitively) to profits rather than wins. *Fort00* pointed out the objective function question can be investigated according to the theoretically predicted behavior of owners of each type. For example, profit maximization would see talent hired until marginal revenue product equals marginal cost while talent is chosen to a proportional rule under winning percentage maximization, that is, according to the ratio of team to total league revenue. In addition, owners of each type may respond differently to various league policies like revenue sharing.

It still remains the case that player pay in Europe is analyzed from the marginal revenue product perspective of profit maximization. While there still are plenty of papers attempting to measure the marginal revenue product of European players, Frick (2011) and Bryson, Rossi and Simmons (2014) are recent examples and provide the literature. Again, interested readers are encouraged to dig in to the reference list in those papers.

I could find three papers related to my suggestion of analyzing actual owner/club behavior vis a vis wins *versus* profits. Garcia-del-Barrio and Szymanski (2009), analyzing Spanish league team owner behavior, find best-responses appear to follow revenue win maximization rather than profit maximization. But then Leach and Szymanski (2015) find that team operations do not change much after they obtained a stock exchange listing, suggesting the teams were already being run on a profit maximization basis in the first place. Buraimo *et al.* (2015) show that the effectiveness of long-term contract management by owners/clubs is counter to the win maximization idea that "profits" are poured back into talent.

Finally, there is the idea that profit maximization should competitively dominate win maximization. There are competitive pressures from within the league, via individual owner comparison of their wealth position under wins versus profits. There would also be competitive pressure from outside the league, via rival leagues of profit maximizers. Two subsequent occurrences support this speculation.

First, while avowed profit-oriented ownership was underway at the writing of *Fort00,* such is now commonplace – Nathan Glazer and Manchester United, Roman Abramovich and Chelsea, Stanley Kroenke and Arsenal, Joe Lewis and Tottenham, and Vichai Srivaddhanaprabha and Leicester City. Second, a corresponding literature has grown analyzing corporate governance, earnings management, capital structures, and the efficiency of corporate structure in European football (Dimitropoulos, 2011, 2014; Dimitropoulos, Leventis and Dedoulis, 2016; Rohde and Breuer, 2018).

V. FORWARD FROM THE PAST

Fort00 offered some insights on competitive balance, the impact of the Bosman decision, broadcasting, and league structure based on a summary conclusion that the two are more alike than not. Some have simply passed into irrelevance with the passage of time. But some have importance in current policy discussions that I would like to address.

From the North American experience, it is pretty clear that pooled local revenue sharing has nothing to do with competitive balance. But it does do two things. First, it reduces player pay. Second, it transfers more of the pay savings to poorer rather than richer clubs. Thus, revenue sharing buoys smaller revenue franchises. Revenue sharing is a type of "guaranteed revenue" insurance policy despite weak team performance, complete with worries about moral hazard.

If there remains concern over weak team insolvency in ELs, revenue sharing "insurance" will help. But given the levels of international agreement and cooperation required to make this happen, it seems as unlikely as adopting P&R in NALs. In this behavior, ELs appear to be more like the NBA than other major NALs with extensive pooled revenue sharing in place.

Increased mobility may be another culprit behind the financial difficulty facing some teams. Pressure on the "retain and transfer" system, in terms of rising player payments, reduces margins for owners/clubs. As a side effect, it's possible that the burden of training falls more on players with increased mobility. Perhaps there is a middle ground on mobility that eases both burdens. In addition, I suspect that these labor mobility impacts explain some of the different invariance principle results in Fort, Maxcy and Diehl (2016) cited earlier.

Super-leagues have failed to appear in Europe. Perhaps ELs are discovering the same things as their counterpart NALs. In the NAL case, the returns to the current structure are simply too valuable – joint venture sales of over the air, cable and satellite, and now streaming rights; stronger bargaining power over labor; and bargaining power over host cities. On similar dimensions, ELs appear to be changing to accommodate the changing needs of members. In the almost 20 years since *Fort00,* ELs are doing quite well in terms of their dominance in Europe. Of course, the power of UEFA and FIFA cannot be ignored as impediments to super-leagues.

I ended *Fort00* with the warning that ELs, in particular, might come to suffer an old proverb, "May you live in lively times." As a final act of penance, I admit this possibility actually applies to all sports leagues, NALs and ELs alike. But particular lively times do appear to be ahead for ELs with the pressure on the highest level of organization, namely, UEFA and FIFA. As always, and perhaps more so with the advent of more sports analytics and big data approaches, it would be beneficial to taxpayers and fans to pursue the insights garnered from both the similarities and differences between ELs and NALs with solid economic and statistical analysis.

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BEHAVIORAL ECONOMICS IN SPORTS

Carlos VARELA-QUINTANA[1]

Julio DEL CORRAL

Abstract[2]

In the present study, the relationship between behavioral economics and sports economics is analyzed. To that end, we first present a review of the existing literature on the main cognitive biases. Secondly, behavioral biases are analyzed from the perspective of agents participating in sport: players, coaches, managers, referees, fans, recreational sport practitioners. Last, prospects for future research are considered.

Keywords: behavioral economics, sports economics.

JEL classification: C93, D91, Z20.

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I. INTRODUCTION

A proper understanding of human behavior is a key precondition for the adequate design of incentive schemes by governments, companies, and households. Over the past few decades, we have witnessed the development of two productive research fields that have contributed to renewing the theoretical and empirical framework for decision-making analysis in the sphere of economics: "behavioral economics" and "sports economics". Behavioral economics has changed the way in which economists conceive human behavior by incorporating psychological and/or sociological concepts into economic analysis. Experimental research on this field has provided evidence of the existence of cognitive biases challenging assumptions of rationality (McFadden, 1999; Levine, 2012) and the rules of dominance, transitivity, and invariance of preferences upon which "Rational Choice Theory" is based (Zamir and Teichman, 2014).

Within this debate, sport functions as an optimal laboratory for testing behavior in competitive environments. Data are abundant and easily available, the goals of participants are often simple (score, win, apply the rules), results are very clear, interest is usually high, and test subjects are experienced professionals (Palacios-Huerta, 2014). Furthermore, sporting competitions provide plenty of natural experiments, that is, real-life situations where individuals included in treatment and control groups have been randomly or almost randomly selected by nature (Dunning, 2012). Such wealth of empirical basis has increased over the past few decades owing to the advent of the new information and communication technologies, which allow for detection of bias that should not be present in situations where rationality, as conceived in the standard model, should prevail. Relevant topics include the advantage of playing at home, that of shooting first, or the possible hot hand fallacy. Thus, sports economics has been a pioneer in adopting certain behavioral ideas, while several seminal works on behavioral economics have used sport as a trigger for research (Humphreys, 2015).

The main purpose of this article is to provide a thorough understanding of the interaction between behavioral economics and sports economics. Specifically, our aim is to grasp the current situation and recent developments jointly pursued and fostered by both disciplines. This effort is relevant for two reasons. Firstly, with notable exceptions (Humphreys, 2015; Coates and Humphreys, 2018), there is not sufficient available research on the productive relationship between both disciplines. Secondly, analysis enables to explore the potential of behavioral economics, which has been insufficiently addressed despite the growing number of articles on the subject produced in the field of sports economics.

The rest of the paper is structured as follows: In Section II, key concepts of behavioral economics are described; in Section III, applications in the field of sports economics are addressed; finally, in Section IV, the main conclusions are presented and possible lines of future research are established.

II. CONCEPTS OF BEHAVIORAL ECONOMICS

In the mid-twentieth Century, the "Expected Utility Theory" provided the standard framework for analysis of decision-making in risk situations, based on the 1738 definition of average utility by Bernoulli (1954) and the axioms of completeness, transitivity, continuity, and independence proposed by von Neumann and Morgenstern (1953). The importance of these axioms lies in their contribution to modeling rationality as maximization of expected utility, as laid down by DellaVigna (2009) in expression [1]:

$$\max_{x_i^t \in X_i} \sum_{t=0}^{\infty} \delta^t \sum_{S_i \in S_t} p(s_t) u(x_i^t | s_t) \qquad [1]$$

where an individual i maximizes an expected utility function $u(x|s)$, given a probability $p(s)$ of a state of the world $s \in S$. Utility depends on the payoff of individual i at time t, x_i^t. Given that maximization occurs at time $t = 0$, the expression incorporates a discounting factor δ in order to discount future utility.

Over the past 30 years, literature has given increasing attention to cognitive biases, understood as systematic errors in thinking whereby an individual's judgement is deviated from what would be deemed desirable from the perspective of accepted norms or correct in terms of formal logic (Samson, 2014). These errors are not random, but the result of heuristics or mental shortcuts, being therefore predictable to a great extent (Ariely, 2008; Kahneman, 2011).

Following Rabin's proposal (2002), DellaVigna (2009) classifies deviations from the standard model on the basis of three elements involved in the decision-making process, which are brought into the equation [1]: the maximization process, the utility function, and the probability of a certain state existing. This enables to distinguish three kinds of behavioral biases, included in Figure 1: non-standard preferences, non-standard beliefs, and non-standard decision-making.

Non-standard preferences refer to utility functions which differ from those included in the rational choice model in three aspects: time preferences, risk preferences, and social preferences. For their part, wrong beliefs about the

FIGURE 1

CLASSIFICATION OF BEHAVIORAL BIASES ACCORDING TO DELLAVIGNA (2009)

Behavioral biases	*Non-standard preferences* (Problems in utility function)	Risk preferences Time preferences Social preferences
	Non-standard beliefs (Problems in determining probability of an event)	Overconfidence Law of small numbers Projection bias
	Non-standard decision-making (Problems in maximization)	Framing Limited attention Heuristics for choice simplification Persuasion and social pressure Emotions

probability of a certain state of the world relate to overconfidence, the law of small numbers, and the projection bias. Last, non-standard decision-making is related to the use of heuristics or simplifying shortcuts to solve complex maximization problems. Decision-making in different contexts or framings, limited attention, menu effects, persuasion and social pressure, and emotions would be included in this group. We now proceed to describe them.

1. Non-Standard Risk Preferences

The prospect theory developed by Kahneman and Tversky (1979) enables to solve the inconsistencies in analysis of decision-making under risk which are to be found in the "expected utility theory". The basic idea of the prospect theory is that individuals classify each event either as a loss or as a gain to later evaluate losses and gains using separate utility functions (Just, 2014). Prospect theory provides abundant empirical and experimental evidence (Levine, 2012), thus enabling to explain inconsistencies such as loss aversion, reflection effect, certainty effect, possibility effect, endowment effect, sunk cost fallacy, or the status quo bias.

LOSS AVERSION. The concept of loss aversion must be distinguished from that of risk aversion. Risk aversion is a preference for security over uncertainty included in the standard model. For its part, loss aversion is a cognitive bias resulting from the fact that the marginal increase in pain associated with a loss is significantly higher than the marginal benefit of a gain of equal magnitude (Just, 2014). This leads to both risk-aversion and risk-seeking behaviors, even though the aim is to avoid a loss. Benartzi and Thaler (1993) attribute to risk aversion generated by loss aversion the so-called "Equity Premium Puzzle" (Mehra and Prescott, 1985), which refers to the existence of a higher-than-expected yield differential between equity and bond yields, a phenomenon observed over the past century.

REFLECTION EFFECT. The reflection effect refers to the fact that individuals, when choosing between two options, opt for one or the other depending on whether results are considered gains or losses, even if magnitudes are identical (Just, 2014). Thus, risk aversion in the positive domain of outcomes is accompanied by risk-seeking in the negative domain (Kahneman and Tversky, 1979). Let us consider the experiment described by these latter authors. In a first scenario, individuals are to choose between getting 3,000 euros[3] with a probability of 100% and taking a bet where they might win 4,000 euros with a probability of 80%. Although the second option implies higher expected value, most subjects adopt a risk-aversion behavior, opting for the first alternative. In a second scenario, individuals are to choose between loosing 3,000 euros with a probability of 100% and taking a bet where they might lose 4,000 euros with a probability of 80%. Although the expected value of the loss is lower in the first option, subjects generally show a risk-appetite behavior, opting for the second alternative.

CERTAINTY EFFECT AND POSSIBILITY EFFECT. Both biases refer to the fact that variation of the probability of winning or losing does not constantly affect subjective valuation of outcomes (Samson, 2014). In the certainty effect, reduction of the probability of a result, provided a constant factor, has greater impact when that result is initially certain than when it is merely probable (Tversky and Kahneman, 1981). Thus, an increase from 95% to 100% in the probability of winning a prize entails greater impact than an increase from 60% to 65% (Kahneman, 2011). For its part, the possibility effect refers to the fact that highly improbable results are disproportionately weighted by individuals, who attach them a higher value than they "deserve". For instance, an increase from 0% to 5% in probability has greater impact than an increase from 5% to 10%. This overvaluation of small probabilities explains the appeal of lottery bets, where people are willing to pay much more than expected in games which offer little chances of winning (Kahneman, 2011).

[3] Kahneman and Tversky (1979) use Israeli pounds in their article; we prefer to use euros.

ENDOWMENT EFFECT. Related to loss aversion, the endowment effect is the phenomenon whereby individuals giving up an object often ask for much more than what they would be willing to pay for its purchase (Kahneman, Knetsch and Thaler, 1991). In other words, individuals attach more value to things once they own them. This is especially true of goods not usually bought or sold in the market, which commonly have symbolic, experiential, or emotional significance (Samson, 2014).

SUNK COST FALLACY. This bias refers to the tendency to continue a project having implied an investment in resources that cannot be retrieved (sunk costs). For instance, a subject might drive for hours through a snowstorm in order to attend a concert simply because he/she feels compelled to attend so as not to lose the initial investment in ticket purchase (Samson, 2014).

STATUS QUO BIAS. It is the tendency of consumers to persist in their current consumption decisions even when more appealing opportunities exist (Just, 2014). This phenomenon would be a manifestation of loss aversion (Kahneman, Knetsch and Thaler, 1991), explained by the fact that individuals tend to more deeply regret losses owing to a decision they made than losses resulting from mere inaction or a missed opportunity (Kahneman and Tversky, 1982).

2. Non-Standard Time Preferences

The standard economic model, integrated into equation [1], assumes an exponential discount factor $\delta = e^{-r}$ that has an important consequence: each additional time unit reduces utility to the same rate, which affords time-consistent decisions. Empirical evidence has nevertheless shown that the temporal dimension distorts human preferences, leading to short-term decisions which would not be made from a long-term perspective applying the same reasoning. This phenomenon causes the anomaly known as "time inconsistency", "present bias", "self-control problem", or "hyperbolic discounting", implying that individuals tend to overvalue immediate events with respect to future events.[4]

O'Donoghue and Rabin (1999a) identify two types of time-inconsistent decisions, procrastination and preproperation, depending on whether individuals are facing immediate costs or rewards, respectively.

PROCRASTINATION. It is the tendency to permanently postpone a decision when cost is immediate and reward is deferred. Examples of this phenomenon

[4] "For instance, most adults state that they would rather get 50 dollars immediately than 100 dollars in two years' time, but, on the other hand, hardly anyone would prefer to get 50 dollars in four years' time over the alternative of getting 100 dollars in six years' time" (Ainslie, 1991).

are the decisions to postpone the decision to study for a test, save for retirement (O'Donoghue and Rabin, 1999b), or go to the gym (DellaVigna and Malmendier, 2006).

PREPROPERATION. It is the propensity to rush into doing something instead of waiting when reward is immediately obtained and costs are deferred. This latter situation is related to problems of addiction to products such as alcohol, drugs, or tobacco (see O'Donoghue and Rabin, 2000; Carrillo, 2005).

Non-standard time preferences do affect decisions as relevant as saving for retirement, addictions, or undue obedience (Akerlof, 1991). There are several noteworthy means to reduce bias towards the present. Firstly, through education, by including financial studies in the educational curriculum (Bernheim, Garret and Maki, 2001); secondly, by assuming previous commitments[5] limiting future unwanted behaviors (Ariely and Wertenbroch, 2002); thirdly, through implementing automatic enrollment plans using the inertia of *status quo* as a counterweight to procrastination (Thaler and Benartzi, 2004); and fourthly, through connecting the present self to the future self, for instance, by interacting with virtual future representations of oneself (Herschfield *et al.,* 2011).

3. Non-Standard Social Preferences

The standard model represented in equation [1] assumes that utility for an individual depends only on his own payments, and not on those received by others. A great number of experiments question this assumption (DellaVigna, 2009). One of the most well-known evidence provided is the "Dictator Game", an experiment conducted by Kahneman, Knetsch and Thaler (1986) in which a player (called "dictator") shares an amount of money with another player (called "recipient"), the latter playing a passive role. Given that, as opposed to the "Ultimatum Game", the "recipient" cannot reject the "dictator's" decision, the experiment enables to verify the assumption that an individual is only interested in maximizing payments and would not give out anything to the "recipient". Findings from most of these experiments show that "dictators" (*e.g.,* Forsythe *et al.,* 1994) decide to share part of the money, thus evidencing that the utility function includes payments received by "recipients".

4. Overconfidence

This bias implies the tendency to attach different probabilities to an event as a result of excessive confidence in one's own ability (overconfidence), in

[5] Making the previous commitment public may be considered a way of imposing a cost on oneself in the form of damage to one's reputation if behavior is not as planned.

time planning (planning fallacy), or in the future occurrence of positive events (optimism bias).

OVERCONFIDENCE. It refers to the fact that confidence of individuals in their own ability is greater than their actual performance. Empirical evidence of this phenomenon has been found in experiments in which knowledge tests are first conducted, and correct answers subsequently compared with the confidence shown by subjects in having provided the right answers (Samson, 2014).

OPTIMISM BIAS. It is the tendency of individuals to overestimate favorable events (for instance, professional success or life expectancy) and underestimate negative ones (for instance, the probability of divorcing or having a traffic accident); it constitutes one of the most robust biases documented in psychology and behavioral economics (Sharot, 2011).

PLANNING FALLACY. It is the tendency of individuals to underestimate the time they will need to take in order to fulfill a task, while overestimating the time that others will need to take. Such bias leads individuals to focus on current planning, disregarding past experience (Buehler, Griffin and Ross, 1994).

5. Law of Small Numbers

The law of small numbers describes the propensity of human beings to make statistical inferences on the basis of small samples. Within this category, DellaVigna (2009) distinguishes between gambler's fallacy and overinference.

GAMBLER'S FALLACY. Also known as the Monte Carlo fallacy, it is the tendency to believe that, in random events, if something occurs more often than usual over a certain period of time, it will occur less frequently in the future, and vice versa (Terrell, 1994).

OVERINFERENCE. It is the propensity to infer future trends on the basis of previous data. One example of this phenomenon is the inclination of investors towards considering past performance in order to determine whether an investment fund is adequately managed (DellaVigna, 2009).

6. Projection Bias

The projection bias implies that, even though individuals are aware of changes in their own tastes, they systematically underestimate the magnitudes of such changes, exaggerating the degree to which future tastes will resemble their current ones (Loewenstein, O'Donoghue and Rabin, 2003).

7. Framing

This bias owes to the effects of context on decision-making. As a result, a problem posed in two different ways might lead to two different answers. In the classical experiment conducted by Tversky and Kahneman (1981), subjects were asked to choose between two different programs to combat a disease. If effects were discussed in terms of people being cured, subjects showed risk aversion; if, on the other hand, options were presented in terms of people dying, respondents were risk-prone.

8. Limited Attention

As opposed to the assumptions made in standard theory, experimental studies show that rationality is bounded by the existence of limits to our brainpower, as well as by availability of information and time. Loosening of the assumption that individuals make economic decisions using all information available has led to the adoption of rationality models incorporating information costs, where less relevant information has a higher cost (DellaVigna, 2009).

9. Heuristics for Choice Overload

The phenomenon known as choice overload occurs when an individual is confronted with a high number of available options, or else when their complexity is high (Samson, 2014). In such situations, economic agents are more likely to resort to any of the following five simplifying heuristics (DellaVigna, 2009): excessive diversification, preference for familiarity, preference for the salient option, not making a choice at all, and confusion when implementing decisions.

10. Persuasion and Social Pressure

In the standard model, subjects take into consideration the incentives of individuals providing the information. In real life this is not necessarily so. According to DellaVigna (2009), in the decision-making process the beliefs of others might have an excessive impact on us, either because we disregard the incentives of information providers (persuasion), or else due to the existing pressure to accept them (social pressure). In this regard, Kandel and Lazear (1992) developed a peer pressure model to analyze how mutual monitoring between workers enables to counteract the free rider problem. According to the authors, this mutual monitoring is likely to be effective only when profits are shared by a very small group.

11. Emotions

In psychology, evidence shows that the state of mind and the degree of excitement play an important role in decision-making, so that small mood changes might have a great impact. For instance, on sunny days, customers leave higher tips in restaurants (Rind, 1966).

III. APPLICATIONS

We shall now provide a brief review of literature analyzing the behavior of agents in sport. Among the different existing options for classifying articles, we have chosen to group them according to the agent involved: players-teams, coaches, owners-managers, referees, league promoters, fans, and recreational sport practitioners.

1. Players-teams

"HOT HAND"

"Hot hand"[6] refers to the phenomenon whereby players or teams have greater chances to succeed (*i.e.,* to score a basket in basketball, to pocket in golf, to win a match) if they have a successful performance record. Gilovich, Vallone and Tversky (1985) and Koehler and Conley (2003), among others, found no evidence of this phenomenon in their studies on basketball, considering that this deep-rooted belief among fans and players is a fallacy resulting from a memory bias and an erroneous perception of chance. This fans belief finds expression, for instance, in the fact that gamblers place more bets than it would be advisable in theory on those teams on a winning streak (Paul, Weinbach and Humphreys (2014).

[6] In some works, it is also referred to as *momentum* (*e.g.,* Dietl and Nesseler, 2017).

PRESSURE

Sport is an optimal testing ground for analyzing of the behavior of individuals under pressure, since there are situations such as penalty kicks, free throws in basketball, or certain points in tennis, which are most conductive to such analysis; given that, both rules and incentives are very clear, and results easy to observe.

In this kind of situations where individuals are subject to strong psychological pressure, players are likely to fail to execute well-learned tasks. Reasons for failure are usually associated with choking, panicking, and "yips" situations (Clark, Tofler and Lardon, Lardon 2005). This emotional state might arise when players or teams lag behind in a match, and is related to loss aversion, inasmuch as the loss implied in failing a throw is perceived as higher than the gain implied in scoring (Apesteguia and Palacios-Huerta, 2010).

Cao, Price and Stone (2011) found that NBA players suffer from choking during free-throws, for scoring rates drop when pressure increases (*i.e.,* when the end of the game is nearer, when the score is tied…). Hickman and Metz (2015) elicited similar findings for the case of golf. The case of penalty kicks in football has also drawn the attention of researchers.[7] Dohmen (2008a) analyzes penalty kicks in the Bundesliga from 1963 to 2003; his findings suggest that players are more prone to suffer from choking[8] in home games; he also found that, if a team is leading by more than two goals, the probability of choking decreases. For their part, González-Díaz, Gossner and Rogers (2012) analyzed data on every single point from 12 US Open tennis editions, concluding that the best players (*i.e.,* the most successful throughout their career) are those capable of improving their performance in important points, when pressure is higher.

This context is suitable to verify if men and women behave differently under pressure. De Paola and Scoppa (2017) show that women are more likely to perform badly than men in a tennis set if they have lost the preceding one. This gender difference increases in decisive matches.

A relevant question is whether being the first to start in a game might afford any advantage. Mixed results are to be found in literature. Magnus and

[7] One of the most important penalty kicks ever taken in the Spanish football league was that of May 1994. Deportivo de La Coruña played against Valencia; if Deportivo won the match, it would win the league; otherwise, the winner would be F.C. Barcelona. At the last minute of the game, with the score tied, the referee awarded Deportivo a penalty kick; the usual kicker, Beteto, ducked out, and Djukic decided to take it; he kicked the ball so fearfully that it hardly reached the goal, and the goalkeeper had no trouble catching it.

[8] He defines "choking" as missing the goal when shooting.

Klaassen (1999), Apesteguia and Palacios-Huerta (2010), and González-Díaz and Palacios-Huerta (2016) found that starting first (serving first in a tennis match, kicking first in a penalty shoot-out, playing White in a chess game) afforded higher probabilities of winning the set, the penalty shoot-out, or the chess game, respectively. On the other hand, Kocher, Lenz and Sutter (2012) or Arrondel, Duhautois and Laslier (2019) found no advantage in being the first to kick in a penalty shoot-out.

HOME ADVANTAGE

"Home advantage" is the term used to describe the phenomenon whereby teams and players tend to win more home games than away games. Thus, Bray (1999) considers home advantage to exist when the difference between wins achieved in home games and in away games exceeds 5%. Many studies have found evidence supporting the home advantage hypothesis. In collective sports, evidence is abundant and robust.[9] In individual sports, in spite of some existing evidence (Gayton and Langevin, 1992; Koning, 2005), findings are far from being as robust as those obtained for team sports (Jones, 2013).

Regarding possible explanations for this phenomenon, various factors have been identified in literature. One of the most relevant is pressure exerted by fans on players and referees[10] (*e.g.,* Petterson-Lidbom and Priks, 2010). Other explanations elaborate on psychological factors such as territoriality of the local team (Pollard, 2006), or the greater confidence afforded by the fact of playing at home (Waters and Lovell, 2002). For his part, Pollard (2002) estimated that moving to a new stadium reduces home advantage by 24%.

GAME THEORY

Sport functions as an excellent laboratory for verifying and/or analyzing behavior in the framework of game theory. The most influential articles published so far are probably those by Walker and Wooders (2001), who analyze serve in tennis, Chiappori, Levitt and Groseclose (2002) and Palacios-Huerta (2003), who analyze penalty kicks in football.

CHEATING

Preston and Szymanski (2003) discuss three forms of cheating: sabotage, doping, and "match-fixing". Sabotage consists in undermining the performance

[9] See reviews such as Courneya and Carron (1992) or, more recently, Carron, Loughhead and Bray (2005).

[10] We will later address biases of referees.

of rivals by means of actions that go beyond legal limits (del Corral, Prieto-Rodriguez and Simmons, 2010). As argued by Preston and Szymanski (2003), it is an accepted aspect of the game in some sports, though it often frustrates spectators who wish to watch opponents maximizing their skills. Garicano and Palacios-Huerta (2014) and del Corral, Prieto-Rodriguez and Simmons (2010) found an increase in sabotage, measured as the number of yellow and red cards shown to a team, after implementation of the three-point rule, a finding consistent with the prediction made by Lazear (1989), who affirms that, if rewards depend on relative performance, an increase in rewards could lead agents to increase sabotage in order to undermine the production of rivals.

Doping may be defined as the use of substances contributing to enhanced performance which are nevertheless incompatible with the sporting spirit. Preston and Szymanski (2003) give four reasons as to why doping must be prohibited: it harms people's health; it gives dopers an unfair advantage; and it undermines interest in sport, as well as its reputation. The authors further state that, the more complex the abilities required to be successful in a sport, the less is doping likely to increase performance significantly. Thus, it is reasonable to think that sports having greater doping problems are those to which the Latin maxim *"citius, altius, fortius"* applies, such as athletics, cycling, or weight-lifting. Maening (2002) provides a detailed analysis of doping economics, where he observes that expected benefits from doping, obtained through additional wins and their subsequent revenue, are higher than expected costs, which consist in the payment of fines and dishonor, especially for "older" athletes hardly affected by temporary suspensions, since they are anyhow close to retiring. From an economic point of view, a possible solution would be to increase expected costs by increasing the fines imposed. A more recent study by Hirschmann (2017) shows, on the basis of a theoretic model, that increase in sanctions for doping offenses might reduce the number of participants in competitions under certain circumstances.

"Match-fixing" owes to various reasons. Duggan and Levitt (2002) observe that sumo wrestlers trade with victories in Japan, due to the particular importance of the eighth win in sumo tournaments, whose impact on the ranking is greater than that of any other win. Thus, for wrestlers who are close to achieving the eighth victory there is an incentive to increase probabilities of winning. This is only natural, for their efforts and motivations are greater than those of their rivals. Corruption appears when the wrestler who would not reach the eighth victory shows an unusual percentage of wins in their next fights, a fact that implies a sort of trading with victories. The same applies to the scoring system in football whereby teams are awarded 3 points per win, for two teams playing each other twice obtain more points if each of them wins one match than if there is a tie in both matches. Haugen and Heen (2018) analyzed this fact and found some evidence of it.

Even more serious is to fix a game by giving money either to the opponent team or the referee. The case of Olympique de Marseille became famous in the 1990s, when it was demonstrated that this team bribed players from rivals, having been relegated to second division (Forrest, 2018). Similar cases occurred in the Greek league (Manoli, Antonopoulos and Bairner, 2017). A quite different case is that of the so-called “bonus for winning”, where a team for which nothing is at stake in sporting terms plays against another team striving to realize a given objective in competition with a third team; if that third team offers a “bonus for winning” to the first one, there is nothing wrong about it, because the first team is being payed to achieve an objective. Another “match-fixing” situation is related to the misuse of bets. Forrest (2018) provides a detailed analysis of outcomes manipulation intended to make a profit in the football-betting market. In the United States, a great number of bets are handicap bets, a system whereby the odds of winning for both opposing teams are leveled by giving a virtual advantage / disadvantage in points or goals to one of the teams. Wolfers (2006) found that 6% of the most favorite teams would be willing to manipulate their performance in college basketball.

The draft system allows for clubs participating in a professional league to sign players from college leagues or other professional leagues. With the aim of fostering competitive balance in the long term, the order of election for clubs in the NBA was inversely proportional to their results in the preceding season, though the system was transformed into a lottery for which weaker teams have more lots but are offered no guarantee, as opposed to the previous system. The ordering system generates a perverse incentive, since, once a club knows that it will not qualify for play-offs, it is in its interest to rank as low as possible. The fact that a team allows itself to be won over in order to get a better position in the draft is known as “tanking”. Price and Wolfers (2010) show that the probability of a team allowing itself to be won over in the closing stages of the season was higher when incentives were also higher. For their part, Soebbing and Humphreys (2013) state that the betting market also believes that clubs practice tanking.

2. Coaches

LINEUP AND SUBSTITUTIONS ANALYSIS

Professional clubs invest huge amounts of money in acquiring players, and differences in the price of players within a same team are often sharp. When coaches line up the most expensive players simply because of their cost, and not because they show better performance, they are introducing the sunk costs bias into their decision. Hackingera (2018), based on data from the Bundesliga, examines the presence of this bias among coaches; his findings suggest that Bundesliga coaches are free of sunk costs bias.

Del Corral, Pestana Barros and Prieto-Rodriguez (2008) analyze substitutions in La Liga; they observe that teams in the lead make the first substitution later than losing clubs do in a match, coaches thus possibly applying the status quo bias to their decision. Another interesting finding is that local teams make a higher number of substitutions at halftime, probably to prevent the public from passing judgement on players being substituted.

DISCRIMINATION

Coaches are not free of biases, whether consciously or unconsciously. Some studies have therefore detected a discriminating behavior of coaches. Berri, Deutscher and Galletti (2015) observed that NBA and ACB[11] coaches were more prone to line up American players, after controlling for productivity. A possible explanation for this finding is that both NBA and ACB coaches trust American players more because the United States obviously is the major world power in basketball. In a similar analysis, Schroffel and Magee (2012), based on data from the NBA, show that, if a player is of the same race as the coach, the former will remain longer on court.

BEHAVIOR TOWARDS THE THREE-POINT RULE

Adopted by professional football leagues in the 1990s in order to increase the number of goals scored, the three-point rule established a value increase from 2 to 3 points for a win, while ties and losses continued to be awarded 1 and 0 points, respectively. Garicano and Palacios-Huerta (2014) found that rule implementation increased the number of both forwards and defenders in initial lineups, and encouraged a more conservative strategy in teams having scored first in the match, as shown by the fact that most subsequently lined up substitutes were defenders. For their part, Dewenter and Namini (2013) analyzed the impact of the rule on the bias whereby local teams adopt a more than convenient offensive style to please their fans. By analyzing the number of goals and probabilities of winning, the authors found evidence that, when reward for a win increases, local teams tend to adopt a more defensive style, since the opportunity cost of adopting a much too offensive strategy increases as well. On the other hand, Varela-Quintana, del Corral and Prieto-Rodriguez (2018a) found no significant impact of the three-point rule on the initial lineups chosen by home and visiting coaches.

[11] Top division of men's basketball in Spain.

3. Owners and Managers

DISCRIMINATION

Club owners and managers must make many decisions. One of them consists in deciding who to hire and who to dismiss. In basketball and American football in the Unites States, most players in both professional (*i.e.,* NBA and NFL) and college (*i.e.,* NCAA) leagues are black, and most coaches were previously professional players; however, most coaches are paradoxically white (Lapchick and Balasundaram, 2017). Thus, it can be observed that in the coaching market for these sports there is certain discrimination against black coaches.

Several studies have attempted to elaborate on this possible discrimination in American professional sport. Kahn (2006) uses duration models to analyze whether NBA clubs are particularly prone to firing black coaches, based on data on coaches, percentage of wins, and spending on players elicited between 1996 and 2004; findings show no discrimination against black coaches. The same results were obtained by Fort, Lee and Berri (2008) and Wangrow, Schepker and Barker (2018); based on data elicited between 2001 and 2004, Fort, Lee and Berri (2008) analyze coach efficiency using a stochastic frontier model; Wangrow, Schepker and Barker (2018), based on a more comprehensive database and using duration models, did not find discrimination either. On the contrary, Gomez-Gonzalez *et al.* (2018) claim that black NBA coaches have significantly higher probabilities of being dismissed on grounds of team efficiency and percentage of wins, a finding obtained by means of a probit analysis; in fact, the percentage of black coaches fired is higher than that of white coaches in all efficiency intervals (*i.e.,* 0-0.1, 0,1-0,2,…, 0.9-1); data were collected between seasons 1993-1994 and 2016-2017. In American football, mixed results are observed. On the one hand, Foreman, Soebbing and Seifried (2018) found no impact on dismissals resulting from the fact of belonging to a minority racial group; on the other hand, Madden (2004) finds clubs to be more prone to firing black coaches.

Analogously to professional sport, findings on the race-related impact on coach dismissal for US college sport are ambiguous. On the one hand, Mixon and Treviño (2004) consider that black coaches are less likely to be fired, and Holmes (2001) observes that belonging to a particular race has no effect on dismissals; on the other hand, Kopkin (2014) and LaFave, Nelson and Doherty (2018) claim that black coaches have higher probabilities of being dismissed.

Club owners and managers might also discriminate against players. Kahane (2005) finds teams including a higher proportion of French Canadian players to be less efficient. For their part, Jewell, Brown and Miles (2002) found some evidence of the fact that retired black and Latin MLB players suffer from discrimination in voting processes for induction in the Hall of Fame.

TYPES OF CONTRACTS

The positive relationship between budgets and results is well established in sport (*e.g.,* Hall, Szymanski and Zimbalist, 2002). However, efficient use of resources is the most important task for club managers and coaches in order to obtain the best possible outcome given the resources available (del Corral, Maroto and Gallardo, 2017). Frick (2007) ascertains that the duration of contracts with football players depends on their salary, a fact that does not surprise him, since the best players are offered the best contracts (*i.e.,* longer-term contracts and higher salary). On the other hand, the market value of a football player decreases when his contract is close to expiration date. Thus, it is reasonable for clubs to sign long-term contracts with players, for, if a player performs satisfactorily, the contract can be renewed well before expiration, or else the player can be transferred at a price not much inferior to fair value.[12] On the other hand, if a player does not perform satisfactorily, he can be transferred at a price close to market value, though in this case he could be depreciated.

Clubs usually sign long-term contracts with coaches as well; however, if results are not as expected, a coach is usually dismissed before his contract expires.[13] Coaches, as opposed to players, do not have a market value, since it is most unusual for a club to pay for the transfer of a coach. Furthermore, as argued by Kuper and Szymanski (2004: 111), "only few coaches obtain better results than what club spending on players would suggest". In other words, outstanding performance by a coach with a team in a given season is by no means guarantee that he will also perform well with another team or even the same team in following seasons. Thus, the lengthy duration of contracts with coaches rather owes to cognitive biases such as optimism than to well-founded economic reasons. We therefore advice clubs to avoid signing long-term contracts with coaches. Alternatively, we suggest signing automatically renewable contracts implying a relevant salary raise for the coach provided that certain objectives are fulfilled.

4. Referees

Referees are one of the most controversial figures in virtually all sports, since their decisions might have a great impact in sports such as football, basketball,

[12] One example is the transfer of Courtois from Chelsea to Real Madrid in summer of 2018 for 35 million euros; although market value was quite higher, the price dropped because the contract was to expire in a years' time.

[13] There is abundant literature analyzing both the causes and effects of coach dismissal in sport (*e.g.,* Audas, Dobson and Goddard, 1999; Tena and Forrest, 2007).

or handball. Referees are considered as judges, and therefore supposed to be impartial, but, as human beings, they are not free of systematic biases.[14]

HOME BIAS

There are several studies providing analysis of a very specific bias of referees, namely, favoring the home team. Many of these studies have been carried out on the basis of data on football. In football, evidence suggests that such bias is present in the additional time allowed in games (La Liga: Garicano, Palacios-Huerta and Prendergast, 2005; Bundesliga: Sutter and Kocher, 2004; Dohmen, 2008b; Brazilian league: Rocha *et al.,* 2013), and in the number of yellow and red cards shown (Premier League and Bundesliga: Buraimo, Forrest and Simmons, 2010; Premier League: Dawson *et al.,* 2007).

The main argument provided to explain the existence of this bias is the pressure exerted by spectators on referees. Boyko *et al.* (2007), based on data from more than 5,000 Premier League games, observe that the number of attendees plays a significant role in the bias whereby referees favor local teams. However, they also observe that crowd density is not a determinant of such bias. Similarly, Page and Page (2010), based on a large database on British teams, conclude that the number of spectators at the stadium determines the appearance of this bias. The same results were obtained by Picazo-Tadeo, González-Gómez and Guardiola (2017) using data on La Liga. Nevill, Balmer and Williams (2002) ran a controlled trial and found crowd noise to be one of the factors affecting referees, while Petterson-Lidbom and Priks (2010), seizing the opportunity provided by the fact that 21 matches where played behind closed doors in Italian *calcio* (Serie A and Serie B) in season 2006-2007, verified how the absence of spectators affected referees' performance. Their findings suggest that the bias favoring local teams only occurs when there is a crowd of spectators watching the game.

The lack of a running track in a stadium, which allows for spectators to seat closer to the playing field, turned out to be significant in various studies (Dawson and Dobson, 2010; Buraimo, Simmons and Maciaszczyk, 2012) for explaining the bias whereby local teams are favored.[15] This finding strengthens the argument that spectators have an impact on referees. Some works have analyzed this bias in sports other than football. For instance, Balmer, Nevill and Lane (2005) analyzed whether, when the winner of a boxing match is established

[14] A thorough review of literature can be found in Dohmen and Sauermann (2016).

[15] Picazo-Tadeo, González-Gómez and Guardiola (2017) did not find the existence of an athletics' track to have a significant impact on the bias whereby local teams are favored.

according to a points decision,[16] the local boxer was more likely to be declared winner; after controlling for the quality of opponents, they indeed found a bias favorable to local fighters.

It appears that this bias needs to be further studied in sports such as handball or basketball;[17] furthermore, the implementation of VAR[18] in football provides a natural trial to verify the extent to which it affects decisions made by referees. In line with the study of Mills on baseball (2014), further research on other sports analyzing the possible bias of referees favoring more relevant or traditional teams is needed.

Discrimination

In a seminal article, Price and Wolfers (2010) detected that referees called more fouls on players who were not of their same race; different race players were thus disadvantaged.[19] In fact, in a subsequent[20] study Larsen, Price and Wolfers (2008) showed that it was possible to make profit in the betting market by exploiting the information on the race of players and referees. In a recent analysis, Pope, Price and Wolfers (2018) verify that the bias detected by Price and Wolfers (2010) between 1991 and 2003 continued to be present in years 2004-2006, but also, based on data from years 2007 to 2010, that it disappeared after the article was published in May 2007. It becomes therefore apparent that studies on discriminatory biases might have an impact on future behaviors and thus contribute to the disappearance of biases.

5. League Organizers: Regulations

Analysis of incentives generated by the regulatory framework has enjoyed great prestige in sports economics. Analysis of the three-point rule, of tournaments consisting in two-leg eliminatory rounds, or of the away goals rule are good examples of it.

[16] A boxing match may be decided in two ways; firstly, by K.O. or technical K.O., which occurs following a situation where a boxer is unable to continue fighting under the same conditions as his opponent; referees usually have little influence on this decision. If no K.O. victory is awarded within regulation time, a set of judges agree on who won the match by scoring the strikes of each fighter, which is popularly known as a "win on points".

[17] The work by Price, Remer and Stone (2012) constitutes an exception; the authors find NBA referees to be subject to the bias whereby local teams are favored.

[18] Video Assistant Referee.

[19] Price and Wolfers (2010) include two races in their analysis, black and white, though they themselves admit that the term 'white' is not altogether correct, since the group includes Hispanics and Asians as well.

[20] The working paper of Price and Wolfers (2010) dates back to 2007.

Although findings are not unanimous, there exists some evidence of the fact that the three-point rule has contributed to reducing the number of ties, while it has not succeeded in increasing the number of goals per match (Palacios-Huerta, 2004; Dilger and Geyer, 2009). Decrease in ties would owe to the assumption of greater risks by teams seeking victory, as verified in analyses of attacking moves (Guedes and Machado, 2002), shots, shots on goal and corner kicks (Garicano and Palacios-Huerta, 2014), foul play (del Corral, Prieto-Rodriguez and Simmons, 2010; Garicano and Palacios-Huerta, 2014), and number of forwards included in initial lineup (Garicano and Palacios-Huerta, 2014; Varela-Quintana, del Corral and Prieto-Rodriguez, 2018a). Moreover, the rule appears to have fostered a more defensive style of play in teams having scored first in a match, a fact that would explain the insignificant variation in the number of goals scored. Thus, Garicano and Palacios-Huerta (2014) observed that, after rule implementation, teams having scored first chose defenders for substitutions. Furthermore, Riedl, Heuer and Strauss (2015) state that, even though the three-point rule reduced the percentage of ties, such reduction was below expected statistical value, a figure consistent with the idea that the increase in points awarded for a win, from two to three, has proved to be insufficient to counteract the deep-rooted loss aversion existing in professional football.

Behavioral economics has also implications for the design of tournaments in which teams play two-leg eliminatory rounds. A corollary of home advantage is the possible advantage implied in playing the second leg as local. Page and Page (2007) found that teams playing the first leg at home show a significantly lower probability of passing a two-leg eliminatory round. Varela-Quintana, del Corral and Prieto-Rodríguez (2015) observe that such advantage is greater when matches are expected to be levelled.

Regarding the "away goals rule", Varela-Quintana, del Corral and Prieto-Rodriguez (2018b) analyzed the natural trial provided by CONMEBOL after rule implementation in season 2005. Findings show that teams having played the second leg as locals had greater chances of failing to pass the round after the "away goals rule" was implemented. Possible explanations for this phenomenon include behavioral biases related to psychological pressure, time inconsistency, and loss aversion.

6. Fans

Coates, Humphreys and Zhou (2014) elaborate a model of consumer behavior in which they model the hypothesis of uncertainty over outcome. Such model shows that the hypothesis of uncertainty over outcome would prove to be true if marginal utility generated by an unexpected win is equal to or exceeds marginal utility generated by an unexpected loss. If prospect theory is applied, marginal utility of an unexpected loss therefore exceeding that of an unexpected win, the hypothesis of uncertainty over outcome is not verified in the model; in fact, the model predicts an increase in demand when uncertainty over outcome decreases.

Behavioral biases are also present in sports betting price-formation. Braun and Kvasnicka (2013) observe that fans are subject to two kinds of bias when betting for or against their national football teams. On the one hand, they are prone to "perception bias", which leads them to overestimate chances of victory for their teams. On the other hand, they are also affected by the "loyalty bias", which deters them from betting against their own teams even when odds are favorable.

7. Recreational Sport

In most Western societies, the practice of amateur sport is gaining momentum (Sánchez-Villegas *et al.,* 2012; Rodríguez, Kessene and Humphreys, 2011). It is thus only natural that determinants of sporting practice have been analyzed (*e.g.,* Humphreys and Rusedski, 2011; García, Lera-López and Suárez, 2011), as well as travel time spending patterns in recreational sport practice (Pawlovski *et al.,* 2009).

In recreational sport, both monetary and non-monetary (*i.e.,* effort, time) costs are incurred immediately, but rewards, in the form of health improvement, are obtained in a not necessarily near future. Thus, time inconsistencies are likely to appear. DellaVigna and Malmendier (2006) analyzed gym attendance behavior as a result of three kinds of contract: daily attendance, monthly flat-rate, and yearly flat-rate. Their findings show that consumers on a monthly flat-rate go to the gym about 4 times per month, when it would be much cheaper to pay a daily fee four times in a month than to pay a monthly rate only to visit the gym four times. Moreover, users on a monthly rate are less prone to quit than users on a yearly rate, a quite surprising finding given that the cost of quitting is higher for the latter. The authors relate these findings, which are inconsistent with the traditional theory of consumption, to the "overconfidence" bias applied to the purpose of visiting the gym.

For their part, Charness and Gneezy (2009) and Acland and Levy (2015) observe positive effects in the intervention consisting in paying for gym attendance, showing that there is room for financial intervention in the formation of healthy habits. Acland and Levy (2015) additionally observe two prediction errors: First, subjects make overrated predictions of their future attendance, which is interpreted as evidence of partial ingenuity regarding the present bias; secondly, there is a significant increase in attendance after intervention that subjects seem unable to predict ex ante, a finding consistent with a projection bias towards habit formation. Analysis of the British *Households Panel Survey (BHPS)* by Humphreys, Ruseski and Zhou (2015) also provides evidence consistent with the present bias and habit formation, as well as evidence of an asymmetrical impact of important events on the decision to quit or begin a regular physical activity.

IV. CONCLUSIONS

Over the past few decades, we have witnessed the development of two productive research fields, which have contributed to renewing the theoretical and empirical framework for decision-making analysis in the sphere of economics: behavioral economics and sports economics. Behavioral economics has changed the way in which economists conceive human behavior. Experimental research in psychology and sociology has provided evidence of the existence of cognitive biases challenging the assumptions of rationality and the rules of dominance, transitivity, and invariance of preferences upon which "Rational Choice Theory" is based. However, doubts that such behaviors could persist in competitive markets where individuals have the ability to learn from their own mistakes have resulted in rationality being still widely assumed in economic theory.

Sport has provided a testing ground for cognitive biases in real-life competitive situations that constitute natural experiments. This relationship between disciplines has generated an extensive literature, which is reviewed in the third section of the present article. Four conclusions can be drawn from literature analysis, as well as four corresponding recommendations on potential lines of future research. Firstly, sports economics has remarkably met the challenge of analyzing cognitive biases present in such competitive environment. Key concepts analyzed include social pressure and emotions, as well as the "hot hand" fallacy. Concepts such as loss aversion and present bias are receiving increased attention in literature, whereas biases resulting from social preferences seemingly provide a research opportunity that has not been fully pursued hitherto. Secondly, studies have particularly focused on the behavior of players and teams. Coaches, club owners and managers, referees, organizers, fans, and recreational sport practitioners are of minor importance. In our view, analysis of these latter agents provides research opportunities inasmuch as it enables to analyze agents with different goals and subject to different competitive pressures and cognitive biases. Thirdly, due to greater data availability, a number of sports such as football, basketball, tennis, or baseball are the study object of a substantial proportion of the existing literature. Study possibilities are therefore open for minority sports, women's sport, lower-level competitions, non-professional sport and non-federate sport. Field research and applications for monitoring sporting performance additionally provide grounds to analyze behavioral biases with a higher degree of control by researchers. Fourthly, competitions in Europe and the United States have until relatively recently captured almost all attention from researchers. Though this trend is starting to be reversed in Latin American sport, with notable exceptions, sports in Asia and Africa continue to be underrepresented in literature.

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PART II

Professional Sport: Markets

DOMINANCE AND DISTRESS[1]

Stefan SZYMANSKI

Abstract

This chapter describes the two states which best describe the condition of any given football club: either dominance or (financial) distress. Organized professional football has been characterized for one hundred years or more by a system in which a small number of clubs dominate the competition and the remainder struggle to break even financially, and frequently experience episodes of financial distress. The chapter outlines the extent and similarity of dominance across European leagues, describes the various routes by which some leading clubs have become dominant, and then outlines how Sutton's exogenous sunk cost theory can account generically for the phenomenon of dominance. The chapter then reviews the extent of financial distress in European football.

Keywords: dominance, distress, exogenous sunk costs.

JEL classification: L13, Z21, Z23.

[1] This chapter is an adapted version of chapter one of Szymanski (2015).

I. THE DOMINATION OF FOOTBALL

In 2018 Real Madrid achieved the unprecedented feat of winning its thirteenth Champions League title, almost double the number of its nearest rival (AC Milan, with seven) and getting on for three times as many as the next nearest (Barcelona, Bayern Munich and Liverpool, each with five). Real Madrid is the closest thing in the football world to royalty. According to the accountants Deloitte, the Spanish club came top of the Football Money League in every season from 2004-2005 until 2014-2015, and in the most recent season (2016-2017) it came second to Manchester United by the narrowest of margins (675 million euros to 676 million euros). According to *Forbes* it also ranked marginally below Manchester United in its valuation, making it the third most valuable "franchise" in any sport, worldwide. If Real Madrid were for sale (and in 2014 there were rumors of a partial stock flotation) *Forbes* reckons it would be worth 4.1 billion dollars. The basis of Real Madrid's strength is its dominance of La Liga. It has played continuously in the Spanish league since its foundation in 1929. It has won the league thirty-three times altogether and twenty-one times in the last fifty years alone, well ahead of archrival FC Barcelona (seventeen times) and way ahead of anyone else (in fact, only five other teams have won the league in the last half-century).

Real Madrid has a lot in common with HB. Havnar Bóltfelag, to give the club its full name, is the largest team in Tórshavn, a town of 13,000 souls that also happens to be the capital and largest town of the Faroe Islands. Founded in 1904 (two years after Real Madrid), HB was a founder member of its national league in 1942 and has won the league twenty-two times, well ahead of nearest rival Kí Klaksvík (eight times). Only nine other clubs have won the league in the last fifty years. To take another example of dominance, Jeunesse Esch of Luxembourg (founded in 1907) has won twenty titles in the last fifty years, nine more than its closest rival, F91 Dudelange. Jeunesse also once held Liverpool to a 1-1 tie at Anfield, the best international result in the club's history. Compared to HB, Jeunesse is a giant. According to the popular website transfermarkt.de, the total squad value of HB in 2018 was less than half a million euros, compared to 1.6 million euros for Jeunesse. The revenue of the Luxembourg league is 50-percent larger than that of the Faroese clubs according to the Union of European Football Associations (UEFA). Yet in both countries we see the same pattern. Real Madrid is larger still, with a squad currently valued at approximately one billion euros. But large or small, the relationship of these clubs to the other teams in their domestic leagues is the same–they are dominant.

Dominance is a feature of almost every football league in the world. Table 1 shows a selection of leagues from across Europe ranging from the plutocratic (England, Germany, Spain, Italy) to the impoverished (Faroe Islands and Luxembourg). Regardless of size, most leagues tell a very similar story: a small number of big clubs dominate. The most dominated league in the half-century was Scotland, where Celtic won twenty-four titles–almost half. Not far behind were Germany (dominated by Bayern Munich), the Netherlands (AFC Ajax), Spain (Real Madrid), Portugal (FC Porto) and Norway (Rosenborg Ballklub). Only in the Republic of Ireland, France, and Poland did the dominant club not get into double figures. On average, the dominant team in the leagues of each of these countries won one third of all the titles.

One of the most important features of the football league system as it operates in most of the world is the promotion-and-relegation system. National leagues are arranged in a hierarchy, and the best-performing teams in a given division are promoted at the end of each season to play in the immediately superior division, swapping places with the worst-performing teams from the

TABLE 1

DOMINANCE IN 20 EUROPEAN LEAGUES OVER 50 YEARS (1964-1965/2013-2014)

Country	*Average club revenue 2012 $m*	*Most league championship wins in last 50 years*	*Number of league championship winners in last 50 years*
England	173.8	15	11
Germany	135.0	23	12
Spain	116.3	22	7
Italy	107.5	18	11
France	72.5	8	4
Russia	70.0	13	14
Turkey	38.8	17	5
Netherlands	30.0	23	5
Switzerland	23.8	16	11
Portugal	22.5	22	4
Norway	13.8	22	12
Scotland	12.5	24	5
Poland	7.5	9	12
Romania	7.5	19	11
Hungary	2.9	11	11
Finland	2.0	16	14
Republic of Ireland	1.1	7	15
Luxembourg	0.8	20	11
Faroe Islands	0.5	19	11
Champions League		12	11

Note: Champions League refers to nations, not clubs. Figures cover seasons 1964-1965/2013-2014 except Faroe Islands, Hungary, Iceland, and Norway refer to the period 1963-1964/2012-2013, Finland to 1962-1963/2011-2012.

higher division. The process is determined by sporting merit rather than financial capability. Over time, this means that, even if there are only twenty teams in a league at any given time, there are potentially many more league champions. If every team in the league hierarchy were of equal strength, and each game played was equally likely to end in a win or loss for the home team, then over a fifty-year period you would expect to see about forty different teams win the league championship.[2] Yet in Portugal only four different teams have won the league in the last fifty years, and in the Netherlands, Scotland and Turkey there have been only five winners over the half-century. The greatest number of teams winning a national championship over this period is fifteen, in the Republic of Ireland, and across the twenty leagues in our sample the average is ten, a long way below what you would expect to see if there were balance in the league.

Looking at Table 1, there seems to be no relationship between the size of the league and the extent of domination. The small leagues are as likely to be dominated by a small number of teams as are the big leagues. Germany, the country with the largest population and the greatest wealth in our sample, looks rather like tiny Luxembourg or the Faroe Islands.

The UEFA Champions League, the pan-European club competition for the fifty-four national associations that belong to UEFA, tells a similar story. Until 1997 the competition involved only the national champion, but since then the larger nations have been permitted more than one entry, and currently up to four teams. Over fifty years, teams from England have won the competition twelve times, and teams from only eleven nations have ever won it. This resembles the averages for the twenty leagues. In this way, at least, the Champions League looks like just another European league.

Many people believe that dominance is a relatively recent phenomenon in football, or that dominance has increased significantly over the last two decades. Commercialization, according to this sentiment, has dumped large amounts of money into the game that has corrupted the system, and created a world of "haves" and "have-nots." There is no question that the amount of money in the game has increased, but in fact there is little evidence to suggest that dominance has intensified significantly. In fact, when we compare the last quarter of a century to the preceding one, the pattern of dominance appears indistinguishable. In the last twenty-five years of the Champions League, the highest number of wins for one nation is eight (Spain), and clubs from eight different nations have won the Champions League trophy. Lo and behold, the quarter of a century before that the numbers are identical. Table 2 illustrates the difference between the two periods for twenty leagues.

[2] The method for calculating this probability is developed in Buzzacchi, Szymanski and Valletti (2003).

To be sure, the story does play out with some variations, and some countries have indeed seen an increase in dominance in their domestic leagues. For example, Germany stands out: not only did the most successful team win more frequently in the last twenty-five years than during the previous twenty-five (Bayern Munich in both cases), but the number of different teams winning the championship fell from nine to six in the same period. In Scotland, always dominated by Rangers and Celtic, at least some other teams won the league in the earlier period; no one else made it past those two in the last twenty-five years. In total, however, there were only nine leagues where the highest number of wins increased, compared to eleven where it stayed the same or fell. There were twelve cases where the number of different champions fell–suggesting increased dominance–but eight where the number stayed the same or increased. Across the nineteen national leagues, the total number of championships won by the most successful team increased from 188 to 205–an increase of 9%–while the total number of different winners fell by 9% from 143 to 130. If dominance increased then surely not dramatically.

TABLE 2

DOMINANCE IN EACH OF THE LAST TWO QUARTER-CENTURIES

Country	*Most wins by one club 1964-1965 1988-1989*	*Most wins by one club 1989-1990 2013-2014*	*Number of winners 1964-1965 1988-1989*	*Number of winners 1989-1990 2013-2014*
England	11	13	9	7
Germany	10	13	9	6
Spain	14	12	6	5
Italy	10	8	10	7
France	7	7	8	11
Russia	11	10	11	7
Turkey	9	11	4	4
Netherlands	12	11	4	5
Switzerland	7	9	8	7
Portugal	15	17	3	4
Norway	6	17	9	8
Scotland	15	16	5	2
Poland	9	8	9	8
Romania	8	11	8	7
Hungary	9	6	6	10
Finland	6	10	9	8
Republic of Ireland	6	6	11	9
Luxembourg	13	11	8	6
Faroe Islands	10	9	6	9
Champions League	8	8	8	8

A small shift is not the same as no shift at all, and to some fans, even a modest increase in dominance will matter. I am not arguing with that point of view–I do maintain, however, that dominance has always been a part of the football system, regardless of time, and regardless of the size of the league. Another way to crunch the numbers is this: 79% of national championships in our sample have been won by the top three teams in each country in the past quarter-century. In the previous twenty-five years it was 73%. In other words, a pattern of dominance was already well established twenty-five years ago. Of course, there are many other ways to measure dominance other than the one I have adopted here (see Appendix 1 for a discussion). I am fairly sure that no other measure would tell a radically different story.

If dominance has characterized the leagues for so long, what accounts for it? It is, I suggest, the natural consequence of the competitive structure of football, which is almost identical everywhere on the planet. The patterns of dominance can be explained by some relatively straightforward relationships, which then account for the success or failure of individual teams. In a recent book, *Money and Football* (Szymanski, 2015), I have tried to set out in detail how competition in football works, both at the sporting level–who wins on the field–and from the perspective of a commercial enterprise–how football operates as a business. In this chapter I will summarize some of the main causes and consequences of dominance, and its football companion, distress.

II. THE MANY PATHS TO DOMINANCE

If dominance emerges from a common competitive framework, clubs still become dominant in different ways. Take Real Madrid, Manchester United, and Bayern Munich.

1. The Royal Team

Real Madrid was founded in 1902, but it was only in 1920 that King Alfonso XIII granted the club his royal patronage. Before the Spanish Civil War and the victory of the fascist General Francisco Franco, the club was by no means the most successful club in Spain. Its fortunes rose under Franco–but how was this possible? During Franco's rule as dictator (from 1939 to 1975), the country was a political outcast because of the Generalisimo's barely concealed support for Hitler and repression at home. So how did Real Madrid establish itself in the 1950s, not only as the dominant team in Spain but also as the first dominant team of Europe?

The memory of the Franco years still generates strong emotions, and Spaniards in general find it hard to talk of the rise of Real Madrid dispassionately. There's little or no evidence to suggest that Franco directly issued large sums of cash to bankroll the team, or even that he took a direct interest in the management of the club. But surely there was never a political environment more favorable to a team that embodied the pride of Castile and the capital of the nation. Santiago Bernabéu, a player, club captain, and then manager before World War Two, became club president in 1943. His ambition to create a great club was symbolized by almost his first act–the decision to construct a new stadium, which would ultimately bear his name, adjacent to the old one but three times as large. Far larger than many people at the time thought a "small club" needed, and right in the heart of the swankiest part of Madrid, the new stadium made a statement. Bernabéu surrounded himself with financially savvy administrators who managed the club as a proper business, not in the amateur way that most clubs were run in those days. The right contacts with the regime were essential–and Bernabéu was able to ensure that Real got the best of everything. Barça fans in particular will point to the peculiar tale of the legendary Argentine player Alfredo di Stéfano's signing: he had first agreed terms with and even played for Barcelona in a friendly, only to be spirited away by Real Madrid. Even more sinister, many detractors will say that the core of the club's strategy was fixing the referees.

Once he had his stadium, Bernabéu set about hiring the greatest players of the era from all over the world–not only di Stéfano, but also the Hungarian Ferenc Puskás and Frenchman Raymond Kopa. While most clubs firmly focused on domestic competition, Bernabéu set out to prove that Real was the best club in Europe. Between 1956 and 1960 it won five European Cups (forerunner to the Champions League) in a row. And from that point the club became an aristocrat of football.

Like the Habsburg dynasty of old Spain, the club's decadence opened the door to northern Europeans. By the 1970s, Dutch, German and English marauders had singed the King of Spain's beard. The death of Franco in 1975, the transition to democracy, the devolution of power to Catalonia and the Basque Country all sapped the strength of Real. But the Madridistas never forgot, and as the economy of Spain emerged into the light of a Europe without borders in the late-1980s, the city of Madrid now represented a golden opportunity. Hot money flowed in from all over Europe in a frenzy of construction and modernization, and the construction magnate and Real Madrid president Florentino Pérez promised to bring a share of this wealth to the club.

Nothing sells better than royalty, and so Pérez launched a global marketing campaign to make the image of Real the image of football. To do this he needed to show that the club was really the heir to di Stéfano's throne, so in one of the most important deals in football history he sold the club's training facility to the city and bought players so out of this world they could only be called the *galácticos*–Zinedine Zidane, Luis Figo, Ronaldo (the Brazilian, not the Portuguese Cristiano Ronaldo, who came later), and David Beckham added to home grown talent such as Raúl and Iker Casillas.[3] It was proof positive that the royal blood line had survived–as was the team's victory in the 2002 Champions League final, which produced one of the greatest goals in the history of European football: Zidane's left-foot volley from the edge of the penalty box. By this time Real Madrid was reaching the top of the Football Rich List, and the club's wealth ensured its continued dominance, even as the Barça rivalry became a global obsession. Unlike most countries, where broadcast rights are shared, Real Madrid (along with Barcelona) resisted sharing until government arm-twisting forced a degree of sharing after 2015. While many pundits believe its dominance will be undermined by domestic broadcast revenue sharing, the global appeal of Real Madrid suggests that its pre-eminence is not under threat in the near future.

2. Red Devils and Red Meat

Louis Edwards was a successful Manchester butcher during the austerity years of 1950s Britain. Butchers do well in hard times. People like red meat and will pay to get it even when they have to economize elsewhere. But people do not want to know too much about how the meat got to their table–butchers, like undertakers, do not get the recognition their services deserve. Edwards wanted status, and so he decided to buy it by acquiring the second most popular football club in Manchester. In those days, not as fancy as their City rivals, the Red Devils were perfectly suited to an unapologetic butcher.

Manchester United was then a limited liability company, like almost every English football club. Its shares had been sold to investors back in the mists of time, held by middle-class fans who owned them as a badge of loyalty rather than a financial investment. By the 1950s and 1960s, those investors had mostly passed away, and their shares in many cases were owned by their widows, this at a time when women were not encouraged to take an interest in the beautiful game. To gain control, Edwards needed to buy these shares. In 1962, he obtained a copy of the club's share register, handwritten on heavy paper in black ink, and he copied out in long hand the shareholders' names and addresses–no photocopiers then, nor faxes or Internet searches. Then he paid a city councilor with a history of corruption to go around the suburbs of

[3] Roberto Carlos, another member of the *galácticos*, pre-dated Pérez.

Manchester knocking on doors, offering to pay for the shares in the currency that had made him rich–a few quid plus a pound of sausages! The widows didn't seem to care, and many of them probably didn't even know about the share certificates buried in the attic. But they dug them out for him, and in this way the butcher got the recognition that goes with representing, rather than merely feeding, a community.[4]

When Edwards secured control of the club in 1964, Matt Busby had already been the manager for twenty years. Busby had agreed to take on that role in 1945, when the club was ailing, on condition that he be given complete control. Before him, the "manager" in English football was little more than a fitness trainer; it was the board of directors that bought and sold the players and picked the team on Saturday. Busby knew he was better than that, and he proved it, winning the FA Cup and two First Division titles (predecessor of the Premier League) by 1956. It was an era when a smarter manager could make a difference on his own. At the time, player wages were still fixed at a maximum, and because that maximum was fixed at a level little better than those of a manual laborer, any player could be afforded by more or less any club. Moreover, players were tied to their clubs by the transfer system, which not only allowed clubs to sell players to each other during their contracts, but also to dictate which club they could move to after their contracts expired. If you could pick better players and train them to play better, then you could also be confident of holding onto your players for most of their careers, bringing long-term success and even turning a profit for the club.

Now, in passing, it must be said that the system was manifestly unfair. The players did the work but could not materially share in the rewards of their efforts. Not only were wages fixed at a low maximum, but also players had no right to move to a different club–even if the club no longer wanted their services. Rightly, in the swinging sixties, this feudal system started to crumble. A player strike eliminated the maximum wage in 1960 and a few years later a judge ruled the transfer system in breach of basic law; almost overnight, English football clubs slipped from profits into deficits.

Manchester United was different because it had the smartest manager around. And then the 1958 Munich air disaster—in which eight players, three staff and eight sportswriters died—created a global surge of sympathy for the club. The poignancy of so many young brilliant players losing their lives touched hearts and created a well of support internationally. Take for example the story of Professor Andy Markovits, who is a leading scholar on the sociology of sport

[4] The story is recounted in *Manchester United: The Betrayal of a Legend,* by Michael Crick and David Smith. Published in 1989, it stands as one of the best accounts of how football clubs worked before the days of huge media contracts.

(among other things): he grew up as a German-speaking Hungarian Jew in the 1950s, later moved to Vienna, and then to New York. He now teaches at the University of Michigan, Ann Arbor. But in 1958, when he was a kid growing up in Soviet-bloc Romania, he was so moved by the newspaper reports of the tragedy that he became a Manchester United fan, which he remains, religiously, even superstitiously, to the present day.

The heroism of Matt Busby in his recovery from life-threatening injury (which kept him in hospital for almost three months after the plane crash), his return as manager in the following season and the breathtaking flair of his new team, led by Munich survivor Bobby Charlton and newcomers Denis Law and George Best, wove a tale of redemption that was irresistible (unless you already had a team); and so Manchester United became the best-supported English team both at home and abroad. After Busby retired in the early-1970s, the team went through an extended period of high spending with limited returns on its investment. But the club retained its popularity and so was still able to make money. All this in an era when English clubs made systematic losses almost regardless of their success on the field. In the early-1980s, clubs such as Bristol City, Wolverhampton Wanderers, Charlton, and many others entered legal insolvency proceedings, usually following relegation. United was relegated in 1974–and bounced back immediately, its fan base, and finances miraculously unaffected.

By this time, Louis Edwards was passing on control of the club to his son Martin. Martin Edwards was unquestionably an innovator, always looking for new ways to bring more money into the club. His schemes did not endear him to the fans–and in the end he decided to sell out. He agreed to sell the club in 1989 for 20 million pounds (about 75 million dollars in today's currency) to Michael Knighton, a schoolteacher turned property developer, but the deal fell through at the last minute after Knighton made a fool of himself by insisting on going on the field before the start of a game to kick a football into the net. It was probably the biggest favor he ever did for Martin Edwards, who was able instead to float the company on the stock exchange in 1991 and in the following decade realized more than £100 million (equivalent to about 230 million dollars today) from his father's investment.

By the late-1990s, United had risen to become not only the most valuable football club, but also the most valuable club in any sport worldwide, worth more, by that time, than the New York Yankees or the Dallas Cowboys. The 1990s also saw Manchester United return to sporting success under the leadership of manager Sir Alex Ferguson. Ferguson's success on the field was extraordinary and unmatchable, but even without him the club's value would have skyrocketed during this era. Globalization of televised football put the international spotlight on the Premier League, and as the most glamorous club in the league it was inevitable that United would reap the benefit. It's not necessary to believe the club's claim that it has 700 million fans worldwide to accept that anywhere you go in the world the club is known, and you can probably buy a team replica jersey.

In the United States, it was a surprise to discover that the world's most valuable sports franchise was not American. But surprise soon led to interest, and to a desire to have a piece of the action. During the last decade, five Premier League clubs have come under American ownership. In any country, foreign takeovers of a treasured domestic assets are controversial. But the Glazer family takeover of Manchester United in 2005 generated far greater and more durable antipathy from fans than any of the others. It was not so much that they were Americans, but the way they did it. The family, led by Malcolm Glazer (who died in May 2014), presides over a real estate empire that ventured into sports in 1995 when it acquired the NFL's Tampa Bay Buccaneers, and won the franchise's first Super Bowl in 2003. After a takeover struggle with rival Irish bidders, the Glazers paid around £800 million (1.3 billion dollars) for Manchester United, almost all of it borrowed; they then unloaded a large fraction of the debt (about 800 million dollars) onto the club. Fans went ballistic. Protests were launched and blogs started screaming that the Glazers would bleed the club dry and leave it on the scrapheap. In the first seven years after the Glazer takeover, United won five league titles, won the Champions League, and appeared in two more Champions League finals–a spectacular performance even by United's standards and better than any other English team. Perhaps the crowning achievement of those years was the 2008 Champions League title. That final could not have offered a bigger contrast between two English clubs. On one side was Chelsea, the monster created by the billions of Russian oligarch Roman Abramovich. His team fielded the likes of Frank Lampard, Didier Drogba, John Terry, Claude Makélélé, Michael Ballack, and Ashley Cole. On the other side were the steely suits of Manchester United, which still retained Cristiano Ronaldo and Wayne Rooney–but by then there were almost weekly rumors that one or both were leaving. The rest of the team was aging, with Paul Scholes and Ryan Giggs still hanging on from the golden generation of the previous decade. Each team was led by a charismatic manager: Alex Ferguson for United and José Mourinho for Chelsea. Perhaps it isn't a surprise that the game went to a penalty shootout, and that it took more than the regulation five penalties per team to settle it.[5] United won, even if you would be hard pressed to find one fan prepared to give the Glazers one iota of credit.

Manchester United may not be rated as highly as the Barcelona team of that period, but the English team would rank alongside anyone else. And in this period the Glazers reduced the club's debt by around a half while paying

[5] The strange story of this penalty shootout appeared in chapter 8 of Kuper and Szymanski (2014).

penal amounts of interest. Revenue has risen so fast that talk of financial problems has now faded. The Glazers floated part of the club on the New York Stock Exchange in September 2012, amid widespread claims that the stock would plummet, but by the spring of 2013 its value had risen by around 25%, placing a 3 billion dollars price tag on the company as a whole.

Not that the Glazers changed the way the club was run that much–though they encouraged a commercial department to develop more international deals, which has produced a lot of extra revenue. In the early days, they made themselves even more unpopular by raising ticket prices, but prices were more or less frozen since the United Kingdom went into austerity after 2008. They have benefited from huge increases in broadcast revenue both at home and abroad. But mainly the Glazers have made themselves richer simply by recognizing that United is one of the most powerful symbols of football in a world where demand for football is expanding.

3. FC Hollywood

Germany is the waking giant of club football, a nation that is crazy about the game and about two teams in particular: the German national team and Bayern Munich. Often it is hard to tell them apart. Bayern, or FC Hollywood as the all-star team is jokingly referred to in Germany, has bossed the Bundesliga almost from the start. With twenty-three championships in half a century, no one else is even close. Other countries have at least two dominant teams (Barça and Real in Spain), many have at least three (AC Milan, Internazionale Milano, and Juventus in Italy), and others have several depending on the era. In England, teams have often switched places. Both Manchester United and Liverpool enjoyed extended periods of dominance, but even at their respective peaks they had close rivals: Manchester City, Chelsea, and Arsenal in recent times; Everton, and Nottingham Forest in times past.

Bayern, by contrast, has no serious rivals in Germany. It has been associated with the dominant players in German football, not least Franz Beckenbauer, *der Kaiser.* It was a stroke of luck that he joined Bayern. He was a childhood fan of TSV 1860 Munich, the city's other professional club, and he had planned to join that rival squad. But, after the youth team that Beckenbauer played for ended up contesting a bad-tempered game against 1860's youth team, he changed his mind and plumped for Bayern Munich. It is a conservative club: Bavarian, industrial-the football equivalent of BMW (although the carmaker does have serious competitors in Germany). Bayern is a magnet for talent: all the great German stars, except some of the radicals and dreamers, end up playing for Hollywood.

Bayern's rise to dominance seems serendipitous. Germany did not even have a national league until 1963, and when the Bundesliga started Bayern was not even included in it because the league preferred to take on the more successful TSV 1860 Munich. The early success of the club in the 1960s was not built on a strong financial base, and there were questions about its solvency right up until the end of the 1980s. No doubt, Bayern benefited from sharing the monumental Olympic Stadium (built for the 1972 Olympics) with 1860, and it no doubt benefited indirectly from the affluence of the Bavarian state. But these are not overwhelming advantages. Instead, Bayern just started winning games, and one thing led to another in that kind of virtuous circle that everyone talks about but seldom lasts. In Bayern's case, it did. Of course, all success is ultimately attributable to good fortune in the sense that we are endowed with skills and capabilities that we did not acquire by design or by merit. But somehow Bayern's success feels at times more like the blind luck of a coin toss that just keeps on coming up heads. The club would probably just say that it always makes good decisions—which its rivals do not appear able to match. For example, in the 2013 Champions League semifinal, Bayern routed Barcelona (7-0 on aggregate), a team that only a year before had looked invincible.

There is little chance that Bayern's dominance can be challenged. Since it became the dominant power in German football, it has been protected from competition because of the organizational model of the sport in Germany. German clubs, including Bayern, are mostly member organizations with guaranteed fan control, thanks to the 50+1 rule, which prevents investors from buying a controlling stake. This makes the German system very conservative. There is no room for sugar daddies or entrepreneurs to take over a club and buy their way to success, and so there is little chance that any club could ever challenge Bayern's place at the top of the German hierarchy.

The German organizational model has recently become popular internationally for a number of reasons. The crop of German players in the 2010s has been stellar, as witnessed by the national team's convincing victory in the 2014 World Cup, although somewhat tarnished by the German debacle at the 2018 World Cup. German ticket prices are relatively low and clubs play in large, well-appointed stadiums, many of them rebuilt and refurbished for the 2006 World Cup, partly at public expense. Average attendance at league games has risen rapidly in recent years, and is now the highest in the football world. The conservatism of the German system, however, also helps to sustain the long-term dominance of Bayern.

These stories illustrate that while, statistically speaking, football dominance looks broadly the same whichever country you look at, there is no single path to dominance. If there were a simple formula, then any club could become dominant. One popular theory in business schools is that "first movers" – those who are in at the beginning, are most likely to become dominant. Football provides a number of interesting counterexamples to the theory – (see appendix 2) Instead, the organizational structure of football creates the conditions where some teams can become dominant, without determining which particular teams those should be.

III. DOMINANCE IN A COMPETITIVE ENVIRONMENT

Dominance is usually associated with the absence of competition, but that is not the case when it comes to football. There are, for example, twenty-five professional football teams within a fifty-mile radius of Manchester United. If fans didn't like United, there are plenty of alternatives. Often, rivals play in the same stadium (Bayern and TSV 1860, Inter Milan and AC Milan are the two most notable examples). And if Spanish fans are looking for variety, there are four other professional football clubs in Madrid to choose from.

Dominance through monopoly, the absence of competition, usually occurs because the scale of the investment required is so great that competition just isn't feasible. Take the water supply and sewerage systems for example. Competition would require individual households and businesses having access to not one, but two or more networks of pipes, a proposition that amounts to economic madness. Laying pipes is very costly, and water supply and sewerage fees have to be set in such a way as to recover these costs. Any benefit that might arise from competition would be dwarfed by the cost of duplication.

But dominance also occurs in markets where competition is perfectly feasible. The beverage market is a good example. Any child can (and often does) set up a lemonade stand on the street and sell to passersby–this is not a business in which entry is difficult or particularly expensive. It remains to this day relatively easy in business terms to set up a production plant to bottle soft drinks, and yet Coca-Cola dominates this world, with a market share of around 42% in 2012, followed by Pepsi with 28%. Despite all that potential competition, these two firms dominate the market. Their hegemony is not explained by set-up costs but–according to the work of John Sutton, an industrial economist–by something different: advertising.[6] Consumers tend to buy soft drinks that they recognize, and advertising is the way that they usually recognize the product. So when sellers compete against each other they compete not just on price, but on recognition. Recognition is costly, and takes years to establish. Moreover, once you have it, and if you want to maintain

[6] His book on the subject remains a classic of the economics literature: Sutton, 1991.

it, you have to keep on investing. Is there anyone on the planet who does not recognize the name of Coca-Cola? And yet the company still spends around 3 billion dollars a year on advertising. That is what it takes to fend off the constant threat of competition.

Sutton argues that soft drinks are a good example of an "advertising-intensive" industry in which a pattern of dominance can emerge. In the early days of such industries there are many competitors jostling for recognition, which leads to an arms race in advertising. Advertising expenditures precede sales, and so represent something of a gamble. For some companies they pay off and the business grows, while for others the sales don't follow and the business goes to the wall. In this way, a small number of successful firms grow into giants. A competitive fringe also survives, mostly consisting of small firms with small market share. In very large markets (such as the United States), the power of advertising conferred a huge advantage on companies like Coca-Cola. In Europe's smaller markets (which tend to be drawn along national lines), more small firms tend so survive, making the biggest firms less dominant (see appendix 3 for further discussion of Sutton's theory).

This is essentially the story of football too. Instead of advertising, think of league championships. Teams that win are the ones that attract the fans–the biggest clubs have the largest number of fans and the largest revenues. The big difference between football and soft drinks is that the pattern of dominance looks the same in small markets (Faroe Islands) as in the big markets (Spain). The reason for this is that in the soft drinks industry, and most other big markets, small firms trying to keep up with the dominant firms go out of business. In football, small clubs almost never disappear. Of the eighty-eight clubs in the English Football League in 1923, eighty-five still exist, and most of them still play in the four English divisions. Of the seventy-four clubs playing in the top divisions of England, France, Italy and Spain in 1950, seventy-two still exist. Unlike most businesses in which loss-making firms are shut down or merged into other businesses, football clubs almost always survive. This does not prevent dominance, but unlike most industries, it does mean that the pattern of dominance tends to look the same everywhere.

IV. DISTRESS

In the summer of 2010, the Italian football federation (FIGC) issued a ruling that twenty clubs in the second, third, and fourth tiers of the various leagues would be subject to sanctions, including exclusion from league competition, for failing to meet their financial obligations. Under the club-licensing rules in Italy, a club may be refused a license because of overdue payments on debts, payments owing to players or other clubs, or overdue payments to the tax authorities. Additionally, every club must disclose its full accounting information, and a license may be refused if the accountants deem that the club is "not a going concern" (a term of art in accounting that means the business is not commercially viable without making some additional assumptions, such as a commitment to further investment by the owners).[7]

As a result, eighteen clubs were liquidated–that is, the companies that owned the clubs were wound up. Out of these eighteen, twelve new clubs were born claiming the heritage and insignia of the defunct club. In three cases, other existing clubs sought to take over the history and identity of the old clubs–two succeeded, and the third, Ancona, is still in the process of doing so. In only three of the eighteen cases was there no successor club: Pro Vasto, Sanguistese, and Pescina. Of the twenty clubs sanctioned, seventeen have entities that have already replaced or will replace the old clubs by the 2014/2015 season. One of these was operating three tiers lower than in 2010, seven were operating two tiers lower, seven were one tier lower, and two were actually playing at a level one tier higher than in 2010.

In May 2014, Spanish secretary of state for sport Miguel Cardenal revealed that professional football clubs in Spain's First and Second Divisions had accumulated debts of 3.6 billion euros (4.5 billion dollars). Seventy-four percent of this debt was owed by just eight clubs in La Liga's Primera División. According to Cardenal, money owed by clubs to the government amounted to 752 million euros (940 million dollars) in January 2012. The inability of Spanish football clubs to pay their debts has a long history. In 1990, the Spanish government passed a law requiring professional clubs to convert from members associations to limited liability companies in the hope that this would stop the clubs from acting irresponsibly, and at the same time cancelled 192 million euros (240 million dollars) of debt.[8]

The reforms made no difference–throughout the 1990s, Spanish clubs continued to rack up debt until in 2003 a new law, the *Ley Concursal,* came to their aid. This was a reform of Spanish insolvency law, which was intended to save indebted companies from being shut down. Prior to that the only option for companies that could not pay their creditors was to close down the business, sell off the remaining assets, and repay as much of the debt as they could. Often this meant closing down viable companies, often with significant

[7] See *The Italian Club Licensing Manual* published by the FIGC, downloaded at www.dirittocalcistico.it/otherside/data/general_stagione/file/34/FIGCliceufa12ingl.pdf on 11/4/2014.

[8] See Ascari and Gagnepain (2006: 77-79). There was an earlier restructuring plan in 1985 that failed. Athletic Bilbao, Barcelona, CA Osasuna and Real Madrid were allowed to remain as member associations on the grounds that at the time of the first reform they still had positive net assets.

loss of employment, just to solve a short-term credit crunch. The *Ley Concursal* enabled companies to negotiate with their creditors with a view to keeping the business running while agreeing to pay back as much money as possible. Spanish football clubs have embraced the new law enthusiastically–between 2003 and 2011, twenty-two clubs took advantage of it to renegotiate their debts.[9] Notwithstanding these restructurings, the Spanish government felt obliged to intervene in 2012 to devise a new plan to force the clubs to pay the backlog of taxes and other social security obligations. This process will take several years to complete, so as yet we cannot tell if this intervention will prove any more successful than the previous attempts.

There is a long history of insolvent football clubs in England. After World War Two, the first club to become insolvent while still competing in one of the top four divisions was Bristol City in 1982.[10] Since then, more than seventy clubs have been involved in insolvency proceedings of one form or another while still playing in the four professional divisions. At the end of February 2010, Portsmouth Football Club became insolvent, the first club ever to do so while playing in the Premier League. However, at the time, Portsmouth was already nearly certain to be relegated, and that indeed happened a few weeks later. Insolvency is mainly a problem of clubs operating in the lower divisions.[11]

Evidence of insolvency problems in England and Wales can be traced back even further by searching the records of the *London Gazette,* whose archives are now available online. Renamed *The Gazette,* it is the publication of record for any company based in England and Wales. All significant events relating to insolvency, such as a meeting of creditors or the winding up of the company, must be published in *The Gazette.* Between 1893 and 1935, a little over forty years, there were twenty-two cases notified to the *London Gazette* involving Football League clubs–about one every other year on average. The first case was the liquidation of Middlesbrough Ironopolis in 1893. Ironopolis was in fact a successful club, having won the Northern League three times and reached the quarterfinal of the FA Cup, a single elimination tournament that is older than the league itself. The year it went into liquidation was also the year it entered the Second Division of the Football League (which only had two divisions at that

[9] Barajas and Rodriguez (2014: 74). The clubs were Las Palmas, Sporting de Gijón, Málaga, Alavés, Celta de Vigo, Real Sociedad, Polideportivo Ejido, Albacete, Recreativo de Huelva, Murcia, Xérez, Granada 74, Alicante, Zaragoza, Levante, Córdoba, Rayo Vallecano, Real Betis, Mallorca, Racing de Santander, Valladolid, and Hércules.

[10] Accrington Stanley resigned from the Football League in 1962 because the directors believed the club was no longer able to meet its financial obligations. Having left the League the club continued to play at a lower level until 1966 when it did finally go into liquidation. The club was revived in 1968, and currently plays in the fourth tier in England.

[11] For a more detailed account of the causes of insolvency in English football in recent years, see Szymanski (2017).

time). The club ultimately failed because it was unable to afford the lease on the stadium it played at, which was adjacent to Ayresome Park–home of the more famous Middlesbrough Football Club.

The list of twenty-two includes some august names–Newton Heath, later renamed Manchester United, Arsenal, Aston Villa, and Wolverhampton Wanderers–all of which went on to win the Football League championship more than once. Only ten of the businesses actually collapsed–in all of the other cases some kind of resolution was found to the financial problem. Of these ten, only three have not reappeared in one guise or another: Ironopolis, Bootle AFC (which collapsed in 1893), and Leeds City, which was expelled from the League in 1919 after being found guilty of paying its players during World War One in breach of the Football Association's wartime rules.[12]

It has become popular in recent years to suggest that some countries, notably Germany, are better managed in this respect and that insolvencies are unknown in German football. Recent research shows that this is not the case (see Weimar and Szymanski, 2018). While it is true that clubs in the top division (1. Bundesliga) have not undergone insolvency proceedings, in the mid-2000s, both Borussia Dortmund and Schalke 04 got into considerable financial difficulties, the former being bailed out in part by a loan from Bayern Munich. Lower division clubs are not so fortunate–there have been at least eighty-six cases of football clubs in lower divisions entering insolvency since 1993, a rate of almost four per year.

These examples are drawn from the big four nations of professional football.[13] According to Deloitte the seventy-eight professional clubs in the top division of these four countries had a combined income of 8.5 billion euros (10.6 billion dollars) in 2013, equal to almost half of the European football market by value. Yet this is only a tiny fraction of the total number of football clubs in Europe and farther afield. There are around 700 clubs in the top divisions of the member nations of UEFA, and hundreds, if not thousands, more clubs in the lower tiers. Clubs in nations that have smaller revenues are more likely to face the threat of insolvency. According to UEFA, in the financial year 2012, 39% of European top division clubs had negative equity–meaning that their liabilities exceeded their assets. This is usually taken as a sign of impending insolvency. However, this figure fell to only 31% when looking at clubs whose annual revenues exceeded 20 million euros (25 million dollars). In other words, larger clubs look more secure. Since the first club-licensing

[12] In some cases clubs merged to form clubs that survive to the present day (*e.g.,* Rotherham Town and Aberdare) while others were revived, albeit with a gap (Durham City folded in 1938 and was refounded in 1950; Merthyr Town folded in 1934 and was refounded in 2010).

[13] For an account of insolvency in French football, see Scelles, Szymanski and Dermit-Richard (2016).

report for the financial year 2008, UEFA has issued figures on the number of clubs whose auditors raised a "going concern" qualification (*i.e.,* that the clubs would need external financial support to survive). Between 2008 and 2011, the fraction of clubs whose accounting information was qualified in this way rose from 10% to 14%. Since 2012, UEFA has chosen not to reveal the percentage.

V. TAKING INEQUALITY SERIOUSLY

In his celebrated book, *Capital in the Twenty-First Century,* Thomas Piketty, the French economist, argues that there are some relationships in the capitalist system that lead inevitably to inequality, and that these processes were overshadowed by the horrendous consequences of two world wars. The key trend, which echoes the work of Karl Marx, is that that over time capital plays a larger and larger role in the national economy, and that if ownership of this capital is concentrated in a few hands then income inequality may grow to extreme proportions. This argument is used to justify government intervention in the form of a minimum income, the provision of basic public services, and a tax on capital.

This narrative may sound oddly familiar to anyone who follows the public debate on football. The following statement comes from a 2003 decision of the European Commission on the sale of UEFA Champions League broadcast rights:

"The Commission understands that it is desirable to maintain a certain balance among the football clubs playing in a league because it creates better and more exciting football matches, which could be reflected in/translate into better media rights. The same applies to the education and supply of new players, as the players are a fundamental element of the whole venture. The Commission recognises that a cross-subsidisation of funds from richer to poorer may help achieve this. The Commission is therefore in favour of the financial solidarity principle, which was also endorsed by the European Council declaration on sport in Nice in December 2000."

At one level, Piketty's argument is somewhat different. Economic activity is generally the product of capital–owned by someone–and labor. Both need to be rewarded for their contribution, and Piketty is arguing that there is natural tendency for the reward to capital to grow to the point where inequality becomes unsustainable. In football, the inequality is among clubs that do the same thing, and in competition with each other. However, there is a logical connection. Those who own capital were once like the rest of us–they relied on income from their labor–but they were so successful that they had lots of spare income that they were able to turn into capital, which then sustained them, their families, and their descendants. Likewise, the dominant football clubs of today are, for the most part, the descendants of some extremely successful clubs from the past, and are able to live off that capital today. Without their history, Real Madrid, Manchester United, and Bayern Munich would struggle like everyone else. Moreover, there is a logic by which their dominance can become unsustainable (if the gap becomes too large then competition with lesser teams becomes unattractive), and the dominant clubs would be better off breaking away and forming their own superleague. This is a proposition that has been in the air since the 1980s, and indeed it was the motivation for statements such as the year 2000's Nice Declaration "on the specific characteristics of sport and its social function in Europe."

Some say a breakaway superleague will never happen, but at the end of 2018 discussion rumours surfaced again, as they have had a habit of doing since the 1980s.[14] Others say that the Champions League is already a superleague in all but name. The superleague model is essentially the model that has been adopted in the American sports system. Rather than an inclusive pyramid structure, where allcomers may compete within a system of promotion and relegation, the American model is a closed system with a limited number of teams (thirty each in Major League Baseball, the National Basketball Association and the National Hockey League and thirty-two in the National Football League). With a limited number of teams, there is a basis for a cooperative action, which has enabled them to adopt a variety of measures to establish a measure of equality. Moreover, these measures are consistent with self interest, since they restrict competition and help to sustain profitability well above competitive levels. Such agreements are unfeasible within the pyramid system. Redistribution on a scale which would achieve a degree of equality comparable to the American system would drastically weaken the dominant clubs, who thus have no interest in agreeing to such a policy.

VI. CONCLUSION

Football then is a competitive enterprise characterized by both dominance and distress. These are not merely a consequence of accidents or misjudgments (although both are common in football as in other walks of life), but they are inherent to the structure of the game and its organization. The key element of that structure is the system of promotion and relegation, which encourages intense competition. It is that competition that has helped to make football the world's most popular sport.

[14] Back in 1999, I published an article with Tom Hoehn discussing the prospects of a superleague (Hoehn and Szymanski, 1999).

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APPENDIX 1

MEASURING CONCENTRATION

There is no unique way to measure dominance. The two measures used here–the highest number of championships won by any one team and the number of different teams winning a championship–are correlated but not identical (the correlation coefficient for Table 1 is –0.64; the minus sign means that the more championships won by one team, the fewer the total number of champions is likely to be). There has been a lot of research on measuring concentration for football and for North American league sports (the term "competitive balance" is often used). These studies tend to look at three types of concentration–1) within each game (how close individual matches tend to be),(2) within the season (how close the championship is), and (3) dominance over time, which is the type of dominance analyzed here. Each type of dominance can be measured differently, although different measures tend to be correlated.

In a recent paper, John Curran, Ian Jennings, and John Sedgwick (2009) looked at teams finishing in the top four places in the top division in England and showed that there had been a gentle increase in the dominance of the four most successful teams until the end of the 1990s–since when the top four have been increasingly dominant, which is almost certainly a consequence of the growing financial importance of the Champions League.

Using an approach that focuses on the dispersion of results within a given season, Arne Feddersen and Wolfgang Maennig (2005) show that there is very little evidence of any trend in concentration of results–so even if the big clubs are more dominant, they do not seem to win championships by a wider margin than in the past.

Back in 2003, I did some research with Luigi Buzzacchi and Tommaso Valletti (2003) in which we compared the number of teams that in theory have the potential to reach the top five positions over a period of time compared to those that actually do. Because of promotion and relegation, the number of clubs that could in theory reach a top-five place if they got the right results becomes very large once you consider a long period of time. Suppose, for example, that every team in every division had an exactly equal probability of winning each game it played. Then, over the fifty seasons from 1950 to 1999, we would have expected 105 different teams to finish in the top five places of Serie A in Italy. In reality, through this half-century, there were only nineteen teams that finished the season in the top five.

APPENDIX 2

FIRST MOVERS AND THE DOMINANT DESIGN

Preston North End won the inaugural Football League Championship in 1888-1989 and won the trophy again in the following season. The club has never won it since, and in the last fifty years it has drifted between the three lower tiers. VfB Leipzig is recognized as the first German national champion in 1903, but the club was reorganized in East Germany after World War Two. Since reunification, it has struggled and currently plays in a fourth tier regional league. Genoa CFC (for Cricket and Football Club!) was the first champion of Italy and won that title nine times between 1897 and 1924. However, while it has had several seasons in Serie A over the last fifty years, Genoa has spent more seasons in Serie B and has even played in the third tier–it has not been a title contender in this period. All of these clubs had a first-mover advantage, but while they have survived as football clubs they have not managed to become part of the dominant group in their countries. In the four big leagues, only Barcelona, which won the first Spanish championship in 1929, has managed to convert that first-mover advantage into long-term dominance.

This might seem surprising, but it is a common phenomenon in many businesses–early innovators often fall by the wayside. That said, dominant firms are dominant because they have been there a long time. Two business school professors, James Utterback and William Abernathy (1978), suggested an explanation of this using the concept of the "dominant design." First movers are creative, but it often takes several years to perfect an innovation–and this is often done not by the innovator, being justly proud of its creation, but by followers who make small but important changes to make the product more consumer friendly. Eventually, a dominant design emerges–and the firms that first exploit this do become dominant.

In football, "dominant design" should be taken to refer to an established structure of competition that commands national attention. While the Football League was established in 1888 it did not reach is current structure until 1923, and it was only after this that teams like Arsenal and Manchester United emerged as dominant clubs. In Germany, the Bundesliga was not founded until 1963, and it was almost at once dominated by Bayern Munich, while Serie A was not established until 1930–its first champion was Internazionale and the second was Juventus.

APPENDIX 3

JOHN SUTTON, SUNK COSTS, AND MARKET STRUCTURE

Economists build models of industrial structures in order to capture the salient facts about markets within a framework of rational decision making. This does not mean that there is no luck involved or that no one ever makes a mistake; however, consumers are assumed to pursue their best interests, given what they know, and businesses try to take advantage of opportunities to make profits if they are there. The salient fact that John Sutton set out to capture in his famous book *Sunk Costs and Market Structure* is that many industries are characterized by a small number of dominant firms and a "competitive fringe" consisting of large numbers of small firms. Dominance is easy to explain if there are very large set-up costs, which, once spent, cannot be recovered other than by operating in the industry–what economists call "sunk costs." For example, there are only ever a small number of electricity generators in a market because building them entails large sunk costs, which are essentially defined by the technology. The dominance of Coca-Cola seems more complex to understand because the set-up costs to manufacture soft drinks are not that high, and most of the sunk costs are incurred in the form of advertising, which is essentially at the discretion of the firm. Advertising is an example of "endogenous" sunk costs meaning they are determined by the decisions of firms in the process of competition, as opposed to "exogenous" sunk costs, which are simply determined by technological requirements.

Sutton develops a model in which firms can pursue one of two types of strategy. One is an advertising-intensive strategy, which makes the product more attractive but at an increasing cost. The second is a non-advertising strategy, which limits the attractiveness of the product to the market but keeps costs down. He shows that an equilibrium is possible in which the market is dominated by a small number of firms that advertise intensively, and a potentially large number of firms that do not. How many fringe firms there are depends partly on how willing consumers are to switch to the high-advertising product. If fringe firms are willing to absorb losses persistently then in theory the number of fringe firms can remain high–although Sutton does not consider this idea in his model.

What determines whether you are in the dominant group or the fringe group? Two obvious mechanisms are first-mover advantage and tastes. First movers can establish a reputation and brand name that gives them a broader appeal than late-arriving upstarts. Tastes also matter.

APPENDIX 3 *(continued)*

JOHN SUTTON, SUNK COSTS, AND MARKET STRUCTURE

Once a product becomes fashionable it can build from this platform, and continually enhance its dominance through advertising. Note, however, that the profitability of being a dominant firm, which has to spend large sums on advertising to maintain its dominance, may not be much greater than that of a fringe firm that, although small, does not have to maintain the advertising outlays. In equilibrium, no one should be making profits above and beyond those required to keep the business going, otherwise new firms would be tempted to enter the market.

Applying Sutton's model to the world of professional club football, one should focus on player investment instead of advertising. The big clubs are the ones that spend heavily on players and achieve a potentially global following–there are only a small number of these large dominant teams. These clubs were able to develop this image because they were first movers, because of their location, because of a specific event in their history, or because of their association with particular individuals or movements. But there is a very large competitive fringe that survives largely on local loyalty, which is intense. These clubs can never break into the dominant group, unless they receive substantial funding from an investor (who does not expect to see a direct financial return) or they are extraordinarily lucky.

DEMAND OF PROFESSIONAL SPORTS: ATTENDANCE AND AUDIENCE

Isabel ARTERO

Eduardo BANDRÉS

Jaume GARCÍA[1]

Plácido RODRÍGUEZ

Abstract[2]

In this article a review of the most recent developments in analysis of demand for professional sports is carried out, with particular emphasis on the role played by uncertainty of outcome, suspense, and surprise. In turn, two empirical analyses on Spanish First Division football games attendance and television audience of matches played by the Spain national football team are presented. Findings show that, while uncertainty of outcome renders games more appealing for television viewers, its effect on stadium attendance is somewhat contradictory, suggesting a greater interest in attending games with more talented players in both teams, increased competitiveness, and higher probability of their (local) team winning.

Keywords: demand, uncertainty of outcome, attendance, audience.

JEL classification: D12, L82, L83, Z20.

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[2] Article translated from the Spanish by Ciro Arbós.

I. INTRODUCTION

Demand analysis in professional sports has been addressed in sports economics from the beginning, having become a key element to characterize the peculiarities of the discipline and, at the empirical level, a most frequently analyzed subject matter in literature. In this regard, though the explicit object of analysis in the two seminal papers on sports economics by Rottenberg (1956) and Neale (1964) are seemingly unrelated to demand –baseball players labor market in the case of Rottenberg, theory of the firm in the framework of sporting and market competition in the case of Neale- revenue obtained from game attendance in professional leagues plays an important role in both studies. In fact, it is the ultimate reference for the theoretical analyses conducted.

Thus, Rottenberg (1956) mentions as one of the arguments most often used in favor of the reserve clause the role played by demand in guaranteeing talent distribution, which is necessary to preserve uncertainty of outcome and, in turn, "is necessary if the consumer is to be willing to pay admission to the game" (p. 246). For his part, Neale (1964) considers that "the first peculiarity of the economics of professional sports is that receipts depend upon competition among the sportors or the teams" (p. 2). To illustrate his point, he resorts to the well-known "Louis-Schmelling paradox" and applies it to the situation experienced by the New York Yankees, an American professional baseball team that, after temporarily losing its supremacy in the World Series in the mid 1950s, "paradoxically" faced a situation where it suffered from sporting misfortune and enjoyed massive stadium attendance simultaneously.

In fact, Rottenberg (1956) makes a thorough description of factors explaining baseball games attendance, which he understands as "a function of the general level of income, the price of admission to baseball games relative to the prices of recreational substitutes, and the goodness of substitutes […] a positive function of the size of the population of the territory in which the team has the monopoly right to play, the size and convenience of location of the ball park; and the average rank standing of the team during the season […] a negative function […] of the dispersion of percentages of games won by teams in the league" (p.246). In other words, Rottenberg lays out the typology of variables to be considered when analyzing demand of professional sports, which would serve as the guideline to classify explanatory factors in numerous empirical studies on this subject matter, most of them included in the general literature reviews carried out so far (Cairns, 1990; García and Rodríguez, 2003 and 2009; Borland and Macdonald, 2003; Rodríguez, 2019).

Demand determinants in professional sports, such demand in principle consisting in stadium attendance, are usually addressed on the basis of classifications of variables which notably include the typical variables used for demand economic analysis (price, income, size of the market, prizes of substitute or complementary goods); variables related to the quality of teams or competitions, including recent performance records; those intended to measure uncertainty of outcome, which is key to the development of sports economics considering its peculiarities; and, in general, all variables that might contribute to approximate the opportunity cost of game attendance, such as weather conditions, television broadcast of the match, distance between hometowns of both opposing teams, or time and date of the match.

Until very recently, most demand-related literature has focused on essentially empirical aspects such as the different ways of approximating variables of interest or the relevance of functional forms and their impact on the findings obtained, which are thoroughly addressed in the aforementioned literature reviews. A theoretical aspect having received considerable attention is the seemingly non-profit-maximizing behavior of clubs, which would result from estimates of price elasticity of demand in professional sports that are generally below the unit in absolute value. Thus, different models aim at giving account of such empirical evidence in the context of profit maximization: demand restraint caused by stadium capacity (El Hodiri and Quirk, 1975); inclusion of the revenue generated by licenses granted for the sale of food and beverage in stadiums (Marburger, 1997; Coates and Humphreys, 2007); consideration of other revenue sources which are more important than revenue from ticket sales (Késenne, 2002); or the existence of a particular link between local television revenue, marginal cost of talent, and average revenue of all other local television networks (Fort, 2004), among other explanations.

Research on audiovisual demand for sporting events is less abundant than that analyzing stadium attendance, due inter alia to reduced availability of data until recently. However, revenues from television rights for players, clubs or federations are much higher than those obtained from the sale of tickets or season passes, which is the reason why the broadcasting of sporting events has gained weight as subject matter for analysis in sports economics.

However, the first references to the impact of sports television broadcasts appear in studies analyzing stadium attendance, where live games television broadcasting is sometimes included as explanatory variable, based on the idea that it might have either a substitution effect or else an effect complementary to stadium attendance, depending on the motivations of each kind of spectator.[3]

[3] The first references to the impact of television broadcasts are to be found in studies on stadium attendance such as those by Kuypers (1996), Baimbridge, Cameron and Dawson (1996), García and Rodríguez (2002), Forrest, Simmons and Szymanski (2004), Buraimo, Forrest and Simmons (2006), Buraimo (2006, 2008), and Allan and Roy (2008).

Apart from the possible crowding-out effect that broadcasts might cause, the key issue in studies on demand for sporting events is to ascertain whether broadcasting determinants are similar to those of stadium attendance. The cost of watching sporting events on television is obviously much lower than that of stadium attendance (there are no travel costs, no tickets or season passes need to be purchased, save for the case of pay-per-view…); therefore, uncertainty of outcome might gain a different relevance as audience explanatory factor in consumption-related decision-making. Moreover, maintaining audience levels throughout the entire live broadcast is essential not only for television networks (advertising), but also for sponsors of players and teams. In the case of stadium attendance, on the contrary, the fact of spectators leaving the stadium before the game ends is not excessively traumatic for clubs from an economic point of view, since fans have already paid for their ticket or season pass (Coates and Humphreys, 2012). As pointed out by Brown and Salaga (2018), another key element explaining behavioral differences between stadium attendees and television audiences is the fact that they follow different behavioral patterns, for, while local supporters prevail in stadium, television viewers also include many visiting team supporters and fans merely interested in the sport or competition broadcasted, the latter generally showing a more neutral or casual demand and probably being more interested in the sporting relevance or quality of the competition.[4] Otherwise said, as stated by Buraimo and Simmons (2009), audiovisual demand is less loyal and might prefer games entailing greater uncertainty of outcome. Furthermore, whereas in stadium demand is strongly influenced by previous expectations and remains usually stable throughout the match, television audiences may easily vary according to the degree of uncertainty or to actual game progress.

As a matter of fact, in recent years the role of uncertainty of outcome has become again the focus of attention in demand analysis in professional sports as a result of the heterogeneity of findings, being uncertainty considered not only in terms of significance or magnitude of its effects, but also even in terms of the sign of effects themselves. In this regard, analysis of determinants of television audiences and their comparison with those of live games attendance has played an increasingly important role; concurrently, as pointed out by Coates, Humphreys and Zhou (2014), after more than fifty years disregarding the rationale for consideration of the effects of uncertainty of outcome on decisions made by consumers, seemingly contradictory empirical findings have raised interest in finding a possible explanation by means of models based on behavioral economics.

[4] It should be noted that patterns for the different explanatory variables are heterogeneous in the case of attendance, depending on whether spectators have purchased a ticket for a single match or else a season pass. In this regard, see García and Rodríguez (2013).

The following section includes a review of the most recent developments in demand analysis in professional sports as regards the role played by uncertainty of outcome, as well as a review of recent applications of the proposal made by Ely, Frankel and Kamenica (2015) whereby individuals obtain utility from their leisure activities through associated suspense and surprise. Furthermore, this article provides a review of the different aspects addressed in the existing literature on demand in professional sports through two empirical exercises on football in Spain. One refers to Spanish league live games attendance, while the other analyzes television audiences generated by the broadcasting of matches played by Spain national team. The closing section includes a summary of key conclusions.

II. UNCERTAINTY OF OUTCOME, SUSPENSE AND SURPRISE

As pointed out in the introduction, the impact of uncertainty of outcome on demand in professional sports has been and continues to be one of the most analyzed aspects at the empirical level in the sphere of sports economics.

The hypothesis associating greater uncertainty of outcome with greater appeal of the game for spectators has been widely accepted from the beginning, though the huge amount of empirical evidence available for different sports, countries and competitions,[5] as well as the kind of demand examined (live or broadcast games) have generated contradictory results. Thus, conclusions arrived at in different studies encompass all possibilities, namely: that increased uncertainty increases demand (Forrest, Simmons and Buramio, 2005; Di Domizio, 2010; Alavy *et al.,* 2010; Schreyer, Schmidt and Torgler, 2017; Artero and Bandrés, 2018); that it has no effect (Buraimo, 2008; Nüesch and Franck, 2009; Scelles, 2017; Caruso, Addesa and Domizio, 2019); that audience attention focuses on the quality and talent of players (Buraimo and Simmons, 2015; Feddersen and Rott, 2011; Pérez, Puente and Rodríguez, 2017); and even that uncertainty reduces audience shares because what fans want is to see their team winning (Tainsky, 2010; Di Domizio, 2013; Nalbantis and Pawlowski, 2016; Pérez, Puente and Rodríguez, 2017; Gasparetto and Barajas, 2018) and that consumers show loss aversion (Humphreys and Pérez, 2017; Pawlowski, Nalbantis and Coates, 2018). Nalbantis and Pawlowski (2007) conclude that

[5] There are also available studies on single sporting events broadcasts that do not attract so many viewers but are of occasional interest for television networks, even though they lack continuity or league coverage structure. In this regard, the analysis of German Formula 1 Grand Prix (Schreyer and Torgler, 2018); the study of professional cycling broadcasts for the three major races in Europe (Vuelta, Giro, and Tour) by Rodríguez *et al.* (2015), or those by Van Reeth for the Tour de France (2013, 2018); the analysis of audience shares of tennis games broadcast in German television by Konjer, Meier and Wedeking (2017); or that of the prevalence of surprise effect over suspense in Wimbledon by Bizzozero, Flepp and Frank (2006) are worth mentioning.

there exist differences between continents as far as consumer behavior is concerned: American viewers prefer watching games with closer outcomes, whereas Europeans show greater risk aversion. Moreover, empirical results do not always match when stadium attendance and audiovisual demand are jointly analyzed, some studies concluding that stadium attendees want to see their team winning, while television viewers prefer games with greater uncertainty of outcome (Buraimo and Simmons, 2009, for Spanish football league; Cox, 2015, for Premier League; or Schreyer, Schmidt and Torgler, 2017, for German football).[6]

As summarized in the literature reviews carried out by Coates, Humphreys and Zhou (2014), Cox (2015) and Budzinsky and Pawlowski (2017) for different professional sports, or by Pawlowski (2014), Schreyer, Schmidt and Torgler, (2016), and Nalbantis and Pawlowski (2017) for European and international football, research shows that factors other than uncertainty of outcome are probably more important for determining audiences, such as direct rivalry, ex ante appeal of the sporting event, game progress, table standings of both teams before the match, quality of the game, or consumption habits of viewers. García and Rodríguez (2002) had already analyzed the importance of each group of variables as attendance determinants, having concluded that variables related to *ex ante* quality of opposing teams were the most relevant, whereas uncertainty of outcome was less important than opportunity cost-related variables. In this sense, authors such as Humphreys and Zhou (2015), Skrok (2016), Budzinski and Pawlowski (2017), Humphreys and Pérez (2017), Brown and Salaga (2018) or Pawlowski, Nalbantis and Coates (2018) underline the lack of empirical support for the uncertainty-of-outcome hypothesis.

Just as with analysis of stadium attendance, in studies on audiovisual demand there is a turning point after publication of the theoretical model designed by Coates, Humphreys and Zhou (2014), based on a previous contribution of Card and Dahl (2011). The decision to attend sporting events is substantiated through a model of consumer choice in turn based on utility maximization, which depends on two components: the usual one based on product consumption and a second one that may be positive or negative depending on game outcome as compared with outcome expected ex ante by the consumer, which allows for introduction of uncertainty (of outcome) in the model. Its predictions render some seemingly contradictory empirical evidences consistent within the framework of the proposed model. Assumptions initially

[6] The lack of unanimity in research has not so far prevented most sporting authorities from pursuing greater competitive balance (aggregate version of uncertainty of outcome) in their interventions. This goal is not always achieved, as shown by the recent study of Carreras and García (2018), who conclude that changes in the television rights revenue distribution system both in LaLiga and the Premier League do not support the aim of reducing financial inequalities in absolute terms (though they do in relative terms), which is what actually contributes to greater competitive balance.

accepted in literature whereby uncertainty of outcome increases the appeal of the game for consumers are verified in the model, provided that marginal utility of an unexpected win is equal to or exceeds that of an unexpected loss. On the contrary, when the latter exceeds the marginal utility of an unexpected win (risk aversion), attendance increases the lower the degree of uncertainty of outcome. This explains why consumers affected by loss aversion prefer to see their team playing against far superior or far inferior opponents over uncertainty of outcome. As pointed out by the authors, the model analyzes the decision to attend a specific live game, and findings might be different when attendance to all season games is observed, or else if the possibility of attendees supporting either the local or the visiting team is considered. Likewise, behavioral patterns might differ if, instead of analyzing stadium attendance according to the model, television audiences are examined through other means. The latter considerations could also help explaining the heterogeneity of findings on the effects of uncertainty of outcome.

According to Pawlowski, Nalbantis and Coates (2018), the model proposed by Coates *et al.* (2014) is one of the three approaches from the perspective of behavioral economics intended to explain the contradictory findings obtained when applying the uncertainty-of-outcome hypothesis to demand in professional sports. The second approach is based on the existing differences between objectively measured uncertainty and uncertainty as perceived by supporters, which could translate into differences in the effects on demand. The authors propose measuring suspense perception by fans in a game on the basis of their answers to a question about this aspect provided in a questionnaire, arguing that such perception may approximate perceptions of uncertainty of outcome both in a game and in a competition (the league), and even the quality of opposing teams. A seeming limitation of this measure of perceived suspense lies in the difficulty to identify what is actually measured, as well as in the inaccurate definition of the word “suspense”, which consequently affects the interpretation of the concept made by each fan when answering the question. Last, the third approach from the perspective of behavioral economics distinguishes three different effects of uncertainty of outcome corresponding to three kinds of attendee, namely, local team supporter, visiting team supporter, and neutral spectator, on the basis of findings obtained in previous empirical works, like that of Schreyer, Schmidt and Torgler (2016).[7]

The empirical analysis of Pawlowski, Nalbantis and Coates (2018) attempts to simultaneously consider these three approaches when analyzing the decision

[7] Cairns, Jennett and Sloane (1986) propose different formulations of what can be understood by uncertainty of outcome, with different implications regarding measures to be implemented in accordance with the significance of the effects considered in each of them. Thus, they address uncertainty of outcome in a single game and in a season, as well as the absence of long-term dominance of a team.

to watch the game on television made by individuals who have little interest in the sport subject to analysis (football). The specified model includes variables relative to the degree of perceived suspense in a match and the subjective perception of win probability for the local team (quadratic profile), as well as interactions with dummy variables representing each fan status (local, visiting, neutral). Regarding the effects of perceived game uncertainty, evidence is similar to that shown in previous studies using objective measures for uncertainty based on information from sports betting. Uncertainty of outcome has the opposite effect to that conventionally expected, a finding consistent with the considerations by Coates, Humphreys and Zhou (2014) regarding risk-aversion of fans. On the other hand, significant effects of both perceived suspense and perceived game uncertainty are identified. Finally, no significant impact of fan status on both perceived game uncertainty and perceived suspense is observed.

As aforementioned, this novel contribution distinguishing between suspense and uncertainty of outcome has the drawback of being inaccurate and the concepts used subject to different interpretations, with its implications for measurement procedures. Ely, Frankel and Kamenica (2015) include the concept of suspense, as well as that of surprise, as relevant elements of the utility generated by certain activities, particularly entertainment activities, which obviously include attendance at live sporting events and their enjoyment through media (television, radio, internet). Suspense is a forward-looking concept related to the curiosity experienced by individuals when a given uncertainty is about to be resolved, uncertainty having a clear impact on the probability of a certain situation occurring, which might therefore substantially change if such uncertainty is resolved one way or the other. Thus, the final minutes of Champions League games generate quite different suspense levels depending on the result at that moment: a 3-0 lead situation hardly generates any suspense, while a 0-0 score does indeed. On the other hand, surprise is a concept associated with a change of mind about what might happen in the future when a certain event occurs. Thus, the fact of scoring a goal in a tight game significantly changes the probability of a certain outcome. As pointed out by Ely, Frankel and Kamenica (2015), suspense is experienced ex ante and surprise is experienced ex post. Furthermore, the authors consider football and basketball to be the most suitable sports for providing optimal levels of suspense and surprise, respectively, as a result of the few and many points awarded according to their scoring systems.

Two applications of the model proposed by Ely, Frankel and Kamenica (2015) to sport are noteworthy. In chronological order, Bizzozero, Flepp and Frank (2016) use television audiences measured by the minute on a sample of Wimbledon tennis championships games to estimate a model in which suspense and surprise are explanatory factors for audiences, having obtained significant effects for both variables, which grow over time, surprise effect slightly prevailing over suspense effect. Findings of this study may be illustrative of how certain changes in the rules of the game might affect audiences, and of how the programming and sale of television advertising spaces can be more efficient when taking account of the peak moments in terms of suspense or surprise.

The second noteworthy study is that of Buraimo *et al.* (2019), who analyze the effects of suspense and surprise on television audiences by the minute on a sample of Premier League football games. The authors also observe significant effects of both variables on audience levels. It should be noted that this work includes a third relevant element in entertainment-related activities: shock. This concept refers to change in the probability of an outcome with respect to that estimated before the game. In their empirical work, this variable has no significant effect on audience levels, though its rate of change by the minute does have an effect.

III. ANALYSIS OF FOOTBALL STADIUM ATTENDANCE IN SPAIN: A NEW APPROACH

The relevant role played by Spanish football clubs in the European scene, as attested by the facts that four of them rank among the top ten in UEFA ranking, that two out of the three clubs with higher revenue in Europe are Spanish (Deloitte, 2018), and that Spanish clubs have won nine times the UEFA Champions League and nine times the UEFA Europa League (formerly UEFA Cup) so far in the 21st Century, provides reason for examining demand for live professional shows through analysis of stadium attendance in the First Division of the Spanish football league. This furthermore enables to update previous estimates for Spanish football made on the basis of data from the 1990s (García and Rodríguez, 2000 and 2013).

1. Data and Variables

Information used for the analysis conducted in this section corresponds to 1,124 games of the Spanish First Division played in seasons 2007-2008 through 2009-2010.[8] Our aim is to analyze determinants of stadium attendance by considering the kind of variables affecting such demand, since each match is different and, consequently, its peculiar characteristics affect attendance. Five groups of explanatory variables have been distinguished:

[8] Due to a lack of comprehensive information, 16 games out of the 1,140 played in those three seasons had to be disregarded.

- **Economic variables:** Price, income, and size of the market, the latter approximated through capacity of the stadium where each game is played.

- **Quality-related variables:** Talent (approximated through the expenditure budget of clubs playing each match, since spending on sport-related wages and salaries represents a large part of budgets), recent performance record (rank of both clubs in standings), and the visiting club being one of the two with a better performance record in the competition.

- **Uncertainty of outcome-related variables:** Uncertainty as perceived by potential spectators (information on bets), uncertainty resulting from performance record of clubs in the season (standings), and aspects increasing uncertainty other than the aforementioned, such as matches between traditional rivals or the particular relevance of a match for both clubs in order to achieve certain objectives (qualify for Champions League or other European competition, avoid relegation…).

- **Opportunity cost-related variables:** Date of the match, kick off time, and kind of television broadcast.[9]

- **Other variables:** Controls for the season and matchday to which each game corresponds have been introduced.

Specifically, variables used in the different subsequent analyses are the following (expected effect in parentheses for explanatory variables):

- Attendance: The dependent variable is the number of spectators having purchased a ticket (excluding members).

- Ticket price: Average price of tickets sold (receipts/attendance). (-)

- Per capita GDP: Variable at the provincial level. (+)

- Capacity: Stadium capacity. (+)

- Expenditure: Expenditure budgets of both the local and the visiting club. (both +)

[9] In previous studies on Spanish football variables related to weather conditions existing the day of the match were also included. Unavailability of such information has impeded its consideration in the present study, though the lack of correlation between this variable and all other variables of interest allows for guaranteeing consistency of estimates finally considered.

- Visiting team: Two dummy variables that take the value 1 when the visiting team is Barcelona or Real Madrid, respectively. (both +)
- Sum of standings: Sum of standings points of both teams. (-)
- Betting odds ratio: Odds of home win to odds of away win ratio estimated on the basis of payout for bets placed on both the local and the visiting team in a match; data elicited from one of the betting agencies operating in the seasons studied. (?)
- Difference in standings: Variable defined as 20 (number of clubs participating in the competition) minus the absolute value of the difference in standings between both clubs. (?)
- Rivalry: Dummy variable equal to 1 for games that may be labeled as local or historical rivalry matches. (+)
- Chances of qualifying for Champions League: Dummy variable equal to 1 if the local team has chances to participate in UEFA Champions League next season. (+)
- Chances of relegation: Dummy variable equal to 1 if chances are that a team will be relegated. (+)
- Weekend: Dummy variable equal to 1 if the game is played on a weekend. (+)
- Kick off time: Dummy variables for five of the six kick off times established in the seasons studied (17:00, 18:00, 19:00, 20:00, 21:00, 22:00). (?)
- Broadcast on pay TV: Dummy variable equal to 1 for games broadcast by a private channel (Canal+ or pay-per-view). (+)
- Season: Dummy variables for two of the three seasons included in the sample. (?)
- Matchday: Matchday number on which each game is played. (?)

2. Specification of the Functional Form

One of the aspects to which special attention is paid in this section, as opposed to most empirical literature, is the specification of the functional form establishing the relation between the attendance variable and the price variable. For the rest of non-dummy variables, original (not transformed) variables are introduced, and, in the cases of betting odds ratio and matchday, a second-degree polynomial has been used; moreover, a term of interaction between the difference in standings and the sum of standings is included, in order to allow for the effect of the former variable, which relates to uncertainty of outcome, to differ according to the quality of teams (second variable).

Specifically, we have estimated models with the dependent variable (attendance) in its original version or transformed into logarithms and/or the same options for the price variable, a first-degree (linear) or third-degree polynomial possibly being used in both versions.[10] Furthermore, models have been estimated where the Box-Cox transformation (Box and Cox, 1964) has been used for the dependent variable and/or the price variable. This is a transformation frequently used in empirical studies on demand (García, 2017), inasmuch as non transformed variables and those subject to logarithmic transformation are particular cases of the Box-Cox transformation. Specifically, for the dependent variable (y), the transformed variable would be:

$$y(\theta) = \frac{y^{\theta} - 1}{\theta} \qquad when\,\theta \neq 1$$
$$= \ln(y) \qquad when\,\theta = 0$$

where, when θ is equal to 1, it is a case of not transformed variable. We will similarly proceed with the price variable in one of the models, using a transformation parameter λ, different from θ.

Table 1 shows the value for the logarithm of the likelihood function as a measure of the explanatory power of the different models considered (non-nested). The first noteworthy evidence is that models where the dependent variable is not transformed imply quite significantly lower values of the likelihood function (worse explanatory power) than the other models do. On the contrary, differences between models with logarithmic or Box-Cox transformation are not so substantial, though findings of models using the Box-Cox transformation, like that of Akaike, are better in terms of information, due to the fact that parameter θ is significantly different from 0 (logarithmic transformation), values being nevertheless low, under 0.2 in all cases.

Regarding the price explanatory variable, the best results are obtained through third- degree polynomial transformation, though differences are very small with respect to linear polynomial, even if always favorable according to Akaike's criteria. The model applying the Box-Cox transformation to both variables does not offer better results than models which only apply it to the

[10] The choice of a third-degree polynomial owes to the fact that it was the specification used in a previous study on Spanish football (García and Rodríguez, 2002).

TABLE 1

EXPLANATORY POWER OF DIFFERENT MODELS WITH ALTERNATIVE FUNCTIONAL FORMS

Attendance	*Price*	*Functional form*	*log L*	*θ*	*λ*
Original	Logarithm	Linear	-10319.7	--	--
Original	Logarithm	3rd degree polynomial	-10314.2	--	--
Original	Logarithm	Linear	-10332.4	--	--
Original	Logarithm	3rd degree polynomial	-10314.1	--	--
Logarithm	Logarithm	Linear	-9400.3	--	--
Logarithm	Original	3rd degree polynomial	-9395.6	--	--
Logarithm	Logarithm	Linear	-9398.3	--	--
Logarithm	Logarithm	3rd degree polynomial	-9394.1	--	--
Box-Cox	Original	Linear	-9343.7	0.199**	--
Box-Cox	Original	3rd degree polynomial	-9339.8	0.197**	--
Box-Cox	Logarithm	Linear	-9345.1	0.192**	--
Box-Cox	Logarithm	3rd degree polynomial	-9337.5	0.198**	--
Box-Cox	Box-Cox		-9342.6	0.194**	0.558*

** $p<0.01$ * $p<0.05$. L log = logarithm of the likelihood function (maximum).

dependent variable while using third-degree polynomials for the price variable, whether original or subject to logarithmic transformation. This is because we do not reject the null hypothesis assigning a value of 1 to parameter λ (linear specification), and value 0 falls outside, though very close to, the 95% confidence interval for that parameter (0.074-1.042). In conclusion, based on Akaike's criteria, that takes account of the value of the likelihood function and the number of parameters to be estimated, the best model would be that applying a Box-Cox transformation to the dependent variable and using a third-degree polynomial for the logarithmic transformation of the price variable.

3. Findings

The next issue to be analyzed is interpretation of the effects of the different explanatory variables. To that end, Table 2 shows findings corresponding to estimates for the model with a better explanatory power according to the evidence provided in Table 1: Box-Cox transformation for the dependent variable and third-degree polynomial for the price variable transformed into logarithms. Findings are presented in terms of marginal effects on the rate of change of the dependent variable: elasticities in the case of quantitative variables and rates of change (in %) if a qualitative variable takes the value 1 with respect to the reference group (value 0). Reported findings are the sample mean of the marginal effects estimated for each match.

TABLE 2

EFFECTS OF EXPLANATORY VARIABLES
Elasticities or rates of change (in percentage)

Economic variables		*Opportunity cost-related variables*	
Average price	-0.71***	Weekend (%)	48.6***
Per capita GDP	0.41***	Kick off time	
Capacity	0.39***	18:00 (%)	26.7**
Quality-related variables		19:00 (%)	15.6*
Expenditure (local)	0.64***	20:00 (%)	3.0
Expenditure (visiting)	0.32***	21:00 (%)	-3.9
Visiting team		22:00 (%)	-1.0
Barcelona (%)	158.2***	Private television (%)	26.7**
Real Madrid (%)	145.3***	*Other variables*	
Sum of standings	-0.16**	Season	
Uncertainty-related variables		2008-2009 (%)	9.1
Betting odds ratio	-0.06**	2009-2010 (%)	19.7***
Difference in standings	0.10**	Matchday	0.62***
Rivalry (%)	65.7***		
Chances of qualifying for CL (local) (%)	11.7		
Chances of relegation (local) (%)	33.5**		

*** $p<0.01$ ** $p<0.05$ * $p<0.10$.

A first conclusion is that all variables show effects with the expected signs. Thus, price elasticity of attendance is -0.71, significantly different from 0 as well as from -1, which would be the case of a unit price elasticity of demand. Such elasticity is similar to that obtained by García and Rodríguez (2002 and 2013) for a log-log model, though it differs from those obtained through a specification based on a third-degree polynomial (higher in absolute value) and when price endogeneity is considered (lower in absolute value). In any case, evidence suggests that behavior of Spanish clubs disregards the profit-maximizing target function, clubs rather aiming at maximizing either chances of winning or else a utility function where profit is one of the arguments, but not the only one.

As for the effect resulting from the quality of teams, it should be noted that attendance elasticity with respect to the expenditure budget of the local team (0.64) doubles that of the visiting team (0.32). Models have been estimated with an alternative measure of talent: the number of players in both the local and the visiting team having played in their national teams. When both kinds of variables (expenditure and number of international players) are simultaneously included, their effect is negative for both teams. When the variable related to the number of international players is used as alternative to the expenditure variable, the value of the log likelihood function is notably lower (-9465.8) than that obtained in our best model.

On the other hand, the presence of Barcelona or Real Madrid as visiting team multiplies attendance by 2.5 on average with respect to games showing identical characteristics with other visiting teams. The sum of standings, as variable recording recent performance of both teams (the higher the value, the worse the performance), has also a positive effect, showing an average elasticity of -0.16.

Uncertainty-related variables show average effects with the expected signs. In the case of betting odds ratio, estimated coefficients for the second-degree polynomial suggest a U-shaped effect where the minimum is just above 7 and average negative effect prevails (-0.06 elasticity), though findings must be interpreted with a degree of caution considering that there are 234 games with a betting odds ratio (probability of the local team winning over probability of the visiting team winning) below 0.9, the effect being opposite to that expected for those bets. On the other hand, there are 78 games whose betting odds ratio is above 7, for which effect on attendance is positive. This might to some extent be a sign of greater preference (and therefore attendance) for uneven matches favorable to the home team, consistently with the arguments based on behavioral economics which were described in the previous section. Moreover, this evidence can be explained as the result of using ratios of original bets, as Peel and Thomas (1992) do, and not adjusted in the way proposed by Forrest and Simmons (2002).

The other variable measuring uncertainty of outcome (absolute value of differences in standings) has the expected average positive effect considering the way in which it is defined. However, given the inclusion of the aforementioned interaction term, effects are positive for certain games but negative for others. Last, noteworthy in this group of variables affecting uncertainty of outcome is the importance of the game being labeled as a rivalry match. In those games, provided identical characteristics, attendance increases by more than 65% with respect to non-rivalry matches.

Effects of opportunity cost-related variables provide especially relevant evidence contributing to the debate on the effects of time and date of fixtures established for LaLiga over the last seasons, which are intended to avoid time coincidences of matches as far as possible and thus favor broadcasting of all of them. Though some games are currently played on Friday or Monday, besides matchdays on weekdays, and schedules provide for noon games both on Saturday and Sunday, findings for the seasons studied suggest a significant impact of the day the game is played on attendance. On average, provided identical characteristics, matches played on weekends entail an increase in attendance close to 50% with respect to games played on weekdays. On the other hand, a significant effect is likewise estimated for kick off times, attendance increasing between 15% and 30% when games begin at 18:00 or 19:00 with respect to other kick off times. For their part, broadcasts on private channels less negatively affect stadium attendance.[11] All this evidence on the effects of opportunity cost-related variables is particularly relevant in the present context, where clubs are to satisfy certain attendance conditions in compliance with regulations for television broadcasting, according to which clubs may be fined if the "television stand", opposite to where the main cameras for broadcasting are placed, does not reach 75% of its seating capacity.

Last, the effect on attendance of the specific matchday in which the game is played is also noteworthy. As aforementioned, we have used a quadratic specification from which a U-shaped effect results, the minimum value being obtained around matchday 15, which translates into an average positive marginal effect, as shown in Table 2. This variable might reflect various effects, such as interest of fans (initial expectation owing to novelty and final expectation for the end of the competition) and the weather conditions effect, a variable not included in this specification since, provided identical characteristics, the highest attendance levels are observed at the beginning and the end of the season, coinciding with the two periods under more favorable weather conditions to attend games.

This approach for analyzing determinants of stadium attendance also enables us to examine the contribution of the different types of variables. To that end, we have re-estimated the model corresponding to Table 2 by suppressing one of the five groups of explanatory variables previously defined and then observing how the value of the log of the likelihood function changes considering the number of parameters not being estimated after excluding the group they belong to. To a certain extent, it is an alternative way of looking at the findings of a likelihood ratio test for the significance of each group of coefficients for each group of variables. Results of this exercise are shown in Table 3.

Evidently, game quality-related variables (talent and recent performance record) are those most sharply reducing the value of the log of the likelihood function when excluded (greater explanatory power). Variables approximating talent in teams, particularly expenditure budgets, are those contributing most

[11] It should be noted that in those seasons games were broadcast either by La Sexta and/or regional channels on a free-to-air broadcasting basis, or else by Canal+ or on pay-per-view.

TABLE 3

COMPARISON OF THE EXPLANATORY POWER OF EACH GROUP OF VARIABLES

Model	*log L*	*No. of parameters*
Final model	-9337.5	30
Without economic variables	-9453.1	25
Without quality-related variables	-9558.7	24
Without uncertainty-related variables	-9348.8	24
Without opportunity cost-related variables	-9359.6	23
Without other variables	-9359.1	26

to such reduction after exclusion. The second group in terms of explanatory ability is that of economic variables, while exclusion of each of the three other groups does not significantly reduce the value of the likelihood function as compared to the ultimately specified model.

Especially noteworthy is the relatively low explanatory power of variables intended to measure the effect of uncertainty of outcome, which is moreover somewhat inconsistent with expectations, as aforementioned. This evidence is in line with the most recent position adopted in the debate on the importance of quality or of uncertainty of outcome for demand (attendance or audience) of professional sports. As aforementioned, some recent works suggest that interest of fans in attending games is triggered by aspects associated with the talent of players from both opposing teams, by probability of their team winning or by intensity of competition rather than by uncertainty of outcome (Pawlowski and Anders, 2012; Scelles *et al.,* 2013; Buraimo and Simmons, 2015; Scelles, 2017). In fact, this kind of findings were already highlighted in the analysis of Spanish football conducted by García and Rodríguez (2002), who opted for an approach similar to that adopted for the present study in the framework of a regression model.

4. Detailed Analysis of Marginal Effects

If marginal effects for the different models considered in Table 1 are calculated, their averages (very similar in all cases) could seemingly suggest that model specification, as regards its functional form, is not particularly relevant for estimating the effects of the different explanatory variables. However, it should be noted that these marginal effects are usually not the same for all individuals and differ depending on the model considered. Ultimately, the mean is a statistic which does not completely and thoroughly describe distribution characteristics.

Table 4 shows some descriptive statistics of the distribution of marginal effects estimated for each game for some explanatory variables on the basis of the specification chosen. As opposed to the model with constant elasticity (attendance and price variables transformed into logarithms and -0.69 elasticity), standard deviation and maximum and minimum values provide an illustration of the great variability of marginal effects, which range from high attendance elasticity as compared with that of price (values in some cases far above -1) to virtually inelastic situations (elasticity close to 0).

TABLE 4

ESCRIPTIVE STATISTIC OF MARGINAL EFFECTS DEPENDING ON THE ESTIMATED MODEL

	Average	*SD*	*Minimum*	*Maximum*
Price	-0.71	0.28	-3.45	-0.31
Matchday	0.62	0.87	-0.25	3.20
Pay TV	26.7	5.7	12.5	50.5

The case of the effects of the matchday variable is relevant to illustrate how average of marginal effects might provide a limited perspective of effects, which, according to the circumstances, can be positive or negative, as is the case of a quadratic specification. Furthermore, average does not allow for highlighting extreme marginal effects, like those which would be observed in this case towards the end of the season, with elasticities above 3.

The case of the marginal effects of broadcasts on pay TV enables to illustrate how average effects provide a limited view of the effects of an explanatory variable in the presence of non-linearities, as well as of qualitative variables. Thus, marginal effects measured in terms of attendance variation rate are not the same for all matches, given the Box-Cox transformation applied to the dependent variable, as opposed to what would happen if it were transformed into logarithms. Noteworthy is the wide range of variation of such effects (between 12% and 50%) in comparison with average effect (26,7%).

Variability of marginal effects is an additional information source particularly relevant for addressing effects of the different explanatory variables, an information that is worth using with greater detail in some cases through more exhaustive statistical analyses. Such detailed analysis of the marginal effects of a given variable can be extended not only in terms of univariate characterization, but also by relating to other variables and taking account of that relation not only in terms of conditional expected value (regression model), but also in terms of conditional distribution (quantile regression).

Table 5 shows findings exemplifying this kind of conditional analysis of the marginal effects of price, based on the local team, the season, the matchday and the fact of the game being broadcast on a pay channel, and using a regression model (OLS) or quantile regressions corresponding to the first decile (Q10), the first quartile (Q25), the median (Q50), the third quartile (Q75), and the ninth decile (Q90).

TABLE 5

ESTIMATES FOR EXPLANATORY MODELS OF PRICE ELASTICITY

	OLS	*Q10*	*Q25*	*Q50*	*Q75*	*Q90*
Team						
Barcelona	0.034	-0.030	-0.064	-0.008	0.051*	0.092**
Málaga	-0.298***	-1.025***	-0.162*	-0.075*	-0.111***	-0.177***
Murcia	-0.497***	-0.902***	-0.660***	-0.421***	-0.458***	-0.479***
Valencia	0.150***	0.220	0.209***	0.164***	0.128***	0.058
Season						
2008-2009	0.021	0.019	0.002	-0.005	-0.021*	-0.015
2009-2010	-0.066***	-0.128**	-0.103***	-0.071***	-0.059***	-0.021
Matchday	0.002**	0.000	0.001	0.001	0.001***	0.002***
Pay TV	0.068***	0.159**	0.091**	0.074***	0.041***	0.008
(Pseudo) R2	0.271	0.226	0.225	0.208	0.186	0.173

Thus, the fact of a game being broadcast on a pay channel, provided that all other variables are fixed, increases price elasticity (reduces it in absolute value) by 0.068 with respect to free-to-air broadcasting, according to estimate of the regression model. That is to say, attendance response to price changes increases. Now, if we examine conditional distribution, the effect is decreasing as we move towards the upper part of elasticities distribution, becoming non-significant and not affecting the elasticity value for the ninth decile. Otherwise said, in games with high inelastic conditional response, such response is unaffected by the fact that the game is broadcasted on a pay channel.

In the case of the matchday-related variable, the effect is positive (lower absolute value) but growing along distribution, being non-significant in its first half. As matchdays go by, responses become even more inelastic in the upper part of conditional distribution. Regarding seasons, while no significant differences are observed both in terms of expected value and along distribution between seasons 2007-2008 and 2008-2009, differences are indeed observed between seasons 2009-2010 and 2007-2008, the former showing lower average elasticities (high in absolute value) but also a clearly growing pattern along distribution, though no significant differences between both seasons are to be found in upper part of the distribution (Q90).

Significant differences in elasticity are also observed according to which team plays as local. Table 5 only includes estimates for teams whose coefficients were either the highest or the lowest in the upper (Q90) or the lower (Q10) part of conditional distribution, though all First Division clubs in the seasons examined are included. The reference category for interpreting the estimated coefficients is Real Madrid. Málaga and Murcia show negative coefficients not only on average but also throughout distribution, which implies that elasticities are lower (higher in absolute value) as compared to those found for Real Madrid. That is to say, attendance at games played by those clubs is more elastic than in the case of Real Madrid, though such effect is reduced as we progress along conditional distribution. This growing effect along distribution is also observed in the case of Barcelona, though positive coefficients are indicative of elasticities higher (lower in absolute value) than those shown by Real Madrid, that is, of a less elastic attendance, the finding being nevertheless only significant in the upper part of distribution. Last, in the case of Valencia elasticities are significantly higher (lower in absolute value) than those shown by Real Madrid, both on average and along most of distribution, though this positive effect is reduced as we move along conditional distribution.

This simple exercise of thorough use of marginal effects when they are different for each individual shows the potential of this kind of analysis, while suggesting that evidence based on average marginal effects needs to be cautiously considered in order to draw conclusions that generally apply to the total population studied, in our case to all clubs.

IV. AUDIOVISUAL DEMAND FOR GAMES PLAYED BY SPAIN NATIONAL FOOTBALL TEAM

Most professional sports events have many more television viewers than spectators at the stadium. Therefore, live sporting events broadcasts have great impact on television audiences in all countries. In Spain, live football broadcasts are one of the most valuable products for the commercial strategy of audiovisual operators. In recent years, the television programs with most viewers have always been football games broadcasts.[12] At the European level, the relation between football and television is increasingly intense because revenues from the sale

[12] In 2018, out of the fifty most viewed television programs in Spain, 48 were football games (World Cup Russia, Champions League, Europa League, and Copa del Rey), with audiences of between 5 and 14 million spectators and shares above 50% in some cases (Barlovento Comunicaciones, 2019).

of television rights for football clubs and federations considerably exceed those obtained from tickets and season passes sales.

Although audience share figures are only available after games are broadcast, to know which variables might determine the size of the audience is a key factor for setting advertising fees and assessing the impact of sponsorships or the future sale of broadcasting rights. Thus, audiovisual demand for live sporting events is next addressed in this section by analyzing audiences of Spain national football team games broadcast over the past fifteen years.

As aforementioned, determinants of the television audience of a live sporting event might differ from those of stadium attendance. For instance, the cost of sitting in front of the television set is much lower for demanders than that of attending a game at the stadium, even if it is broadcasted on a pay-per-view channel. Moreover, for television audiences there are no restraints resulting from supply capacity. Another differential aspect is the type of consumer: while local fans interested in seeing their team winning prevail at stadium, viewers are a priori more likely to be neutral and prefer games entailing grater uncertainty of outcome.

193 matches played by the Spain national football team were broadcasted free-to-air between June 2004 and November 2018. Games were of varying sporting relevance: 40% were friendly matches, 36% were qualifying, and the remaining 24% were matches played in the final stages of international championships. In the present empirical work, the dependent variable used is the size of the average audience[13] of games, measured in thousands of viewers.[14]

Besides its distinct features as an audiovisual product (not limited by capacity of or distance to stadium, unaffected by travel time spending and admission cost…), demand for games played by a national team shows other singularities. Thus, the number of matches played per year by a national team is much smaller than that played by teams participating in their national leagues,

[13] The dependent variable may be measured in absolute (number of viewers) or relative (share or rating) terms. However, it should be noted that audience shares sometimes include the effects of opportunity cost, for instance resulting from program hours or weather conditions (Schreyer, Schmidt and Torgler, 2016). Thus, two games may have equal shares but different number of viewers. An example to be found in our study sample would be the qualifying match for the World Cup in South Africa between Armenia and Spain, whose kick off time was 6:00 p.m. Average audience was 3,157 thousand viewers, while audience share was 33%, a percentage equal to that reached in the friendly match between Spain and Colombia, broadcast in prime time and having more than doubled the number of viewers (6,720 thousand).

[14] Data on audiences are elicited by estimating the preferences of about 12,000 individuals over four years of age through people meters hooked up to tv sets in approximately 4,625 households. One bias of this measurement procedure (conducted by Kantar Media) is failure to include viewers who do not watch the game at home but elsewhere (bars, hotels, restaurants…), a quite usual practice in Spain.

and both regularity and qualifying implications (friendly matches, qualifying rounds and final stages of international competitions) are quite different to those usual in competitions between clubs, either at the national (leagues) or the international (Champions League, Europa League) level. All of this reduces the number of observations per year, whose distinct characteristics furthermore differ from those made in other studies on demand for television broadcast of sporting events. In the case of national teams, potential demand includes the total population of a country (it is most likely that almost all viewers are "fans" of the same team). This causes a "patriotic" identification effect, adding "social" viewers to the usual amount of football fans, especially in decisive matches and the final stages of championships. This feature is favored by the fact that Spanish regulations deem of general interest official matches played by the national football team, thus imposing their free-to-air broadcast.[15] That is, consumers do not pay to watch the game and television networks do not need to choose among several matches for broadcasting, as is the case of national leagues, where multiple games are played at the same time, which might lead to a selection bias in both supply and demand.

The purpose of this empirical analysis is to study which factors have greater impact on audiovisual demand for football games played by Spain national football team. To that end, explanatory variables are grouped according to the factor they help appraising, namely, consumption preferences or habits, game quality, sporting relevance, uncertainty of outcome, and opportunity cost (day of the week, kick off time, or season of the year).

Consumption habits or preferences of viewers are approximated by means of three variables: average number of viewers for the 3 preceding games (previous games audience), aimed at evaluating if past audiences have any carry-out effect on present audience; days where the national team does not play (days without national team), aimed at verifying if viewers' interest increases as competition progresses or when games are played more often; and last, the dummy variable playing in Spain, aimed at appraising if matches played in Spain enable media to create increased expectation in the preceding days that might translate into an increase in the number of viewers.

A key element in sports economics, as pointed out when addressing the preceding model, is **game quality**, which is approximated by measuring quality

[15] Audiovisual Communication General Act No. 7/2010 of 31 March. Formerly, according to the Competitions and Sporting Events Broadcasting and Live Broadcasting Act No. 21/1997 of 3 July, sporting events of general interest were established for each season. In this spirit, in July 2013 the Court of Justice of the European Union dismissed an appeal brought by UEFA and FIFA concerning broadcasting rights for FIFA World Cup and UEFA European Championship, allowing governments to impose free-to-air broadcasts of the final stages matches from both competitions (Court of Justice of the European Union. Judgements in cases C-201/11P, C-204/11P and C-205/11P, UEFA and FIFA vs. Commission, 2013).

of both opposing national teams. Variables included are: National team caps,[16] measuring the number of international matches played by the currently capped footballers, and the opponent's reputation variable, a dummy variable recording whether rivals are national teams of recognized standing, such as France, England, Italy, Germany, the Netherlands, Brazil and Argentina.[17] Data for these variables were elicited from RFEF (Spanish football federation), FIFA, and UEFA web pages.

In order to appraise the **SPORTING RELEVANCE** or relative importance of games played by the national team, based on the assumption that viewers increase as competition progresses, games are classified as friendly (reference group), qualifying for international competitions (World Cup, European Championships…), corresponding to earlier rounds and round of 16 of international competitions, and to quarter-finals, semi-finals*, and finals.* It is moreover verified if broadcast of a *decisive match* is also key in terms of audience, considering as such matches determining if a team advances to the next round in a competition. Out of the 193 games played by Spain national team and broadcast on television throughout the 15 years examined, 38 were decisive. Among them, 18 were round of 16, quarter-finals, semi-finals, and finals matches, in which both effects concur.

One distinct feature of demand for live sporting events is that consumption entails decision-making over a product the outcome of which remains uncertain, being therefore essential to verify if greater similitude in the performance potential of both national teams positively affects consumption, which would in turn help verifying the uncertainty-of-outcome hypothesis (UOH), so often tested in sport economics. Given that in literature there is no single variable reflecting the different aspects that might affect **UNCERTAINTY OF OUTCOME**, its impact is approximated by means of different variables that give rise to five models: win probability for Spain,[18] draw probability, differences in win probabilities for both national teams, Theil index, and a last model including dummy variables that group Spain's win probability in sections.

The closer Spain's win probability is to 50%, the more even is the match expected to be. Therefore, if uncertainty-of-outcome hypothesis comes true, such games should have greater audience. In order to appraise this effect more

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[16] Defined following Feddersen and Rott (2011).

[17] The reputation variable might also reflect rivalry, since national teams of countries geographically close to Spain with which a certain rivalry exists are mostly reputed opponents. This is why we have opted for exclusion of rivalry in this empirical work, since its inclusion would suppress the significance of both variables.

[18] Probabilities are estimated on the basis of data from Oddsportal website.

accurately, the possibility of viewers' preferences being asymmetrical is also considered, which in turn implies that the relation between game outcome and demand might vary depending on whether a win or a loss is expected.[19] In order to allow for such flexibility, a set of dummy variables representing seven levels of win probability for Spain, is included, ranging from values below 0.335 in the first band to 0.906 in the last one. An asymmetrical behavior of demand would imply that not all regression coefficients are significant.

As aforementioned, in audiovisual demand many consumers have no a priori preference for a local win, or else they are neutral; thus, two additional uncertainty-of-outcome-related proxy variables are draw probability and absolute difference in win probability for both opposing national teams. A preference for tighter games will result in a positive relationship between audience and the former variable, though negative between audience and the latter, since the closer its value is to 0, the greater the uncertainty.

When estimating differences in win probability for both opposing national teams, it is implicitly assumed that draw probability remains constant. In order to include variation in draw probability together with win probabilities for both teams in estimates, a Theil index (Buraimo and Simmons, 2008, 2015) is included as measure of uncertainty of outcome encompassing probabilities (P_i) of the three possible outcomes: Spain's win, draw, or opponent's win.

$$\text{Theil} = \sum_{i=1}^{3} \left(P_i \times \ln\left(\frac{1}{P_i}\right)\right).$$

If viewers prefer matches between teams with similar sporting performance potential, the index will be positively associated with demand, and maximum uncertainty of outcome will occur when odds for home win, away win, and draw are equal (33% each), which would result in a Theil index of 1.1. On the other hand, in a context of full certainty (win probability of 99% for one of the national teams), index would be close to 0. An increase in this measure is therefore associated with an increase in uncertainty of outcome (in our analysis average Theil index is 0.81, minimum is 0.18, and maximum is 1.1).

Last, the **OPPORTUNITY COST** of "sitting in front of the TV" varies depending on whether games are broadcast on a *weekend* or not, on the *season of the year* (*a priori,* audiences should increase in winter), or on the kick off time, distinguishing between three non-homogeneous time slots: prime time (21:30 to 23:30), access prime time (20:00 to 21:30), and all other time slots. These variables will be used to control possible unobservable heterogeneities in consumer behavior. Since the present empirical work analyzes national audience,

[19] Coates and Humphreys (2012), and Cox (2015).

additional factors such as the size of the market are similar for all games and therefore not included in the model.

Before addressing adjustment of audience behavior models, and given that uncertainty of outcome is going to be approximated by means of different variables, we conduct a nonparametric analysis graphically displaying local adjustment between audiovisual demand (D_{TV}) and each of the variables used

FIGURE 1

NONPARAMETRIC ANALYSIS. AUDIOVISUAL DEMAND

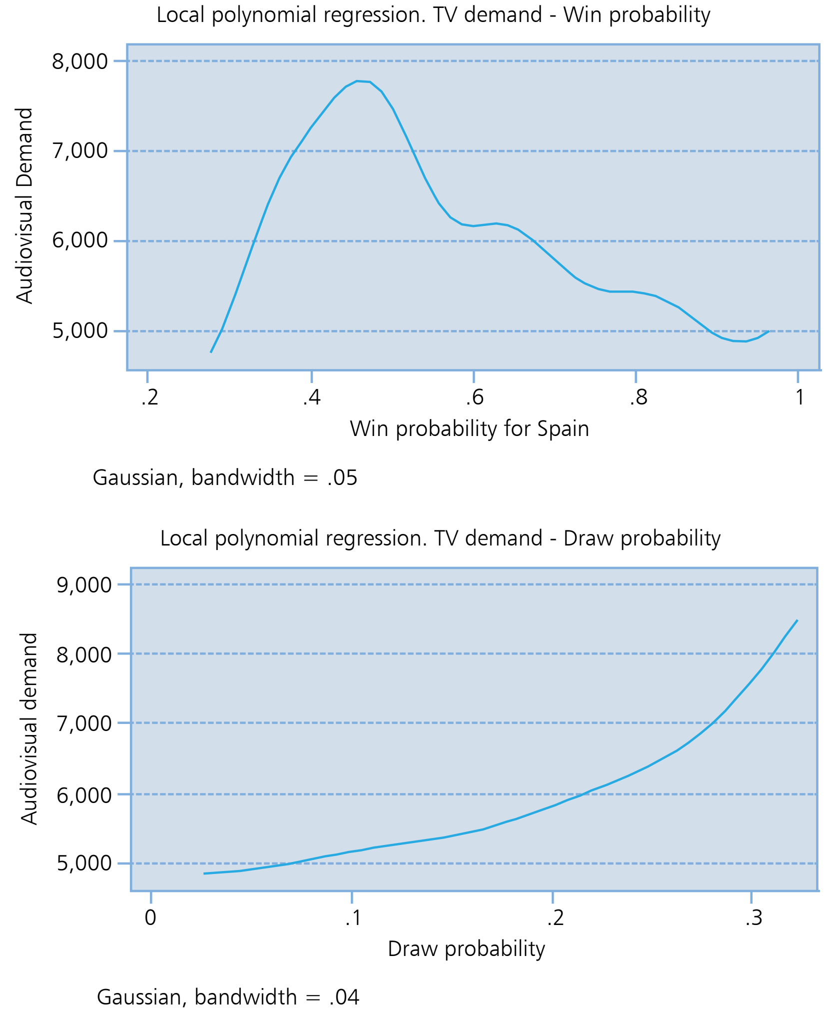
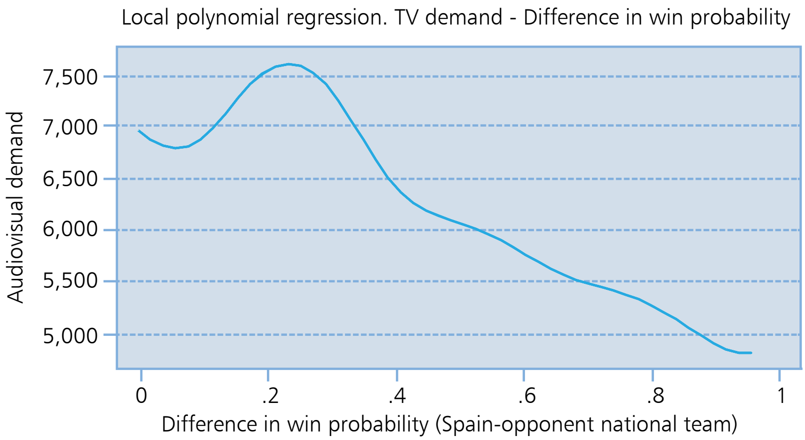
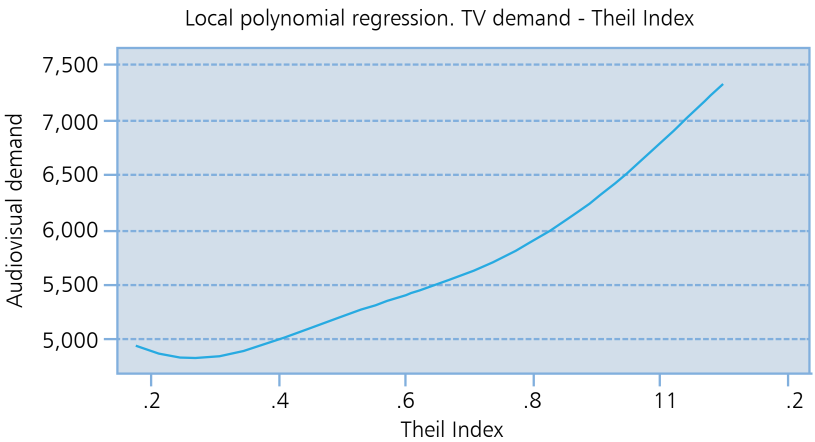


FIGURE 1 *(continued)*

NONPARAMETRIC ANALYSIS. AUDIOVISUAL DEMAND



Gaussian, bandwidth = .09



Gaussian, bandwidth = .16

to approximate uncertain outcome. In these nonparametric estimations, the linearity hypothesis is substituted by the smoothing hypothesis, thus allowing for data themselves to define the functional form of s (), as shown in Figure 1.

$$D_{TV} = s\ (uncertainty\ of\ outcome) + \varepsilon_i$$

Figures suggest a positive relationship between uncertainty of outcome and audiovisual demand. For instance, each point in the first figure adjusts or predicts DTV data by attributing greater weight to observations close to or in the range of the corresponding win probability for Spain. This nonparametric approach enables to graphically observe the relationship trend between both variables. The largest audiences are achieved when uncertainty of outcome is greater and win probability is in the range of 0.5. As probability moves away from that figure, audience shares decrease, whether Spain has a higher ex ante win probability or not. The same conclusion can be drawn from adjustment to the rest of variables measuring uncertainty: the higher the draw probability, the higher the demand; greater difference in win probability entails less viewers; and the more even are both national teams, as reflected by the Theil Index, the greater the uncertainty and the audiovisual demand.

On the basis of the aforementioned explanatory variables, several models of audiovisual demand for Spain national football team are subsequently estimated by OLS, which differ from each other by the variable used to measure uncertainty of outcome.

1. Findings

As can be observed in Table 6, the estimated models have the ability to explain 78% of variation in television demand for matches played by Spain national football team. Coefficients show the expected signs and are consistent with all five regressions.

Variables reflecting sporting relevance and opportunity cost are significant and moreover those most contributing to an increase or decrease in the number of viewers, respectively. Final stages of competitions increase audience by 4-5 million viewers with respect to friendly matches in all models estimated. Decisive matches where continuity in a competition is at stake for Spain national team regularly increase audiences by 1.6 million viewers, an effect which, as aforementioned, is combined with the final stages effect. It is furthermore estimated that matches broadcast on weekends approximately have 450,000 less viewers than those played on Monday or Friday. On the other hand, opportunity cost is lower in winter, when audience increases by 1.5 million viewers with respect to autumn, whereas in summer it is the opposite, probably due to increased leisure and entertainment alternatives; as a result, decrease in viewers may even amount to 1.2 million with respect to autumn. Likewise, the broadcasting time slot is key to attract a larger audience, matches whose kick off time coincides with television prime time possibly reaching 1.8 million additional viewers with respect to all other matches, save for those broadcasted in access prime time.

The three variables representing consumption habits are also significant, but only the carry-out effect caused by matches played in Spain contributes to significantly increasing audience levels, probably owing to the pre-match excitement generated by media (increasing the number of viewers by more than half a million). For its part, a broader international experience of players capped is indeed significant for demand, but no model shows an increase in viewers above 37,000 on account of each additional cap.

Findings show that there is enough empirical evidence to consider reputation of the opponent national team as determinant of audiovisual demand, suggesting that quality of the rival national team is important for followers of Spain national team, as is the case of competitions between clubs, where quality of the visiting team is key in terms of audience (Buraimo and Simmons, 2015).

Regarding uncertainty of outcome, empirical analysis confirms its importance in determining audience success,[20] as well as robustness for any of the variables chosen to measure uncertainty of outcome. If it is approximated through win probability for Spain, regression shows that the greater the odds of Spain winning the match, the lower the number of viewers who will seat in front of the TV: for each percentage point increase in win probability for Spain, the model shows a reduction of approximately 26,000 demanders.[21] Likewise, a greater difference in win probability for both national teams (less uncertainty) reduces audience levels. Thus, according to this proxy variable, the difference between broadcasting an even match (difference in win probability of 5 percentage points) and a very uneven match (60 percentage points) would translate into a difference of almost one million viewers. The draw probability for a match is the proxy variable implying the greatest increase in viewers, for a tiedraw probability increase of over 10% reduces uncertainty of outcome while increasing audience levels by more than half a million viewers.

According to the estimated coefficients for the Theil index (model 4), increase in the number of viewers when figures increase from maximum certainty

[20] A similar empirical support was obtained in previous studies estimating television audience, like those by Forrest, Simmons and Buraimo (2005) on the English Premier League; by García and Rodríguez (2006) on the Spanish LaLiga for seasons 2000 through 2003 (free-to-air broadcast matches); by Buraimo and Simmons (2009) on Spanish First Division for seasons 2003 through 2007 (second half of the season); by Cox (2015) on seasons 2004 through 2012 of the Premier League; by Tainsky and McEvoy (2012) on the NFL, seasons 1991 through 2002; and by Grimshaw and Burwell (2014). However, findings are diverging in other recent studies on demand where consumers show loss aversion or are unaffected by uncertainty, such as those by Buraimo and Simmons (2015), Nalbantis and Pawlowski (2017), Scelles (2017), Humphreys and Pérez (2017), Pérez, Puente and Rodríguez (2017) Pawlowski, Nalbantis and Coates (2018) or Caruso, Addesa and Di Domizio (2019).

[21] The quadratic relation between audiovisual demand and win probability for Spain has been estimated according to recent contributions to literature. Findings lack significance, which suggests that, though nonparametric analysis (Figure 1) shows concavity in the relation between demand and win probability, linear adjustment prevails, since betting agencies predict ex ante that odds of Spain winning the match exceed 45% for over 80% of the games.

TABLE 6

AUDIOVISUAL DEMAND FOR SPAIN NATIONAL FOOTBALL TEAM (thousands o viewers)

	Model 1	*Model 2*	*Model 3*	*Model 4*	*Model 5*
Constant	2178.0***	-648.4	133.5**	-932.7	-397.8
Consumption Habits					
Previous games audiences	0.21***	0.21***	0.21***	0.21***	0.21***
Days without national team	-12.1***	-12.0***	-11.6***	-11.7***	-11.8***
Playing in Spain	676.6**	611.1 **	656.3**	602.6**	596.4**
Game Quality					
Caps	37.6***	36.3***	37.1***	35.7***	34.8***
Reputation	888.2**	1,009.1***		1,048.1***	1,030.0**
Uncertainty of Outcome					
Win probability for Spain (P_{WS})	-2,644.3***				
Draw probability		5,478.9***			
Difference in win probability			-1,699.9***		
Theil index				1,714.4***	
$0.27 < P_{WS} < 0.33$					1,570.6*
$0.33 < P_{WS} < 0.44$					1,427.7**
$0.44 < P_{WS} < 0.56$					1,285.9**
$0.56 < P_{WS} < 0.67$					1,025.5*
$0.67 < P_{WS} < 0.79$					701.4
$0.79 < P_{WS} < 0.90$					685.1
Sporting Relevance					
Qualifying	1,349.8***	1,353.0***	1,339.9***	1363.5***	1,302.7***
1st round and round of 16	4,828.7***	4,727.6***	4,849.3***	4819.8***	4,782.8***
Quarterfinals, semifinals, finals	5,305.5***	5,210.8***	5,303.4***	5260.1***	5,280.2***
Decisive match	1,603.1***	1,628.5***	1,593.8***	1578.5***	1,640.8***
Opportunity Cost					
Weekend	-441.5*	-466.4*	-443.4*	-455.7*	-453.3*
Winter	1,569.9***	1,584.4***	1,582.4***	1,562.4***	1,547.2***
Spring	173.2	167.4	182.1	165.8	152.5
Summer	-1,250.7***	-1,241.1***	-1,235.7***	-1,231.8***	-1,289.5***
Access Prime Time	1,528.2***	1,579.8***	1,527.3***	1596.7***	1,599.0***
Prime Time	1,792.7***	1,822.4***	1,794.7***	1836.2***	1,823.6***
R^2	0.777	0.778	0.780	0.777	0.774
Adjusted R^2	0.757	0.760	0.756	0.757	0.746

****p<0.01; **p<0.05; *p<0.1.*

(Theil index equal to 0.18) to maximum uncertainty of outcome (Theil index equal to 1.1) would amount to almost 1.6 million. Last, if win probabilities for Spain are grouped by intervals, the asymmetrical behavior of demand according to expected outcome of the match based on win probability is also confirmed. If win probability for Spain falls between 30% and 60%, a greater number of viewers is to be expected, provided that all other match characteristics remain unchanged. The effect of win probability for Spain exceeding 70% does not statistically differ from the effect of probability falling under 30%. Estimates also confirm that, regardless of the variable chosen to approximate uncertainty of outcome, viewers of Spain national football team wish to enjoy even matches where a very probable win or loss for Spain is not previously expected.

As in the case of models for attendance demand, once analyzed the significance of variables determining consumer behavior, the contribution of the different types of explanatory variables to audiovisual demand estimated in model 1 is considered.

Findings in Table 7 show how sporting relevance-related variables are those with greater explanatory power of audience behavior in the case of Spain national football team, since, when excluded, there is a much sharp decrease in the value of the log of the likelihood function as compared with all other variables. Game quality-related variables rank third as far as explanatory power is concerned, just below opportunity cost-related variables, while uncertainty of outcome-related variables show the least explanatory power. Thus, although all five models estimated on the basis of data on Spain national team audiences reveal that audience is sensitive to more even matches, thereby confirming the uncertainty-of-outcome hypothesis, analysis by group confirms that uncertainty-related variables are not those most contributing to increase the number of viewers, since it is sporting relevance what enlarges audiences, a fact that could owe to the impact of "social fans", who join the audience on an exceptional

TABLE 7

COMPARISON OF EXPLANATORY POWER OF DIFFERENT VARIABLE GROUPS
(Audiovisual demand)

Model	*Log L*	*No. of parameters*
Final model	-1672.7	16
Model without consumption habits	-1682.6	13
Model without uncertainty of outcome	-1677.3	15
Model without sporting relevance	-1764.2	12
Model without game quality	-1683.6	14
Model without opportunity cost	-1699.6	10

basis, when the opposing national team is particularly reputed or in the final stages of a competition.

5. CONCLUSIONS

The main purpose of this article is to analyze whether in studies on stadium attendance and demand for television broadcasting of sporting events demand determinants are similar or consumer motivations are different. To that end, a thorough review of literature on both kinds of demand is carried out, leading to the conclusion that demanders indeed show different behaviors. The increasing impact of uncertainty of outcome on both types of demand is particularly addressed by means of models based on behavioral economics and by elaborating on analysis based on utility functions of spectators, using concepts only recently applied in sport economics such as suspense, surprise, or shock.

For analysis of stadium attendance demand, explanatory variables have been classified into five groups. Game quality-related variables (talent and recent performance record) show the greatest explanatory power, especially variables approximating talent in teams, and in particular those representing expenditure budgets. The second group in terms of explanatory power is that of economic variables, while exclusion of all other three groups of variables does not significantly decrease the value of the likelihood function as compared with the model finally specified. The relatively low explanatory power of variables aimed at measuring the effect of uncertainty of outcome is particularly worth mentioning. Marginal effects for the different models considered are furthermore calculated, estimates showing significant differences depending on which is the local team playing.

Data on audience shares of Spain national football team matches broadcast over the past fifteen years have been used for analysis of television audiences. Coefficients obtained have the expected signs. Variables reflecting sporting relevance contribute the most to an increase in the number of viewers, whereas opportunity-cost related variables have the opposite effect. The final stages of competitions increase audience in all models by 4-5 million viewers with respect to friendly games. Decisive matches in which continuity of the national team in a competition is at stake regularly increase the number of viewers by 1.6 million, an effect which is combined with the final stages effect. Games broadcast on weekends have less viewers than those played on weekdays. On the other hand, opportunity cost is lower in winter (there are more viewers) than in summer, probably due to the greater number of leisure and entertainment alternatives in the latter season. Last, the broadcasting time slot is key to attract more audience when games are broadcast in prime time.

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BETTING: THE BENEFITS AND RISKS TO SPORT

David FORREST

Levi PÉREZ

Abstract

Online technology has facilitated a huge growth in the scale of sports betting Worldwide and a shift towards betting in-play rather than pre-match. These developments provide benefits and costs to sport. In-play betting is strongly complementary with sports consumption and provides new opportunities for revenue from data sales. At the same time, high liquidity in sports betting markets and enhanced opportunities for match-fixers to make profits in-play raise integrity risk. The paper discusses both the new opportunities for sport from betting and the nature of and reasons for the match-fixing threat and how sports should respond.

Keywords: sports betting, sports integrity, match fixing.

JEL classification: K42, L83, Z20.

I. INTRODUCTION

Throughout its history, organised sport has generated associated betting activity. And throughout its history, this has brought both benefits and costs. The benefits arise because betting is a complementary good to sport. Betting gives spectators the opportunity to take a monetary stake in the outcome of an event, making it matter to them more and therefore taking more excitement from the experience. Interest in the sport generally will be greater as bettors will wish to follow form and news about teams and players in order to inform their wagering. Demand for viewing sport should therefore be enhanced when betting is offered alongside. Sports may also make additional gains by capturing some of the profits that the betting operators earn. However, these various gains in revenue come with costs. Specifically, there is risk that individuals from inside or outside sport will attempt to manipulate the outcome of contests in order to make illicit gains on associated betting markets. Where such manipulation comes to light, there may then be a loss of confidence in the authenticity of the competition. In the limit, this could lead to the collapse of the competition and even to falls in participation by recreational players as, for example, parents come to regard the sport as disreputable and an unsuitable activity to introduce to their children.

The potential gains and risks to sport from betting have always been evident since organised sport as we would recognise it began to develop in the eighteenth century. Vamplew (2007) attributed to gambling a prime role in the development of rules for sports in their early days. For example, cricket was perhaps the first professional team sport which operated across wide geographical areas. That this became feasible could be attributed to the betting which accompanied the sport. As with boxing and golf, the first common rules were drawn up by betting interests who needed to eliminate disputes over the conduct of matches, which could lead to ambiguity over which wagers had been successful. These new common rules promoted the possibility of national and international matches in a sport where every region had previously played its own variant of the game to different sets of rules (Munting, 1996). Thus the very development of cricket was promoted by betting. According to Thorn (1992), baseball, the sport which displaced cricket as the dominant sport in nineteenth-century America, also depended crucially on betting interest for its development. He argued that baseball scarcely merited press coverage until betting houses introduced wagering and promoted it by producing the rich array of statistics with which the sport has been associated ever since.

While the histories of cricket and baseball illustrate that opportunities to gamble may underpin the growth of sports, each also provides more than ample evidence of the pitfalls from sport's link with gambling. Cricket in England in the eighteenth and nineteenth centuries was notoriously subject to betting-related match-fixing: Mitford (1832) avoided professional matches because they were "affairs of bettings and hedgings and cheating." As it developed, baseball was to prove no less susceptible to corruption. A magazine article from 1874 claimed that "There is no sport in which so much fraud prevails as baseball. Any professional team will throw a game if there is money."[1] Through their subsequent histories, both cricket and baseball threw up regular fixing scandals where players contrived to lose at the behest of betting interests, including at the very highest levels of competition- as in baseball's World Series of 1919 and in the cricket international match between South Africa and England in 1990. Betting-related fixing also surfaced regularly in other sports throughout the twentieth century.

While the benefits and costs from betting have been ever-present in organised sport, one of the themes of this paper is that both the benefits and the costs have been magnified in the twenty-first century. The potential revenue for sport from betting has greatly increased and the risk to the integrity of sport has also greatly increased. As in many areas of life, change in this case may be linked to the pervasive influence of the internet. Technology has fostered a huge growth in the volume of betting on sport not only through making betting more accessible but also through enabling new betting products which increase the degree of complementarity between sports and betting. These changes have created opportunities for new revenue streams for sport. At the same time the step change in the liquidity of sports betting markets, allied with liquidity being concentrated in the unregulated sector, has made match-fixing a much more lucrative crime and manipulation of sports events appears to have become more commonplace.

II. DEVELOPMENTS IN SPORTS BETTING

Globally, since the Millennium, there has been remarkable growth in sports betting activity. In 2000, annual GGR (Gross Gaming Revenue– the amount bookmakers win from their clients) from sports betting, defined to exclude bets on horses and dogs, was estimated as 6,000 million euros. The corresponding figure in 2010 was 19,000 million euros (Sport Accord, 2011). By 2016, the estimate was 30,000 million euros (IRIS, 2017). Thus bookmakers' win increased five-fold in sixteen years. Moreover, since intensifying competition was improving odds for bettors throughout these years, allowing them to claim back a higher proportion of their stakes as winnings, sports betting turnover will have increased even faster than that. Important to what follows is that

[1] Cited in Cook (2005).

much of the growth was concentrated in jurisdictions where betting was largely illegal, with China and the United States being the largest markets (IRIS, 2017).

As significant as the growth in overall activity has been the evolution of the sports betting product. In particular, technology has permitted not only ease of access to international providers for those would-be bettors who had hitherto had resort only to illegal street bookmakers or to state monopolists offering unattractive odds but has also enabled betting houses to offer them bets during rather than only before sports events. The new speed of communication allows data on an event (such as every goal scored in a football match or every break of service in a game of tennis) to be transmitted virtually instantly to both the bookmaker and the bettor. Algorithms based on sports forecasting models can then be used by the bookmaker to adjust odds automatically in response to action on the field and these new odds are immediately visible on the computer and mobile 'phone screens of potential clients. In turn, clients can then place a bet in seconds. Moreover clients can now be offered the chance to wager on thousands of events since the whole process is automated and not limited by a need for specialist staff to assess probabilities and adjust odds manually. Consequently the growth of sports betting volumes has been achieved not only by increases in the depth of markets on major sports events but also by the introduction of betting on minor sports events on which betting had previously not been possible (except perhaps through local bookmakers near or at the event).

The popularity of in-play has fuelled the rapid growth of betting volume and it now claims a significant and increasing share of the market. Although definitive aggregate figures are not available, in-play appears to be particularly popular in Asia. For example, one operator reported 90% of betting on basketball was during the match and others had given up on pre-play betting altogether.[2] But even in Europe, in-play appears to account for the bulk of the *online* market. Bet-365, a leading international operator, reported that 80% of its revenue accrued in-play in 2015.[3] In Spain specifically, data for 2017 show that 67% of online sports betting volume, and 57% of sports betting GGR, was generated in-play rather than pre-play (Gómez and Lalanda, 2018).

As channel shift steadily increases the proportion of betting taking place online,[4] in-play becomes the most relevant form of sports betting from the

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2 https://www.reviewjournal.com/sports/betting/in-play-wagering-wave-of-future-at-nevada-sports-books/

3 https://www.online-betting.me.uk/news/bet365-reveal-80-of-sports-betting-revenue-comes-from-live-in-play-betting.html

4 By 2017, GGR from authorised online sports betting in Spain (305 million euros) was approaching that from offline betting (330 million euros) (Gómez and Lalanda, 2018). Given that some online bettors may trade through unauthorised offshore sites, online may even have had a majority of the Spanish sports betting market. It may be noted that sports betting had substantially replaced the football pools *(La Quiniela)*, once very popular but in 2017 yielding only 100 million euros GGR.

perspective of how sports may gain from betting markets and also the form of betting typically used by match fixers when manipulating sports events. Using the in-play markets will also influence *how* criminals seek to manipulate the event.

III. BENEFITS TO SPORT FROM BETTING

1. Complementary Goods

In a general sense it has perhaps always been the case that the sports betting market has generated spillovers advantageous to the sports industry because betting helps maintain the interest of an engaged group of fans who form part of the audience in the stadium or, in more recent times, at home watching television. Formal evidence consistent with this intuitive idea was provided by Salaga and Tainsky (2015). Their paper models how the size of television audience changes during college football games in the USA. They find that audience size is enhanced when the current score is close to the betting spread quoted by bookmakers even if the outcome of the match itself is no longer in doubt. This suggests that significant numbers of viewers continue to watch while and because the outcome of the most popular bet is still uncertain. Similarly, audience size appears to fall when the second-most popular bet, where bettors wager on whether total points will be over or under the bookmaker quote, is already decided by the points total on the field having gone 'over'. Both these findings are consistent with a significant part of the audience being motivated to watch by their engagement with the betting market. Since the value of broadcasting rights depends on television ratings, this points to sports' revenue being directly enhanced by interest in the parallel betting market. And this, note, was in a country where betting was illegal for most of the population.[5]

The study by Salaga and Tainsky (2015) was in a context where pre-play wagering was still dominant. As in-play betting increases its market share, there is greater potential for consumers to maintain their motivation to view the game. New betting offers now continue to be put before prospective bettors even as the game proceeds. For example, in a high scoring match, the benchmark for over/ under bets will be adjusted upwards such that a new bet will still have a

[5] The formal evidence is consistent with survey evidence that betting interest drives audience size for American sports events. A Nielsen Sports study reported that 84% of adults said they are more likely to watch an NFL game that they were previously not interested in when they bet on it, and 77% said placing a wager made games more fun and enjoyable (https://www.americangaming.org/sites/default/files/Nielsen_NFL_Betting.pdf).

very uncertain outcome even if the outcomes of pre-match wagers are already determined. This itself should hold up audience size for sports events and therefore the value of advertising spots and the value of broadcasting rights to the League.

This is just one specific route by which betting may be expected to become more beneficial to sport as a result of it becoming predominantly in-play. More generally, in-play betting allows participants to turn watching a sports match into an interactive experience, where they watch events unfold on screen and respond to these events by placing wagers. Ely, Frankel and Kamenica (2015) identified "suspense" as a key driver of demand for sport and other entertainment industries. The interactive product allows viewers to create suspense for themselves since their wagers allow them to make what happens next matter to them even when the match outcome is in little doubt (and even when they have no particular affinity with either of the teams). To this extent, in-play betting could be thought of as strengthening the complementarity between sport and betting and enabling sports to generate greater revenue even if there is no separate revenue stream headed "betting".

2. Direct Revenue from Betting

Naturally, sports leagues tend not to acknowledge these spillovers flowing from the betting sector to the sports sector. Nor do they even concede a model of mutual dependence of the two industries. Rather, in public pronouncements, they simply represent sport as generating product on which the betting industry can offer wagering opportunities, creating profit for betting operators. Frequently they have lobbied for a "sports right" whereby betting operators would pay a share of this profit to sport. This may be argued to be "fair" or even to be compensation for the costs from match-fixing associated with sports betting, correcting an externality. In an academic contribution, Dietl, and Weingärtner (2014) took this perspective and argued for property rights to be granted to sports organisers as "producing institutions", in contrast to bookmakers whom they termed "exploiters".

In fact, there are precedents for sports organisers to be granted a legal entitlement to a share of bookmaking revenue from their events though necessarily this can be applied only to the legal betting sector. For example, a sports right has been introduced in Australia and, in the special case of horse racing, in Great Britain. Generally the courts have not been sympathetic to sports claiming revenue from bookmakers for use of sports information in the public domain (for example, fixture lists) on grounds of ownership of intellectual property rights and so such arrangements would typically require specific legislation.[6]

On the other hand, sports are unlikely to have to depend on the imposition of what would effectively be a hypothecated tax since they are well placed to create new revenue streams by themselves exploiting betting activity through sales of data to betting houses and via fees for advertising and sponsorship. Indeed British horse racing receives more than twice as much revenue from the betting sector through data sales, advertising and sponsorship of races as it does from the statutory levy of 10% of bookmaker winnings (Frontier Economics, 2014).

For sports other than horse racing,[7] in-play betting in particular offers increased potential for gaining significant revenue from selling data. In-play betting is only possible at all if the bettor is able to watch or follow developments in the game *at the same time* as he or she trades in the betting market. Therefore an essential input to the product is very fast communication of live data from the stadium to the bettor's computer or mobile 'phone. Data here may refer just to information on the event as it progresses (for example, the scoring of each point in a tennis match) and supplementary information relevant to bettors (various metrics from the application of sports analytics); but there is a premium on pictures being streamed (perhaps via bookmaker websites) to the bettor so that he or she can personally view the action to help decide how to bet next.

Sports organisers possess a strong degree of monopoly power in the provision of reliable data/ pictures since they control the venues where the events takes place. Data providers and betting companies may use self-employed "data scouts" but sports bodies are better able to assure continuous and reliable coverage of events. Further, unauthorised data scouts may have to operate under-cover because organisers seek to exclude them from the stadium and they could certainly not access positions from which they could transmit high quality pictures.

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[6] Following a Supreme Court judgement in 2018, which gave American states the right to legalise sports betting within their borders, several have initiated such legislation. Major League Sports have lobbied for the inclusion of a sports right in states' legislation. Initially their demands appear to have been unrealistic as they proposed that sports should be entitled to 1% of betting turnover. This would eliminate one-fifth of bookmaker winnings if odds were set such as to return 95% of stakes to bettors, leaving them with insufficient to cover operating costs. Since this is a typical pay-back ratio in the illegal sector, the new legal industry would probably be unable to be competitive in odds, given that states will also impose their own taxes, and would then be unlikely to displace the currently flourishing black market to any great extent. The naïveté of the proposal was to suggest turnover rather than GGR as the 'tax base'.

[7] Horse racing is less suited to in-play betting than most other sports because many races are of very short duration, creating a level of pressure for bettors which may be unappealing for all except professional traders. The decline of horse race betting relative to sports betting could be linked to its unsuitability for the in-play product.

Over the last couple of years, sports leagues from the most powerful (such as the NBA) to the more niche (such as Gaelic Sports in Ireland) have contracted with specialist firms, or even formed their own (as in English and Scottish football), which purchase their data rights and then sell live coverage and up-to-date metrics directly from the stadium to operators' betting platforms around the World. In 2016, for example, Genius Sports "was selected as exclusive rights holder to distribute the ACB's Data for betting purposes" (The ACB is Spain's basketball league).[8] And in Spanish football, in 2017, La Liga made the Perform Group its data supplier for all its men's and women's competitions.[9]

Sponsorship and advertising represent another potential flow of income from betting to sport. Given that there are overlapping audiences for betting and sport, and given that joint and simultaneous consumption is increasingly common, it is natural that betting companies will seek to win market share by advertising within the theatre of sport itself, either in the stadium or during any telecast.

Restrictions on advertising are in place in many jurisdictions which either prohibit betting or attempt to maintain local monopolies. However, where it can do so legally, sport has proven very ready to forge relationships with the betting industry. In 2006 and 2007, the international operator, Bwin, secured the right to shirt sponsorship at AC Milan and Real Madrid and this set a precedent for betting houses to seek to increase brand awareness by having their names on players' shirts in football clubs across Europe[10] and the practice has since extended to many other sports, such as rugby and e-sports. By 2016, ten of the twenty English Premier League clubs carried the name of a betting operator on their shirt fronts. Hertha Berlin and Valencia were examples of clubs in top-tier Continental European leagues which were sponsored by betting companies; in Australia, the bookmaker Ladbrokes sponsors two National Rugby League clubs, Newcastle Knights and Gold Coast Titans; and Dafabet sponsors the e-sports team, Fnatic. Naming rights for leagues and competitions (for example, the top three tiers of Scottish football, the Snooker World Championship and nearly all professional darts tournaments) and for stadia (Stoke City in English football) have also been acquired by betting companies which are also active in pitch-side advertising (tennis, cricket and other sports).

An interesting development which reflects the Global nature of sports consumption is that there are several instances where betting houses whose

8 https:/ sbcnews.co.uk/retail/2016/10/13/spain-acb-unlocks-data-value-genius-sports/

9 https://sbcnews.co.uk/retail/2017/09/05/laliga-announces-partnership-perform-group-enhance-delivery-competition-data/

10 https://sbcnews.co.uk/features/comment/2018/03/14/scott-longley-short-history-betting-shirt-sponsorship-football-part-1/

customers are in one part of the World have invested in sponsorship and marketing within sports leagues based in other regions. Thus SportPesa, an African operator, sponsors not only the top division in Kenyan football but also the English Premier League club Everton. The Asia-facing Dafabet has sponsored the Welsh Premier League and three English clubs (as well as one of the top players in World snooker). Such operators may aspire to grow into European markets but the main return from their marketing activity is likely to be in their home regions where European sport represents the main subject of betting and where televising of the games enables potential customers to be exposed to the brand. Indeed this may be the only way of bypassing restrictions in jurisdictions where betting is not authorised.

The sums of money involved in these various transactions are relatively minor from the perspective of the major sports leagues. For example, a typical English Premier League sponsorship by a betting company is worth 10 million pounds per season, a small amount relative to broadcasting revenue; and even Formula One's plan to raise 100 million dollars from betting sponsorship over five years from 2019[11] could be seen as small in the context of that particular sport; and of course the gain to any sport from sponsorship by betting is less than the amount of the payments because gain should properly be measured as the difference over prospective income from the next-highest-bidding-sponsor. On the other hand, for minor leagues and minority sports such as darts, sponsorship value outside betting may be negligible since brand owners in other sectors have no strong incentive to engage with relatively small fan groups who do not have a particular propensity to consume their product. For less prosperous sport, then, betting sponsorship may be relatively more important. So too may the value of data sales to be used for betting purposes. For football in smaller countries, data sales may fund much of the national association's activities. In the most recent financial year, the 3 million pounds received by the Scottish Football Association represented 8% of its revenue (and all betting-related income, including from naming rights of its competitions, accounted for about 20%).[12]

The close liaison between the sport and gambling industries has attracted unfavourable attention from the public health lobby, which is concerned that betting may be "normalised" for children and lead subsequently to cases of gambling harm (see, for example, Bunn *et al.,* 2018). This has led to political pressure, which may restrict revenue for sports leagues in future. For example, at the time of writing, the Italian Government has proposed a complete ban on advertising and sponsorship by gambling companies and restrictions are

[11] *Financial Times,* September 18, 2018.

[12] https://www.sundaypost.com/fp/the-numbers-game-how-football-bosses-are-making-millions-selling-the-match-data-used

proposed in Spain, Belgium, Ireland and Great Britain. In our context, focusing on integrity risk, a close relationship with the betting industry may also be problematic. There may be a trade-off between revenue from the betting sector and integrity risk. Where the operator offering sponsorship is based in Asia, the sport could be accused of encouraging the growth of liquidity in effectively unregulated markets, which, as we shall see, could elevate risks of match-fixing. The same applies to data sales and indeed tennis is considering discontinuing data sales for events on the Men's Futures Tour on the grounds that provision of data allows liquid betting markets to develop in an environment where they may then be used by match fixers.[13]

IV. COSTS TO SPORT: BETTING-RELATED MATCH-FIXING

1. A Serious and Growing Threat to Sport

While the very rapid growth of, and innovation in, the sports betting sector present opportunities for sport, these developments have also been associated with what seems to have been a step-change in the extent of corruption. Of course, as noted above, there has been manipulation of events since organised sport began. And not all fixes are betting-related.[14] Nevertheless the frequency of betting-related cases to have come to light in the last decade has been remarkable.[15] Cricket, football and tennis have been most regularly implicated; but problems have emerged in numerous other sports such as badminton, basketball, e-sports, handball, rugby league, sumo wrestling and volleyball. Attempts to fix are likely to be even more numerous than the proven cases imply, even in very high-level sport. In 2018, the International Cricket Council Annual Report[16] revealed that, in the preceding twelve months, five captains of

[13] The recommendation was from an *Independent Review Panel,* set up by the World governing bodies, to examine corruption in the sport. Its Report in 2018 described a 'tsunami' of match-fixing (the Report is available at www.tennisirp.com).

[14] Some fixes may be intended primarily to secure sporting objectives. A particularly common scenario is that of a club seeking to buy a result which could save it from relegation. Recent alleged cases related to relegation issues in football have emerged in Belgium, Italy, Spain, Saudi Arabia and a number of African countries. The problem may have become greater because broadcasting revenue has become disproportionately concentrated in top divisions, implying higher costs than before from falling to a lower division. In end-of-season matches, there may be considerable asymmetry of rewards to winning a match between a relegation-threatened club and one in mid-table with little to play for: consequently 'gains from trade' from the parties agreeing to engage in corrupt manipulation of the match result.

[15] The sceptical reader is invited to refer to the bi-weekly *Integrity in Sport Bulletin,* published by Interpol (https://www.interpol.int/Crime-areas/Crimes-in-sport/Integrity-in-sport), which documents reports on cases from around the World.

[16] https://content.yudu.com/web/4397h/0A43ae0/ICCANNUALREPORT1718/html/index.html?page=4&origin=reader

national teams, four of them in the small elite group of playing countries, had notified the Integrity Unit of "suspicious approaches".

While we know that there has been this torrent of proven cases over the past decade, the prevalence of match-fixing is impossible to quantify with any precision because, as with many crimes, most may never come to light. Nevertheless the application of forensic statistics may give clues as to the scale of the frequency of fixing.

Wolfers (2006) examined the pattern of results in a very large sample of college basketball matches. The probability distribution of results (defined as the number of points by which the favourite beat the bookmaker spread) might be expected to be normal with a mean of zero; but in fact there was an unexpectedly large number of matches where the favourite just failed to beat the spread while still winning the match. Wolfers interpreted this as resulting from the practice of "point-shaving", where the stronger team holds back from winning by as much as it could in order that bettors can win a wager that the team will fail to beat the spread. With this approach, Wolfers' estimate of the proportion of fixed matches in the sample was about 1%.

That sample was historic, extending back decades. But it shows the power of statistics to reveal malpractice (even if Wolfers' paper was open to criticism, such as the evidence being consistent with alternative explanations, for example occasionally teams may just be respecting sportsmanship by avoiding inflicting too heavy a defeat on opponents).

In the present era, the most likely sources for estimates of prevalence of match-fixing are the reports of betting monitoring companies, which offer integrity services to sport.[17] Organisations such as Sportradar and Starlizard monitor odds worldwide to identify anomalies in betting markets and report where there is strong evidence of the pattern indicating a fix. Sportradar monitors betting markets on all UEFA competitions and all matches in the top two divisions of 55 European countries. Typically it reports a little less than 1% of matches as very likely to have been manipulated (Van Rompuy, 2015; Forrest, and McHale, 2015). Starlizard reported having monitored betting markets on 54,757 football matches in 2017 and identified about 0.75% of them as suspicious.[18] These sorts of prevalence-rates indicate that, in-season, there might be around ten fixed matches per week in European leagues covered.

[17] Prospects for identifying particular matches as manipulated from use of sports data alone appears unpromising. There is a great deal of 'noise' in outcomes of sports events (indeed it is part of the appeal of sport that 'anything can happen') and highlighting unexpected occurrences involving underperformance would lead to large numbers of false positives were screens to be based on sports data alone.

[18] https://www.starlizard.com/wp-content/uploads/2018/07/FINAL-Suspicious-Trends-in-Global-Football-Report-2018-v1.4.pdf

And that could be regarded as a lower-bound estimate. In an academic audit of Sportradar's system, Forrest and McHale (2015) judged that matches were classified as likely to have been fixed only on the strongest evidence (specificity of the screen was high) but that the sensitivity of the screen could not easily be evaluated. Some fixes may not have been picked up or the evidence not strong enough to merit the serious decision to "report" the match as manipulated.

While betting may open up enhanced revenue for sport, the threat from fixing to some competitions or even to whole sports might be existential rather than marginal. No doubt, other factors were also at work but the swift demise of pedestrianism (long-distance walking, usually in a stadium), for a time the most popular spectator sport in English speaking countries in the nineteenth century and one attracting considerable betting volume, may be linked to its loss of credibility after numerous fixing scandals (Algeo, 2017). More recently, since the 1990s, several Asian sports leagues have collapsed as a direct result of match fixing activity, which had led to loss of confidence by fans, broadcasters and sponsors (Hill, 2010). Despite the loss of reputation of a number of leagues in Europe, above all perhaps in Italian football, from several extensive fixing networks having been uncovered, no league has so far been forced to close down (or perhaps none has yet reached the tipping-point beyond where this would come about). Nevertheless the competitions affected may still face falls in demand when fixing is revealed, which could lead to lower revenue and have other consequences such as making it difficult to recruit talented players from the international market.

Unfortunately there has been no formal evaluation of whether and to what extent demand is affected by betting-related match-fixing cases. However, Buraimo, Migali and Simmons (2016) modelled attendance at Italian football matches in a period when attendances were in trend decline. They found significantly faster falls in attendance at matches involving clubs which had been sanctioned for attempting to manipulate matches to gain advantage in the Championship (rather than to enable gains on the betting market). Therefore part of the audience appears to have been repelled by these breaches of integrity and this was where clubs were cheating to win. Betting-related fixing normally involves underperformance and conspiring to lose and so may alienate fans even more. However, formal testing of the impact of fixing on demand has yet to be conducted in the way it has been for doping scandals.[19]

[19] Cisyk & Courty (2017) found only short-run impacts on home attendances after revelations of doping scandals involving players in Major League Baseball. Van Reeth (2018) found no impact on next-day television audiences for the Tour de France after major doping stories had broken. The challenge in such studies, as it would be in any future work on match-fixing revelations, arises from the fact that there may already be common knowledge that such practices are taking place and so the publication of a scandal may not affect audience size- this will *already* have been depressed by the loss of spectators or viewers with a distaste for corruption.

2. Why has Fixing Become more Common?

Similar to other types of fraud, fixing sporting events to secure betting gain can involve somewhat petty sums of money at one extreme or millions of euros at the other.[20] For example, players may agree among themselves to lose a match with little sporting importance in order to allow winning bets to be placed by themselves or their family and friends. Often, in Europe at least, such activity will be detected readily as the participants in the fix will likely bet naively in the legal and regulated betting market. An example of such a fix occurred in French handball where some members of the Montpelier club, including the captain of the national team, were convicted of manipulating an end-of-season match. There had been a highly elevated number of bets on the fixture and nearly all of them were placed in the Montpellier region and for Montpellier to lose. In the judicial hearings, it was suggested that the players had hoped to make extra money for their holidays.

At the other extreme, domestic or international organised crime may engage in regular and systematic match-fixing, seeking to influence numerous matches and thereby secure profit in the millions of euros every year. From criminal trials, we know that, in virtually all such cases, and regardless of where the sports event takes place or from which region the criminal groups come, the associated bets will be placed in Asia through betting agents. Markets in Asia have the advantage of high liquidity, allowing large bets to be placed without attracting undue attention, and the further advantage of lack of transparency given weak regulatory supervision (for example, the agency system allows the origin of funds to be hidden and untraceable).

The first example of systematic fixing involving hundreds of matches (in that case in football in thirteen different countries) was the Bochum case, tried in Germany. Among many subsequent examples, the extent of match-fixing networks in Italy has been revealed by the *Calcioscommesse* affair (which has implicated players from clubs across all tiers of Italian football). In these and similar cases, sums of money involved can be very substantial indeed. For example, in *Calcioscommesse*, the prosecutor found that the result of one of the many matches found to have been manipulated had been "purchased" for 600,000 euros, enabling the instigator to win approximately 8 million euros in the Asian over/under market on that match (IRIS, 2017).

While local match-fixing by players has probably been present for a long time, widespread fixing, sometimes across national boundaries, instigated by organised crime as part of its wider portfolio of illicit activities, appears to be a

[20] Of course, either may be damaging to sport if revealed.

more recent phenomenon and one that has contributed heavily to what seems to have been a "tsunami of corruption".[21] To help understand the increase in fixing activity, an economic model is likely to be informative.

Forrest (2012) applied the idea of analysing crime in terms of a market for offences (Ehrlich, 1996) to the particular case of betting-related sports corruption. The supply of fixes comes most commonly from players.[22] The demand for fixes comes mostly from betting syndicates[23] planning on making illicit gains in the betting market.

The supply of fixes will be upward sloping because different players will have different perceived psychic and financial costs from agreeing to participate: for example, players will be heterogeneous in terms of the moral discomfort they would experience and in terms of the financial loss were they detected and suspended from playing (for example veterans may have less future earnings to lose than players in mid-career). In general, one would expect the supply curve to lie further to the right in circumstances where the probability of detection is low, the level of present and expected future earnings is low and the level of grievance against the sport is high.[24]

The position of the demand curve (which is a derived demand) will depend on how much gain can be made in the betting market from organising a fix. This in turn depends on liquidity in the market around a particular event. The greater the liquidity, the greater the size of bet which can be placed without attracting undue attention and without driving odds against the bettor (eroding profit). It also matters whether liquidity is concentrated in regulated or unregulated markets. In a regulated market, investigators will be able to trace bets back to source but in an unregulated market there is little prospect of finding out

[21] The term is borrowed from a Report on tennis referenced in Footnote 3 above.

[22] Other sports insiders such as owners and coaches may also deliver fixes. Sometimes even technical staff have the potential to manipulate outcomes. In English football in the late 1990s, Asian betting interests paid security guards to use a circuit breaker to manufacture floodlight failure when it was advantageous for them to terminate the match (http://www.independent.co.uk/news/uk/crime/the-floodlights-went-out-ndash-and-an-asian-betting-syndicate-raked-in-a-fortune-2066133.html). In 2017, a cricket groundsman was arrested for allegedly accepting money to water the wicket (the strip in the centre of the field where the batsman receives the ball) before an Indian Premier League match. This would be expected to slow the ball as it hits the surface before the batsman's stroke, making it appreciably harder to score runs. Manipulating the game in this way could be exploited in the popular over/ under total runs market (http://www.hindustantimes.com/ipl-2017/ipl-betting-case-how-bookies-fixed-pitches-with-excess-watering-explains-cops/story-VniNvdMWnMDZjrOAyvXqUI.html).

[23] Indian Bookmakers have been involved in several cricket cases. Of course it is obvious that inside knowledge that a particular result is to be manufactured could be exploited on either side of the betting market but it is unclear why only in cricket are fixes typically ordered by bookmakers rather than bettors.

[24] For example, where players are treated badly or wages unpaid. This will plausibly reduce moral scruples over betraying the sport.

who placed nefarious money even in the event that a fix is suspected *ex post.* Demand for fixes will therefore be highest where there is a deep betting market with no effective supervision.

Focusing on the supply side of the market is useful for predicting which competitions and which players present greatest integrity risk. However, it is not obviously useful for understanding why there has been a strong increase in the prevalence of fixing over time because there is no particular reason for suspecting that players collectively have become more willing to accept bribes.

But, while the supply of fixes curve may not have shifted, one has every reason *a priori* to expect the demand for fixes curve to have shifted right, generating a higher equilibrium price and a higher number of fixes. It is already documented in this paper that sports betting volumes have exploded since the Millennium and that a high proportion of activity takes place in unregulated markets and particularly in Asia.

As argued, high liquidity in an unregulated market makes for prospectively high profits from arranging fixes. Reference has already been made to the substantial return from manipulating a high level fixture in the Italian football league. But there is also high liquidity in the betting markets on many low level competitions. Researchers for IRIS (2012) asked betting agents how much could be staked on their behalf (split across Asian operators) on the result of a Belgian second division football game. The consensus answer was 300,000 euros. With this level of liquidity available, fixers could make a betting profit of perhaps up to one million euros from fixing a match and relatively little might need to be paid to players given the low wages at that level of competition.

With liquidity so high now in the Global betting market, and therefore the profits to be made so great, it should not be surprising that organised crime has added fixing to its portfolio of activities. Fixing uses the strengths of organised crime because such groups have developed the capacity to maintain networks of corruption in different jurisdictions and to shift funds across national boundaries (in the case of betting, to Asian markets). Moreover, relative to potential profits, fixing carries light penalties for those convicted. For example, the principal organiser of the Bochum match-fixing ring, despite previous convictions and despite having (according to the Prosecutor) made profits from fixing of millions of euros per year, received a sentence of only five years, which would be low for, say, drug smuggling with comparable levels of profit.

The economic model therefore attributes the tsunami of match-fixing to the growth of liquidity in the Global betting market: additional liquidity and the resulting potential for greater profit for criminals has shifted the demand curve for fixes to the right.

The availability of in-play betting has been another factor in increasing the potential profit from and therefore demand for fixes. First, tainted money may be fed into the market more slowly, triggering a slower deterioration in the odds on the outcome which the fixer has arranged. Second, fixers can earn greater profit by exploiting the dynamics of the in-play market. For example, in a football match, the fixers may instruct corrupted defenders to allow opposition goals such that they win a bet that the number of goals will be above a certain number. In a market with only pre-play betting, it would not matter when in the match these goals are scored. However, with an in-play market, fixers may instruct the corrupted players to give away the goals only late in the match. On average, this will permit higher profit to be made. As a match proceeds, the odds against a high number of goals will likely lengthen because there is less time left for the goals to occur. Knowing that the goals will come if all goes to plan, fixers can then time their bets to take advantage of this lengthening of odds, placing the bulk of their funds shortly before the manipulation takes place on the field.[25]

Evidence consistent with the argument that in-play markets are commonly exploited by fixers was provided by Van Rompuy (2015) who examined 1,468 football matches classified by Sportradar as likely to have been manipulated. In two-thirds, betting anomalies were found in both the pre-match and in-play markets and in another 17%, they were found only in-play.

3. Where in Sport is Risk Greatest?

The economic model suggests that risk assessments for a sport should consider *both* supply and demand. *Ceteris paribus,* the willingness of players to supply fixes will be greatest where pay is low, the culture of the sport is tolerant of corruption, players are disillusioned with the sport, the chances of being detected are low and the penalties for infringement are low. The demand for fixes will be greatest where betting volumes are large and where a high

[25] This scenario is an example of where manipulation is likely to create one of the anomalies which algorithms used in monitoring betting markets aim to detect. For example, the score in a football match is 2-0 with ten minutes remaining. Odds that there will be more than three goals in the match should be lengthening as the minutes pass because there is less and less time for two more goals to be scored. If at this point, the odds begin to shorten, this will reflect that there is an inflow of betting money which expects the goals to appear. This is an 'illogical' movement of odds. The match will be examined by analysts to check whether there is a legitimate explanation, such as a goalkeeper injury. If not, and if the movement in odds has been sufficiently sharp, the match will be a candidate for investigation.

proportion of volume is in unregulated markets where nefarious bets may be placed with impunity.

Since a high level of fixing activity requires both sufficient willingness of players to supply *and* a strong incentive for criminals to purchase, it follows that one might expect the prevalence of manipulation to be highest in situations where the volume of betting is disproportionately high relative to athletes' remuneration. College sport in the United States provides a classic example since there is considerable betting activity and yet players are not paid at all (and moreover the large majority have no prospect of progressing to the professional game and hence little stake in the sport). Indeed college sport in America has been tainted by numerous fixing scandals.

The predictions of the economic model appear to be borne out by the patterns of fixing we observe. A caveat is that we observe only fixes that have been detected and publically revealed, sometimes through criminal trials or (more frequently) through announcements of sanctions by sports governing bodies. However, some additional indicative evidence might be gleaned from the results of surveys of players where they are asked about their knowledge of fixes having taken place in their competitions.

Individual sports organised as tours- tennis, badminton, darts, snooker- appear to rank particularly highly in terms of integrity risk. Typically only the very highest ranked players earn significant rewards from prize money and most fail even to break-even given the high costs of travel between international venues, hotel bills and paying a coach. Betting markets are active in these sports, particularly tennis (and badminton, where its popularity in East Asia generates betting interest). Many players are therefore likely to be susceptible to approaches which offer to them useful sums of money, for example to lose a first round match where the prospect of advancement beyond the second round to earn a significant prize would be low and the costs of remaining in town to try would be high.

Tennis indeed generates frequent reports of betting market anomalies and sanctions are regularly issued for integrity offences. Police action has also been targeted at the sport. For example, in 2016, six players were arrested in Spain where police alleged that they had been involved in fixing matches where the betting syndicate organising the manipulation had made 500,000 euros profit.[26] With such profits available, it is likely that criminals will be able to recruit a sufficient number of susceptible players to carry out their instructions.

[26] https://www.nytimes.com/2016/12/01/sports/tennis/match-fixing-arrests-spain.html

In *team* sports, even the highest levels of competition cannot be regarded as safe from manipulation, as illustrated by experience in Italian football (where at least one individual from each top-division club was implicated in the *Calcioscommesse* scandal) and cricket's Indian Premier League (where player rewards per match may be the highest in any sports league outside North America and yet fixing has been a problem). Player remuneration in such elite sport may be so high that most would not find it worthwhile to risk involvement in manipulation; but there will always be players who can be identified as vulnerable on account of personal circumstances and criminals are proven to be skilled in identifying them. However, from evidence in criminal trials, reports by betting monitoring services and player surveys, the highest risks are at more modest levels of competition where there is nevertheless high liquidity in the betting market. English domestic cricket receives little attention from the public (attendances sometimes only in the hundreds) but is the subject of strong betting interest in India and criminal trials of players have indicated that bribes to underperform have their origin there. In European basketball, weaker national leagues appear sometimes to have serious integrity issues. For example, of 259 Lithuanian basketball players surveyed by Transparency International, 21% reported having been personally approached to take part in a fix (Trumpyte, 2016). In European football, cases appear most often in the lower and youth tiers of major countries like Spain and England and in top-tier leagues in lesser football powers such as Finland, Sweden and Albania. International friendlies at senior or youth level involving minor countries such as Malta appear also to be high risk according to known cases and betting monitoring alerts. All these situations correspond to the scenario of players being low paid and betting markets being active, particularly in Asia.

One of the companies which monitors betting markets for signs of match-fixing, Starlizard, published a list of 397 matches it had identified as suspicious among the 54,597 games in 90 countries that it analysed in 2017.[27] It tabulated the relative frequency of suspicious matches by tier (where tier corresponded to amount of betting activity, which will be highly but not perfectly correlated with sporting status). No cases were detected in the top-tier and the proportions in tiers 2 and 3 (of eight) were 0.17% and 0.36%. But the proportions in the remaining tiers approached 1%. One unnamed European youth league had the highest proportion of alerts of any of the worldwide competitions included in the data: 9% (22 of 244 matches). These were of course only betting alerts that provided grounds for investigation, not proven cases. And the patterns identified may be biased because suspicious betting is harder to detect in top-level sport where total volume of bets is extremely high and even a very substantial bet may not perceptibly shift odds. Nevertheless the broad pattern is consistent with the pattern of fixing revealed in criminal trials and is likely to be

[27] For reference, see Footnote 18 above.

indicative of relative risks in football, which is the most popular sport for betting and liquidity is therefore surprisingly high in some quite minor competitions.

Revelations of match-fixing in Spain and identification of cases of suspicious betting correspond to international experience. In 2017, a whistle-blower on the team alerted authorities to a fix carried out by Eldense in its Second Division B match against Barcelona B. Two players and two coaches[28] were arrested. The fixing exercise had involved substantial in-play betting on the exact half-time score.[29] The scandal appears to have provoked overdue positive action from La Liga, which strengthened its integrity protection infrastructure. Investigations by its "Pizarro" and "Cortes" task forces led in 2018 to arrests of several players (and a referee) in the fourth tier of men's football and of three players in the first tier of the women's competition. A fixing network was alleged to have had links with China and corrupt players had received payments of up to 50,000 euros, a substantial amount relative to typical player incomes.[30] From betting monitoring of all levels of its competitions and syndicated friendlies in season 2017-18, La Liga escalated 24 matches for investigation, again all in lower tiers.[31]

IV. WHAT CAN SPORTS DO TO PROTECT INTEGRITY?

Any successful policy to reduce the prevalence of fixing must, in the market for fixes, either shift the demand curve to the left or shift the supply curve to the left or both.

Demand for fixes is currently so high because such substantial profits are available from betting in highly liquid illegal (or effectively unregulated) markets, largely organised in offshore betting hubs in Asia (to serve the East Asian market) and the Caribbean (to serve the North American market).

From a Global perspective, the most obvious policy to help sport would be to shift liquidity out of these "grey" markets[32] and into closely monitored

[28] Coaches can influence results by instructions to corrupted players and by team selection.

[29] https://en.as.com/en/2017/04/05/opinion/1491385054_756783.html

[30] https://g3newswire.com/spain-investigation-into-match-fixing-continues-with-21-more-arrests/#

[31] Problems may extend also to futsal. A survey by Spanish player unions revealed that significant numbers of players in both men's and women's futsal had received suspicious approaches (http://protect-integrity.com/wp-content/uploads/2018/02/2017-EU-Athletes-Evaluation-of-the-effectiveness-of-the-PROtect-Integrity-player-education-programme.pdf).

[32] The term 'grey market' is commonly used to describe betting markets where the operators are located and licensed in offshore jurisdictions (hence themselves legal) but where the bets they receive through agents originate in countries where betting is illegal. For example, the largest bookmakers in the World are licensed in a local jurisdiction in The Philippines (where regulation is minimal) but the bulk of betting volume is drawn from China where betting is illegal.

markets where operators were obliged to know their customers and to record transactions in such a way that sources of bets could be traced back to individuals. If the majority of legitimate, recreational bettors were to use legal and well-regulated markets, fixers could not safely follow them into that controlled environment. And residual liquidity in grey markets could no longer support the sizes of bets which make match-fixing so lucrative.

The World is a long way from moving significantly in this direction. The biggest betting countries by volume are China and the United States. Depriving unregulated markets of sufficient liquidity to make a big difference would require legalisation of sports betting in these countries[33] *and* the new legal sectors would have to be sufficiently attractive to bettors to induce them to shift their spending away from the illegal channels they use now. China has shown no signs to date of legalising sports betting.[34] The United States moved towards legalisation in 2018 when federal legislation preventing individual states permitting sports betting within their borders was declared unlawful by The Supreme Court. At the time of writing, several states within the United States have made preparations to introduce legal sports betting (it has even begun to operate in New Jersey); but it is unclear whether many or any will set a framework where new, legal operators can compete successfully with the existing illegal sector. States appear typically to prioritise the potential of legal betting as a tax vehicle. In any case, states seem to plan to grant limited numbers of licenses; and the prohibition of cross-border bets by the Wire Act also points to the likelihood of a monopolistic environment with high prices (poor odds) for consumers. High volume bettors at least are all too likely to continue to bet illegally through agents of offshore operators.[35] Legalisation as it seems to be being applied, does not yet look likely to take a form which would radically change the integrity threat to sport.

While sport is limited in the extent to which it can wish away the existence of high volume international grey markets, it can address the supply side of the fixing market because it is its players, referees and clubs which execute the fixes.

First, it should address general governance issues. Much of sport has a high level of corruption in terms of extraction of economic rents by officials of its governing bodies and by owners of clubs who may, for example, use them as vehicles for tax evasion or money laundering. In the general literature on corruption, Liu (2016) provides evidence that the degree of corruption in

[33] Coaches can influence results by instructions to corrupted players and by team selection.

[34] It permits some gambling on sport through the state-sanctioned Sports Lottery but this does not offer fixed odds betting on individual matches, let alone betting during matches.

[35] There has also been little discussion within America of how the new legal sector should be regulated to protect sport integrity. The lack of a federal framework for betting will make it hard to implement regulation as effective as that found in, for example, France, Great Britain and Spain.

organisations affects individual choices of whether themselves to engage in corruption in their own roles. In terms of our economic model, psychic costs of participating in match-fixing will be low where leaders of the sport are using it for their own illicit gain and so willingness of players to supply fixes will be high.

Second, it should address the particular issue of controls on ownership of clubs. Fixing has proven sufficiently lucrative that criminal interests have purchased clubs specifically to use them to deliver fixes. They can do so by transferring in pre-corrupted coaches and players or else intimidate players to collaborate in fixing exercises by threatening not to pay their wages. This scenario has been uncovered in football in Belgium and Finland and is believed to be relatively common in some countries in Eastern and Southern Europe. Generally, governing bodies fail to guard against such criminal infiltration of their sports. A recent Report found that, of 25 countries surveyed, only England and Italy applied fit-and-proper-person tests to football club ownership.[36]

Third, there is dangerously high tolerance, in football in particular, of clubs failing to pay wages due to their players. Academics from the University of Manchester analysed some 14,000 responses to questionnaires distributed by football player unions in 54 countries.[37] 41% of players had experienced a delay of one month or more in wage payments in the preceding two years. Some delays had been of more than one year. Researchers found a clear correlation between players who failed to receive wages and players who reported having been approached to fix a match. It is all too obvious that players without current income would be likely targets for match fixers and occasionally withholding pay may even be a deliberate strategy by owners to secure collaboration in fixing.[38]

Abstracting from issues of flawed governance, sports' policies might be informed by economic reasoning. If athletes are Beckerian actors, they will compare the reward offered by fixers with the expected cost of participating in the manipulation of the event. Elements in their decision will include the probability of detection and the financial cost if their offence is detected. Financial cost may be dominated by the present value of future income lost by exclusion from the sport.

Detection is increasingly the focus of policy in many sports. International cricket and tennis were the first to establish intelligence units staffed mainly

[36] https://www.sportsintegrityinitiative.com/research-into-football-club-ownership-proves-poor-scrutiny-and-lack-of-due-diligence/ (November, 2018).

[37] https://fifpro.org/images/documents-pdf/2016-fifpro-global-employment-report.pdf

[38] Within Europe, missed wages are most common in Eastern countries; but Spain has also had many well documented cases of players failing to be paid for extended periods. For examples, see https://bleacherreport.com/articles/2416314-outside-la-ligas-heavyweights-spanish-football-still-blighted-by-unpaid-wages

by former policemen and, as noted above, Spanish football has established task forces to uncover manipulation. UEFA was the first organisation to invest heavily in betting monitoring. Following a Judgement (CAS 2016/A/4650) at the Court of Arbitration for Sport, which upheld its exclusion of a club from the Champions League primarily on the basis of betting monitoring reports, several if not most major and minor sports, including the Major Leagues in the United States, have subscribed to monitoring services. Other policies put into place across a wide range of sports include provision of whistle-blowing lines[39] and player education programmes. For example, during the Spanish football season, 2017-2018, La Liga provided 132 integrity workshops for players from all levels of the sport.[40] Such education programmes may have value in raising awareness of the risks of involvement in fixes and explaining to players the insidious methods employed by fixing rings to recruit them. However, education programmes are unlikely to modify behaviour since they do not address the underlying incentives that drive players to take part in corruption.

In individual sports, player income is derived primarily from prizes and appearance fees. This raises the possibility of working on prize structures to modify the incentive to fix. For example, most tennis players earn inadequate amounts to cover their costs because they are unlikely to progress to the stages of tournaments where they would access serious prize money. They are therefore susceptible to approaches to lose early round matches where the small prize for progression to the next round is dominated by the fixer's bribe. Redistribution of the prize money pool towards higher prizes for early round wins would therefore be likely to reduce the number of fixes. This idea has been acted on in Grand Slams. However, organisers of lesser tournaments may find the idea non-viable because they need to attract top players to achieve acceptable ticket sales and this in turn requires that the budget be channelled towards those players through appearance fees and a high reward for winning the tournament. As with virtually all other sports, the size of the sport is such that most athletes operate in low-level tiers where the financial status of tournaments is very marginal. That such low-level sport has active betting markets makes it very vulnerable to corruption because it lacks the resources to reward its athletes at a level where few would choose to fix.

This raises an awkward question for sport. In this paper, we have argued that betting can provide opportunities for sport. Particularly the shift to in-play presents the prospect of generating new revenue streams from sales of data and

[39] South Korean football has gone further by offering financial rewards for players who provide information. In 2018, a player was paid the local equivalent of €53,000 euros for reporting an approach, which led to a criminal conviction (https://www.sportsintegrityinitiative.com/sports-integrity-briefs-18-october-2018/)

[40] https://www.sbcnews.co.uk/europe/2018/10/25/la-liga-dgoj-collaboration-strengthens-spanish-football-against-corruption/

the appeal of the product should also boost existing revenue streams because of complementarities in consumption. But is there in fact a trade-off between the benefits to be gained by engagement with the betting sector and the safety of the sport? For example, should sport consider withholding data supply because this would disrupt in-play betting markets? Should it lobby governments to prohibit in-play betting because it elevates integrity risk to sport?

These policies would of course be somewhat akin to prohibition. The idea is sufficiently alluring that tennis is considering withholding official data supply in the case of its third-tier, the Futures Tour. And some jurisdictions, such as Australia, indeed prohibit licensed operators from offering in-play betting.

Economists would naturally urge caution in adopting a prohibitionist stance. First, experience in all eras and jurisdictions is that, if there is demand for betting, it will be supplied in the illegal sector wherever it is not tolerated in the legal sector. For example, participation in betting in the United States is at a similar level in the United States as in Great Britain even though it has been illegal in the one case and accessible legally in every local shopping strip in the other. The more betting is driven into unregulated markets, the greater is integrity risk, in our view. Second, even if betting markets on low-level competitions could be suppressed, it has to be asked where the amounts bet would go. Into what other products would consumers substitute? For example, tennis betting is quite a niche product. Therefore the most plausible substitution if betting on the Futures Tour were to be made unavailable would be into greater amounts bet on the next tier up in the sport. There is then a risk of moving integrity problems into that higher level where the potential for reputational loss where fixing occurs is greater.

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LABOR MARKETS IN PROFESSIONAL TEAM SPORTS

Rob SIMMONS

David BERRI

Abstract

The purpose of this paper is to summarise the state of research on labor markets in professional sports leagues around the world. We report the main theoretical contributions to sports labor markets and set out the main research findings in North American and European team sports as applied to four core themes: labor market institutions, monopsony exploitation, labor market efficiency, and salary discrimination.

Keywords: labor markets, monopsony, efficiency, discrimination.

JEL classification: Z20, Z22.

I. INTRODUCTION

The purpose of this paper is to summarise the state of research on labor markets in professional sports leagues around the world. We report the main theoretical contributions to sports labor markets and set out the main research findings in North American and European team sports as applied to four core themes: labor market institutions, monopsony exploitation, labor market efficiency, and salary discrimination.

In section II, we shall cover the institutional context of particular sports and show how different institutions shape market structures so as to deliver wage and employment outcomes for players. Section III considers the extent of monopsony exploitation in North American sports. Section IV then takes up the theme of so-called *Moneyball* effects in team sports. Here, authors have seized upon the supposedly innovative practices of Billy Beane, General Manager of Oakland A's Major League Baseball club in generating successful performances out of a limited payroll in a small market team. We discuss this particular case, emphasising how it related (or not) to possible labor market inefficiency and also report empirical results on alleged *Moneyball* effects in sports leagues other than baseball. Section V then focuses on recent evidence on salary discrimination in sports. Section VI concludes.

II. LABOR MARKET INSTITUTIONS

> "The financial results of the past season prove that salaries must come down. We believe that players insisting on exorbitant prices are injuring their own interests by forcing out of existence clubs which cannot be run and pay large salaries except at a personal loss."

The above quote sounds like something that might be said by a sports owner in the 21st century. But as Eckard (2001: 118) notes, it actually comes from a statement issued by the National League in 1879. Eckard (2001: 118) also noted that two weeks after baseball's National League announced that salaries were too high the league took action to change what baseball players are paid.

> "The principal cause of heavy losses to [NL clubs] is attributed to high salaries, the result of competition... it was proposed that each [club's] delegate be allowed to name five desirable players from his own club... chosen men should not be allowed to sign with any other club without permission... The aim of the league is to reduce expenses so that clubs can live."

Initially the reserve clause applied to only five players. By the end of the 1880s it applied to all players. Eventually, –as Quirk, and Fort (1992: 185) noted– the following reserve clause appeared in every player's contract.

> "[If] the player and the club have not agreed upon the terms of such contract, then … the club shall have the right to renew this contract for the period of one year on the same terms, except that the amount payable to the player shall be such as the club shall fix in said notice."

Essentially, the reserve clause prevented baseball player from entertaining offers from any team besides the team that held the player's rights. This principle dominated the labor market in Major League Baseball until the 1970s.

There was a group of athletes, though, were not covered by the reserve clause. Players who had not signed with any club were still able to bargain with any franchise. As Berri (2018) explains, in 1935 in the National Football League, two teams –the Brooklyn Dodgers and Philadelphia Eagles– entered a bidding war for Stan Kostka (a player who recently starred at the University of Minnesota). At the end of the bidding war, Kostka agreed to a 5,000 dollars contract with the Dodgers. Such a contract was equivalent to the pay of Bronco Nagruski, a player who had been an NFL All-Pro from 1932 to 1934.

The losing team in this bidding war was owned by Bert Bell. He argued that teams should no longer bid for college stars. Instead, the league should create a reverse-order draft where the worst teams from the previous year could select the best players from the college ranks. Once selected, the player could only negotiate with the player who held his rights. Hence –like the world observed under the reserve clause– players could only bargain with one team.

The institution of the reverse-order draft was eventually adopted by the NBA, NHL, and Major League Baseball. This institution conferred substantial monopsony power to the owners of the teams in this league. As we will see, the data indicate that when teams have substantial monopsony power the wages of players are depressed.

We should note additional labor market institutions. In the 1970s, players with six years of experience were made free agents (*i.e.,* given the right to bargain with any team when their contract expired). As Table 1 indicates, a form of free agency was also adopted by the other major North American sports leagues.

Starting with the NBA in 1983, leagues began to create institutions to limit the ability of teams to pay free agents as they would earn in a completely

TABLE 1

FREE AGENCY CONDITIONS IN VARIOUS SPORTS LEAGUES

League	Years to qualify for unrestricted free agency	Interim status	Years to qualify for interim status
Major League Baseball	6	Final offer arbitration	3
National Basketball Association	Varies but offers depend on length of service and salary cap rules	Restricted free agent; current club has right to match outside offers	3 years except 4 years for 1st round draft picks
National Football League	4	Restricted free agent; current club has right to match outside offers	3
National Hockey League	7 or age 27 whichever is earliest	Any player who is not entry-level, but does not meet the qualifications of unrestricted free agency becomes a restricted free agent when his contract expires.	Variable
Major League Soccer	No free agency agreement between league and players union is yet reached. Next negotiations scheduled for 2020.	Transfers of players under 21 years old are regulated with fees settled by tribunal according to costs of player training and development. Up to three designated player spots per team which are exempted from the general salary restrictions and contract regulations imposed by MLS	N/A

Source: Own elaboration.

unfettered market. These institutions included final offer arbitrations, a cap on team payrolls –called a "salary cap"– that can be either hard or soft, a cap on rookie salaries, a cap on veteran salaries, and a luxury tax that penalized a team if its payroll exceeded a certain threshold. Each of these institutions is defined as follows:

- Final offer arbitration: This is a process applied in MLB whereby a player can become eligible for salary arbitration after a given number of years' experience (three in MLB). Offers from players and teams are generated and simultaneously revealed to both parties. Further negotiation can occur but if no agreement is reached, the offers are submitted to binding arbitration where a salary is specified.

- Payroll Cap: Agreed and well-defined sources of revenue are added up and divided among teams. A given percentage of these total revenues forms a salary cap per team. This is rigorously applied in NFL and NHL.

For example, the NFL salary cap in the 2018 season was 177 millions of dollars per team.

- Cap on rookie salaries: This specifies an upper limit on salaries of drafted players where the limit depends on years of experience (up to three in NFL) and position in draft order. The cap is set by a Collective Bargaining Agreement in NFL and NHL and there is typically a floor as well as a ceiling.

- Cap on veteran salaries: This specifies an upper limit on free agent salaries, typically alongside a salary cap which will in any case likely constrain free agent pay levels.

- Luxury tax: This is an amount paid by a team when they have a total payroll that exceeds a given amount. Typically, the proceeds of the tax are taken by the league and distributed to lower revenue teams. A luxury tax is currently applied in MLB where the 2019 threshold was set at 206 millions of dollars per team.

As adapted from Rascher and DeSchriver (2012), Table 2 reports which institutions have been adopted by each major sports league in North America.

TABLE 2

INSTITUTIONS IN EACH OF THE MAJOR NORTH AMERICAN SPORTS LEAGUES

Institution	*NBA*	*MLB*	*NFL*	*NHL*
Payroll Cap	Soft Cap	No	Hard Cap	Hard Cap
Individual Salary Cap	Yes	No	No	Yes
Rookie Salary Restrictions	Yes	No	Yes	Yes
Luxury Tax	Yes	Yes	No	No
Reverse Order Draft	Yes	Yes	Yes	Yes
Salary Arbitration	No	Yes	No	Yes

Source: Berri (2018: 119).

Each of these institutions has been rationalised in terms of competitive balance. But as we will demonstrate, the primary impact of these institutions is to give teams monopsony power. Before we can illustrate this point, though, let us consider a labor market where these institutions do not exist.

The labor market structure in European football is radically different to North American sports. Players enter a professional league at any age from 16.

They are not drafted. Trades for cash are common but a free market only applies for players over the age of 21. Following the Bosman ruling of 1995, players can move freely within the European Union if they are out of contract. Players who are tied to consensual contracts my still move to other clubs but the club holding the player's registration is entitled to ask for a transfer fee as compensation for loss of services (Terviö, 2006). Players do sign long-term contracts but these are no more than five years long. Players arriving into a European league from outside the European Union have to apply for work permits and these are granted under particular conditions which vary by league. The top five European Leagues are England, France, Germany, Italy and Spain and these each have high proportions of foreign-born players on club rosters. In the 2010-2011 season for top divisions, Maderer, Holtbrügge and Schuster (2014) find that Spain and France had around 40% of players that were foreign-born. Italy and Germany had around 50% of players that were foreign-born while England has just over 60% share of foreign players on the rosters.

Labor markets for footballers in Europe have not always been so open and competitive (Dobson and Goddard, 2011). In England, footballers were subject to a maximum wage until 1961. In 1958, this was 20 pounds per week-average weekly earnings for male manual employees were 12.83 pounds. Not surprisingly, there were many cases of illegal payments in kind to players. Player registrations were treated as tradeable commodities and players could only move if the current club was prepared to sell or release the registration.

Until 1963, the 'retain and transfer' system operated similar to the reserve clause arrangement in North American leagues. That is, out-of-contract players were still tied to their parent clubs which could demand transfer fees for switching clubs. Specifically:

- The player could re-register for the same club at any time between 1 April and the first Saturday in May. In effect, the contract was simply renewed.

- The club could retain the player on less favorable terms by serving a notice between 1 May and 1 June giving details of the terms it was offering. If the Football Association considered the offer to be too low it could refuse the retention, but if it felt the terms were reasonable, the player could not sign for any other club. Players were allowed to petition the Football Association with their reasons for wanting to move to another club, but if the Association refused to intervene clubs could retain a player indefinitely.

- The player could be placed on the transfer list at a fee fixed by the club.

- If the club did not want to keep the player and did not seek a fee for him, it could release him and he would be free to conduct negotiations with other clubs at any time from the end of June.

The retain and transfer system was abolished following the Eastham case of 1963. The club holding a player registration had to offer a new contract on at least same terms (pay level, duration) as old contract– but could still insist on a fee for a player move. Salary inflation was high as restrictions were removed and salary growth exceeded revenue growth (90%, 30% over 1961-1974). The numbers of players in English football fell: 3,000 in 1961 to 2,400 in 1967 (Dobson and Goddard, 2011). In 1995, the next big step was taken towards liberalising the footballers' labor market. The Bosman ruling put an end to paying transfer fees for all out-of-contract players (Frick, 2009).

The economic case for abolition of the transfer system is made by Szymanski (2015). Szymanski argues that part of the surplus from a player-club job match is retained by team owners. Owners of larger clubs have more valuable players on their rosters and retain larger surpluses. With transfer fees payable for within-contract players, free movement is curtailed. Large clubs trade players between themselves with high transfer fees and in so doing sustain an unbalanced, uncompetitive product market for football. According to Szymanski, players should be able to switch clubs at short notice with no transfer fee involved.

Counter-arguments to the transfer market abolition proposal are that players should be viewed as tradeable assets and a transfer fee represents compensation for loss of a valuable asset (Tervio, 2006). In practice, football players arrange moves even when they are under a long-term contract. For example, the 30 year old French star player Dimitri Payet became dissatisfied at English Premier League club West Ham, part way through a lucrative five year contract citing, amongst various factors, a desire to return to home city club, Olympique Marseille. After effectively sitting out his contract for a number of games and becoming alienated from coaches and teammates, Payet was transferred back to Marseille for a fee of 25 million pounds, much more than the 11 millions pounds fee originally paid by West Ham to Marseille. Thus, West Ham was compensated for loss of a valuable asset whereas under Szymanski's proposal they would receive nothing.

The only European football league to report actual player salaries as opposed to estimated "market values" is Italy Serie A. Data are collected in September of each season since 2009-2010 by journalists at *Gazzetta dello Sport.* The data conform to insider expectations and appear to be consistent. They show annual basic pay, without bonuses, for each player registered on a team's roster at September in a given season. In 2016-2017 the highest payroll was spent by the league's champions, Juventus, and the top earner, at 7.5 million of euros, was the same team's star striker, Gonzalo Higuain who arrived in summer of 2016 from Napoli for a transfer fee of 90 million euros. This trade was facilitated by the outgoing transfer of Paul Pogba from Juventus to Manchester United for a then world record fee of 105 million of euros. This is the kind of trade involving large clubs that Szymanski (2015) disapproves of.

Table 3 reports 2016-2017 salaries for two Italian teams: Napoli and Empoli. Napoli is a large market club that would see itself as Championship contender and aspires to Champions' League qualification. Empoli is a small market team which was relegated to Serie B at the end of the 2016/2017 season.

TABLE 3

TOP 10 PLAYER SALARIES AT NAPOLI AND EMPOLI, SEPTEMBER 2016

Napoli			*Empoli*		
Player	*Salary €m net*	*Contract date*	*Player*	*Salary €m net*	*Contract date*
Hamsik	3.50	2020	Saponara	0.90	2018
Callejon	3.00	2020	Gilardino	0.70	2018
Milik	2.50	2021	Pucciarelli	0.40	2019
Reina	2.50	2018	Costa	0.40	2019
Albiol	2.10	2017	Pasqual	0.40	2017
Gabbiadini	1.90	2019	Mauri	0.40	2017
L. Insigne	1.80	2019	Laurini	0.35	2018
Chiriches	1.70	2020	Maccarone	0.35	2017
Jorginho	1.60	2020	Mchedlidze	0.30	2018
Zielinski	1.50	2021	Skorupski	0.30	2017

Source: Own elaboration.

Immediately from Table 3 we see that Napoli's top 10 earners have longer contracts, on average, than Empoli. The salary of Empoli's top ranked player is equal to the 20th ranked player at Napoli. Not shown in the table, only one out of Napoli's top 10 earners is Italian while for Empoli six out of the top 10 players are Italian-born. Napoli has a more diverse squad of players, with fewer Italian-born, compared to Empoli. Napoli has stronger attraction for foreign players due to larger market size, a history of fielding foreign players (primarily from Argentina due to Diego Maradona's club legend status), a global scouting network, higher salary offers and the prospect of playing Champions' League football. Empoli does not have these advantages.

In summary, North American leagues confer monopsony power over players to some extent. In European football, all players are free to negotiate contracts with any club and players can move freely within the European Union subject to terms set by clubs and players within the transfer market.

Given the contrasting nature of restrictions in the two labor markets, economic theory would suggest salaries would be lower in North American sports and many North American athletes are exploited. As we will see, the data generally confirms this theory.

III. MONOPSONY EXPLOITATION

There have been several research attempts from North America to determine the extent of monopsony exploitation in sports leagues. The starting point was Scully (1974) who estimated the following model for MLB:

$$\text{Revenues} = f\,(\text{Team wins}) \qquad [1]$$

$$\text{Team wins} = g(\text{Player inputs; Managerial input; Control variables}) \qquad [2]$$

This two-stage model relies on careful specification of revenues (broadcasting and gate; local and national) together with a complete specification of the wins production function. If these conditions hold then the player contribution to team wins is an estimate of marginal physical product. Marginal revenue product is then marginal effect of team wins on revenues times marginal physical product.

TABLE 4

SCULLY'S TEAM WINS MODEL

Variable	*Coefficient*
Team slugging average	0.92***
Team strike-out to walk ratio	0.90***
National League dummy	-38.6***
Team in contention for playoffs	43.8***
Team out of contention for playoffs	-75.6***
R^2	0.88
N	44

Note: In all tables reporting econometric results, *** denotes significance at 1% level, ** shows significance at 5% level and * indicates significance at 10% level.
Source: Scully (1974).

Scully's estimates of his team wins model are shown in Table 4 while estimates of the team revenue model are reported in Table 5. The data covered two seasons, 1968 and 1969 when the league comprised just 22 teams.

TABLE 5

SCULLY'S REVENUE MODEL

Variable	*Coefficient*
Win percentage	10,330***
Population	494,585***
Fan reaction to winning	512***
National League dummy	-762,248*
Old stadium dummy	-762,248*
Percentage of black players	-58,523***
R^2	0.75
N	44

Source: Scully (1974).

Scully's headline result was that average baseball hitters who were subject to the reserve clause in 1968 and 1969 were paid a mere 11% of their marginal revenue product.

Not surprisingly, scholars have made various attempts to revise and update the Scully model to the present day (see for example, Bradbury, 2010). This work has generally confirmed the idea that workers with limited bargaining power will be a paid a wage that is less than a worker's marginal revenue product.

Although Scully's approach has proven popular, Berri, Leeds, and von Allmen (2015) noted a significant issue in applying this method to data from today's sports. When Scully (1974) wrote his original paper, teams primarily earned revenue from the sale of tickets. Today, revenue is dominated by broadcasting deals. The money earned from these deals is independent of a team's wins. Scully (1974), though, argued that players contribute to wins by producing wins. If one takes that approach then one would be arguing that players do not contribute to the revenue generated from the broadcast of games; even though, it is clearly the players who people are tuning into watch.

Berri, Deutscher and Galetti (2015) noted that applying the Scully (1974) approach to MLB, NFL, NHL, and the NBA indicated –as Table 6 indicates– that the percentage of revenue attributed to wins fell far short of 50% of a the league's revenue (which is close to what leagues in North America tend to pay).

TABLE 6

PERCENTAGE OF REVENUE ATTRIBUTED TO WINS IN NORTH AMERICAN SPORTS

League	*Percentage of Revenue from Wins*
Major League Baseball	27.9
National Football League	1.4
National Basketball Association	26.2
National Hockey League	30.1

Source: Berri, Deutscher and Galetti (2015).

Berri (2018) also looked at Major League Baseball at different points in time. For example, when Scully's approach was applied to baseball from 1964 to 1985 the summation of the player's MRP (*i.e.,* the value of their wins) was 105% of league revenue. Yes, players appeared to be underpaid by this method. But one reason is that the approach clearly overstated the player's value.

When the Scully approach was applied to data from 1991 to 2001, then players were worth 55.6% of league revenue. This seems like a sweet spot in the data since that is quite close to what the players were being paid. But when the data were taken from 2002 to 2011, then the aforementioned result (*i.e.,* players were worth 27.9% of revenue) was noted.

The Scully approach has other shortcomings. If we think players only produce wins then players who play rarely play –or never play– have essentially no value. But these players are crucial to a team since they allow the team to practice. These players also provide injury insurance. So it is not correct to think these players have no value.

There is an alternative to the Scully approach. Krautmann (1999) offered an approach that began by assuming that free agents were paid their marginal revenue products and proceeded to estimate the gap between pay and marginal revenue products who had not reached free agent status. Krautmann *et al.* (2009) extended this approach to cover all four major North American sports leagues and their results are reported in Table 6.

In Table 7, Krautmann et al make a distinction between apprentices and journeymen. The former are reserve clause players tied to their teams while the latter are eligible for an arbitration process. In baseball, reserve clause players were found to earn 19% of competitive marginal product.

TABLE 7

DIFFERENCE BETWEEN ESTIMATED MRP AND WAGES (*I.E.* SURPLUS) FOR NON-FREE AGENTS IN MLB, THE NFL, AND THE NBA
(Number of observations in each cell, 2004 constant dollars reported)

		ALL		Starters	Utility
		SURPLUS	*Wages ad a % of* $\widehat{MRP}$	*SURPLUS*	*SURPLUS*
MLB	Apprentices[a]	$1,217,000 (165)	19	$1,676,000 (114)	$311,000 (51)
	Journeymen[b]	$221,000 (78)	86	$304,000 (64)	-$158,000 (14)
NFL	Apprentices[c]	$492,000 (198)	50	$575,000 (71)	$482,000 (127)
	Journeymen[d]	$264,000 (86)	77	$551,000 (59)	$178,000 (27)
NBA	Apprentices[e]	$732,000 (272)	66	$2,700,000 (83)	$564,000 (189)

[a] For MLB, Apprentices refers to arbitration-ineligible players (mostly those with less than four years of experience)

[b] For MLB, Journeymen refers to arbitration-eligible players (those with between four and six years of experience)

[c] For the NFL, Apprentices refers to reserve players (those with less than three years experience and playing under the reserve clause)

[d] For the NFL, Journeymen refers to restricted free agents (those with three years of experience, and whose team can match any free-agent offer

[e] For the NBA, Apprentice refers to players with less than four years of experience

Sources: Krautmann, Von Allmen and Berri (2009); and Berri (2018).

The key assumption in these estimates is that free agents receive their marginal revenue product as salary and this is inherently difficult to test. Bradbury (2013) has criticised this assumption while Krautmann (2013) offers a defence of his method. To the extent that free agents are paid above marginal revenue product, which would happen when a "winner's curse" applies to the transaction, then the estimates of pay to MRP ratios in Krautmann, Von Allmen, and Berri (2009) will be biased downwards and monopsony exploitation will be overstated. Bradbury (2010) argues that very few baseball players are overpaid but this is a conjecture that merits further investigation.

Despite this issue, reading across sports, the Krautmann approach illustrates how players without bargaining rights tend to be paid less than free agents. This result is clear in baseball, basketball, and football. One can also see a similar result with a simpler approach detailed in Berri (2018). As noted, bargaining rights of players changed over time in various sports leagues. Economic theory would suggest that when bargaining rights are depressed, the share of revenue that goes to player salaries would also be depressed.

The data seem to confirm that theory. For example, utilizing data *from Rod Fort's online Sports Business Data* page (sites.google.com/site/rodswebpages/codes) we can see that the 16 teams of Major League Baseball in 1953 reported (to the Committee on the Judiciary of the U.S. House of Representatives) average revenue of 2,055,595 million of dollars. But in this same report, the average salary from 15 teams (one team did not report) was 426,154 dollars. This means that the average team paid 20.7% of their revenue to its players.

In 1953 the reserve clause was fully enforced in Major League Baseball. That means a veteran player could only negotiate with one team. Fifteen years later, NBA players faced a very different labor market. The American Basketball Association (ABA) began play in 1967. So in 1968-1969, professional basketball players could elicit offers from at least two teams. According to the aforementioned data from Rod Fort, the Seattle Supersonics reported to the U.S. Senate Committee of the Judiciary that the team earned 992,000 dollars in revenue in 1968-1969. Rod Fort does not report average salary from 1968-1969, but two years later he reports that the 14 players on the Sonics earned 45,000 dollars. This means the Sonics paid 630,000 dollars in salaries in 1970-1971. Assuming revenues had not changed dramatically in two years, the Sonics were paying 63.5% in revenue that season.

The ABA partially merged with the NBA in 1976. To make that deal happen the NBA agreed to give its players significant free agent rights. By 1983, though, player salaries were considered excessive by the league as they exceeded league gate revenues at that time. Consequently, the NBA and its players agreed to a cap on player salaries that guaranteed the players a total payroll of 53% of league revenue.

The story of the Sonics and the birth of the payroll cap in the NBA illustrates how bargaining power impacts the percentage of pay given to the players. Further support for this story can be seen in the English Premier League. As Berri (2018) reports, in 2012-2013 the average team in the English Premier League paid its players 69.5% of team revenue. Once again, European sports leagues do not have many of the institutions (*i.e.,* reverse order draft, reserve clause, salary caps, payroll caps, luxury taxes, etc...) that limit player pay. Meanwhile North American sports leagues today with limited free agency –yet all the aforementioned institutions– typically pay around 50% of league revenue to their players.

The percentage of revenue paid to players –like the aforementioned empirical work inspired by Krautmann (1999)– indicates that players with limited bargaining power will be paid less. We should note that in recent years there has been renewed interest in the subject of monopsony by economists (see *e.g.,* Ashenfelter, Farber and Ransom, 2010). The research we have cited has indicated sports economists have been studying this issue for nearly five decades.

IV. LABOR MARKET INEFFICIENCIES

The subject of monopsony is not the only area where it appears sports economists are out in front of the majority of economists. In recent years the field of Behavioral Economics has taken off and the study of sports has played an important role. This can best be seen by the studies of the efficiency of labor markets in sports.

A player labor market will be inefficient when returns to a given performance metric are out of line with the wins returns to that aspect of performance. This misalignment was a prominent argument in the best-selling book, later an Oscar-nominated movie, by Michael Lewis (2003), *Moneyball,* which focused on the ability of Oakland A's General Manager, Billy Beane to exploit low valuation of win returns to On Base Percentage (OBP). Apparently, Beane hired hitters who could exercise plate discipline and who could secure bases rather than home runs, partly by drawing "walks" from pitchers where four pitches are thrown outside the strike zone without the hitter being out. According to Hakes and Sauer (2006, 2007), just after *Moneyball* was published, and just after a successful winning season for the A's the salary returns to OBP rose temporarily, in 2004 in response to a growing team demand for OBP from hitters, but then fell back as the free agent market re-adjusted back to equilibrium. A further theme of *Moneyball* was the influence of the inputs of statistical analysts who could spot promising hitters better than orthodox scouts, who would tend not to use statistical evaluation and rely on 'eye' and 'instinct' to guide hiring choices. Analysts claimed to be able to detect likely player prospects from data patterns. Moreover, some authors have claimed to find similar *Moneyball* effects in other sports.

The essential *Moneyball* story is that decision-maker were not valuing player performance data correctly in baseball. Such a story seems problematic, though, since the data being discussed has existed since the 19th century. And more recent work by Holmes, Simmons and Berri (2018) suggests –contrary to the *Moneyball* story– that decision-makers in baseball were not valuing players incorrectly.

Holmes *et al.,* modelled free agent salaries for newly signed contracts over 1997 to 2012, giving 793 observations. The authors find a correlation between OBP and SLG of 0.77, so these variables are not independent. Following Hakes and Sauer (2007), they propose an alternative set of hitting metrics. *Eye* is the three year ratio of walks and hits to plate appearances, so this captures the specific component of OBP that interested Billy Beane. *Bat* is the three year hitting average. *Power* is the three year isolated power measured as slugging minus batting average, so that is the specific component of SLG that might matter for salary. Table 8 reports results of a salary model with these revised hitter metrics.

TABLE 8

HOLMES, SIMMONS, AND BERRI (2018) ESTIMATES OF MLB FREE AGENT SALARIES

Variable		
Batting average	13.883***	11.889***
Eye	2.866**	2.663***
Power	4.530***	6.062***
Batting average* 2004		1.242
Eye* 2004		3.023
Power* 2004		3.135**
Average* Post 2003	-2.851	
Eye* Post 2003	-1.490	
Power* Post 2003	3.291***	
R^2	0.70	0.70

Note: Models control for plate appearances, age and speed and include position, year and team dummies.

Source: Own elaboration.

From Table 8, we cannot confidently claim that valuation of plate discipline drove changes in player valuation. Holmes et al find that OBP*2004 is only significant if SLG interactions are excluded from the model. In the revised specification, Eye*2004 and Eye*Post 2003 are not significant while Power*2004 and Power*Post 2003 are significant. This suggests that Moneyball effects are illusory; the free agent market for hitters could have been efficient before and after publication of *Moneyball.*

It is worth asking a larger question: Was the baseball labor market inconsistent with what we would expect if we look at what determines wins? Holmes, Simmons, and Berri (2018) run a regression of runs per game with hitting measures as production inputs. From this model we see that the elasticities with respect to batting average, isolated power and eye were found to be 1.48, 0.34 and 0.27. In a comparable salary model wage elasticities with respect to batting average, isolated power and eye were 3.23, 0.93 and 0.27. The ordering of win elasticities is the same as the ordering of salary elasticities. Teams primarily pay for the ability to hit the ball effectively. Power is also valued while the ability to draw a walk is not as important. When we look at runs scored per game we see essentially the same story. In sum, the focus on a player's ability to draw a walk appears to be misplaced.

None of this should be surprising. Again, the box score data used to evaluate hitters in baseball has existed since the 19th century. In other sports, box score data isn't quite as old. For example, the NBA only started tracking factors like offensive and defensive rebounds, turnovers, steals, and blocked shots in the 1970s. Do decision-makers understand the value of these data?

Executive decisions in professional basketball have been examined with respect to NBA free agent salaries (Berri, Brook, Schmidt, 2007), the NBA draft (Berri, Brook and Fenn, 2011), the WNBA draft (Harris and Berri, 2015), the sports media's voting for the NBA MVP award (Berri, Van Gilder and Fenn, 2014), and how minutes are allocated in the WNBA (Harris and Berri, 2016) and how minutes are allocated in the NBA (Berri, Deutscher and Galletti, 2015). All of these studies tell a similar story. The number of points a player scores dominates player evaluation in basketball.

A player's impact on wins, though, goes far beyond how many points the player scores. As Berri (2018) observes, wins in basketball are about acquiring the ball from the opponent without the opponent scoring (*i.e.,* force turnovers, grab defensive rebounds), keep the ball away from the opponent (*i.e.,* avoid turnovers, grab offensive rebounds), and convert possessions into points (*i.e.,* get to the free throw line and shoot efficiently from the line and the field). Given what determines wins, player evaluation in basketball should emphasize shooting efficiency, rebounds, steal, and turnovers. But again, the aforementioned studies that examined player evaluation found that it was total points scored –not shooting efficiency, rebounds, steals, and turnovers– that primarily drive where a player is drafted, what salary they are paid, what awards they receive, and how many minutes they play.

Inefficiencies do not just exist with respect to the evaluation of box score statistics in basketball. Motomura (2016) finds that teams overreacted to early success in drafting international players over 1999 to 2001 with underperformance of first round international draft picks after 2001. Teams viewed early success of international draftees as normal and failed to extract good performance from later first round picks from abroad (see Hill and Groothuis, 2017, for similar results).

Basketball is not the only place we see inefficiencies in decision-making. Berri and Simmons (2011) and Massey and Thaler (2012) both uncovered issues with respect to the NFL draft. The former noted that quarterbacks in the NFL will be drafted first if they are tall, run faster, and did better on the Wonderlic test. But none of those factors predict future NFL performance. In fact, these authors note that where a quarterback is drafted doesn't appear to predict future NFL performance.

Massey and Thaler considered all positions in American football. Their study considered the cost of each draft pick and the draft picks expected value. What they found is that the draft position with the most surplus value (*i.e.,* expected value minus cost) was the first pick in the second round. This research suggests teams are over-valuing top picks in the draft.

The study of player labor market efficiency in American football is hampered by lack of econometric identification. Ideally, the researcher needs to locate an exogenous source of variation in player performance that is undervalued or overvalued in a competitive market. Roach (2018) offers a promising approach to this problem in his study of NFL players. Roach considers offensive and defensive players on NFL rosters. Taken as a whole, competitive equilibrium requires that the ratios of wage to marginal revenue product should be equalised across offense and defense. If not, then teams could reallocate playing resources across positions, subject to the NFL constraints of a hard salary cap and fixed roster size (53 players). Roach uses percentage of team payroll resources that are inactive during a season. Inactivity is primarily through injury, which in NFL can be argued to be exogenous, but could be a result of coaches' player selection decisions. Unused salary significantly predicts team performance *i.e.,* more unused salary is associated with worse team performance. Roach finds that resources devoted to offensive positions, especially offensive linemen and starting quarterbacks have higher marginal impact on team performance over other positions. This result implies underpayment of players in these offensive positions and overall inefficiency in hiring and salary determination in the NFL free agent market.

The work of Gerrard (2007) can help us understand the results with respect to baseball, basketball, and American football. Gerrard notes that both basketball and American football are both "complex invasion sports" where participants attempt to take an object from one end of the field of play to another. Such sports require extensive teamwork making evaluation of players difficult. In basketball, statistical analysis can be used to measure individual player productivity accurately. In football, though, this is more difficult. Of course, given that performance data in both sports hasn't been around for very long (and many decision-makers do not have extensive training in statistical analysis) it is not surprising that player evaluation can be inefficient.

In contrast, the evaluation of hitters in baseball is much easier. The data have existed for over a century and interaction effects are small or non-existent. So it should not be surprising that player evaluation in baseball is much more efficient.

V. DISCRIMINATION IN LABOR MARKETS

Perhaps the most common topic economists have addressed in the study of labor markets in sports is the subject of discrimination. Not only is this literature abundant, stories from this literature tend to get noticed by the popular media. For example, Berri and Simmons (2009) studied racial discrimination in the pay of NFL quarterbacks. This story was reviewed by Zengerle (2009) as part of the *New York Times* 9th Annual List of Ideas. A study by Berri, Van Gilder, and Simmons of how NFL teams favor physically attractive quarterbacks in determining pay was noted in a number of media sources and was also the subject of a brief video by NFL Films. The Price and Wolfers (2010) examination of racial discrimination by NBA referees was a front-page story in the *New York Times.*

As these three examples illustrate, there is quite a bit of diversity in the study of discrimination by economists. The most common approach, though, is to study salary discrimination via the methodology summarized by Kahn (1991). As Kahn observed, researchers examining salary discrimination generally estimate the following model:

$$S = \beta_0 + \beta_1 {*} R + \beta_n {*} X_N + e_i \qquad [3]$$

The dependent variable in this model is player salary. One should note, though, that this approach can also be applied to a variety of other worker evaluations (*i.e.,* fouls called by referees, allocation of minutes, who gets cut from a team, etc...). The list of independent variables includes measures of productivity, team factors that impact pay, and a dummy variable for a player's race. Although this approach is common, researchers have noted several pitfalls that have to be addressed.

For example, Jenkins (1996) noted that researchers have to consider which sample of players to include in the study. Earlier studies tended to consider all players for which salary data could be obtained. But Jenkins (1996) argued that one has to consider when a player's salary is determined. If a player's salary was determined many years in the past, then the link between current salary and current performance may be weak. To overcome this issue, Jenkins

(1996) argued that researchers should focus on recent free agent signings. Prior to Jenkins, researcher had argued that black players in the 1980s were discriminated against. The work of Jenkins, though, suggested that there was no discrimination in this time period.

The choice of sample is not the only issue. Fort and Gill (2000) argued that one has to also consider how race is measured. Traditionally researchers decided on their own if a player was black or white. Fort and Gill (2000), though, argued that different people would come to different conclusions regarding a baseball player's race.

Once one has determined the appropriate sample, one has to then consider the robustness of their findings. Groothuis and Hill (2013) demonstrated in a study of NBA players that the findings of racial discrimination –both with respect to pay and whether or not a player would be cut from a team– depended on how one constructed the model. Berri, Van Gilder and Fenn (2014) told a similar story in the study of racial discrimination in the study of how the NBA's MVP was selected. This latter work also highlighted that how one measures productivity of the player is important. Specifically, a researcher has to think about how decision-makers perceive performance. As our discussion of the *Moneyball* issue highlighted, perceptions of performance in sports do not always match how that performance impacts game outcomes.

The work of Groothuis, and Hill (2013) and Berri, Van Gilder and Fenn (2014) highlights how estimating multiple versions of a model can cast doubt on whether or not discrimination is actually seen in the data. Price and Wolfers (2010) estimated a variety of models in the aforementioned study of how fouls are called in the NBA. Across all specifications the researchers found that the racial composition of the NBA referee crews impacted the number of fouls called on black and white players. These findings were summarized by the authors as follows:

> "These results are striking, given the level of racial equality achieved along other dimensions in the NBA and the high level of accountability and monitoring under which the referees operate. Although the external validity of these results remains an open question, they are at least suggestive that implicit biases may play an important role in shaping our evaluation of others, particularly in split-second, high-pressure decisions. That is, although these results may be of interest to those intrigued by the sporting context, we emphasize them instead as potentially suggestive of similar forces operating in a range of other contexts involving rapid subjective assessments."

This study was widely covered in the popular press. A subsequent study by Pope, Price and Wolfers (2016) looked at whether or not the implicit bias noted in the prior study persisted once the referees were made aware of this bias. As Pope, Price and Wolfers (2016)noted, the time period after the *New York Times* story in 2007 indicated there was no longer evidence of implicit bias among NBA referees.

Although it appears racial bias has been eliminated by NBA referees, there still appears to be some bias in the evaluation of NBA players. Berri, Deutscher and Galletti (2015) looked at nationality bias in the allocation of minutes in professional basketball. Once again, one issue with respect to racial bias is that different researchers may reach different conclusions about who is black or white. Nationality, though, is less subjective. In addition, there is reason to think players born in the United States –where basketball was invented– might be favored. And this is what these researchers uncovered. Both in the NBA and the Spanish Liga, players born in the United States received more minutes after controlling for performance.

The approach taken by these researchers also deviated from the basic single regression methodology that Kahn (1991) noted was used in so many studies. Instead of this single model, Berrim, Leeds and Von Allmen (2015) utilized the Oaxaca-Blinder decomposition.

Such an approach was also utilized in studies of salaries in baseball by Bodvarsson and Sessions (2011) and Bodvarsson, Papps, and Sessions (2014). Specifically, these studies estimate salary differentials for four pairs of players:

- White pitcher versus Black hitter.
- White pitcher versus Hispanic hitter.
- White hitter versus Black pitcher.
- White hitter versus Hispanic pitcher.

The question posed by the authors is the extent to which ethnic pay gaps across complementary job assignments are attributable to discrimination. Bodvarsson, Papps and Sessions (2014) estimate market discrimination coefficients as the percentage earnings premium paid to whites after controlling for both, productivity differences between whites and non-whites and interactions between race and productivity. The estimation is essentially an extension of the standard Oaxaca-Blinder decomposition.

Denoting the superscript B as black, W as white, S as log salary, x as performance measure:

$$S^W = \alpha^W + \beta^W x^W \quad [4]$$

$$S^B = \alpha^B + \beta^B x^B \quad [5]$$

At mean values denoted by * the salary gap between whites and blacks is:

$$S*^W - S*^B = \beta^W(x*^W - x*^B) + x*^B(\beta^W - \beta^B) + \alpha^W - \alpha^B \quad [6]$$

The Oaxaca-Blinder method decomposes a wage gap into an explained part and unexplained part. The explained part is the mean difference in characteristics (endowments) of the two groups given by the first term in [6]. The unexplained part is the difference in returns to characteristics and this difference is attributable to salary discrimination. From [6], the measure of discrimination is:

$$x*^B(\beta^W - \beta^B) + \alpha^W - \alpha^B \quad [7]$$

In order to compute this measure of discrimination, we need to be confident that all relevant characteristics have been included in a vector of x covariates. If relevant productivity measures have been omitted then discrimination will be mis-measured. One possible source of mis-measurement is the omission of teammate productivity spillover effects.

Bodvarsson, Papps and Sessions (2014) have data on 1,092 hitters and 1,204 pitchers over 1992, 1993, 1997 and 1998, a period during which monopsony power fell in baseball. Suitable summary measures of productivity are OPS (on base percentage plus slugging) for hitters and defense independent earned runs average (DICE) for pitchers. The method was to first estimate a salary model with player productivity measures only and extract fitted values. These were inserted into a second salary model with standard control

TABLE 9

DISCRIMINATION COEFFICIENTS FOR CROSS-ASSIGNMENT PAIRS: BODVARSSON, PAPPS AND SESSIONS (2014)

Comparison groups	*0.10 quantile*	*Median*	*0.90 quantile*
White pitcher/black hitter	0.187***	0.027	0.036
White pitcher/Hispanic hitter	0.333***	0.036**	-0.109
White hitter/black pitcher	-0.609***	-0.100	0.493**
White hitter/Hispanic pitcher	-0.502***	-0.195***	-0.209***

variables. Bodvarsson, Papps and Sessions (2014) extended the Oaxaca-Blinder decomposition to estimate discrimination coefficients using quantile regression. These coefficients are reported in Table 9.

The discrimination coefficients show a mixed pattern of significance at the top end of the salary distribution. At the bottom end of the distribution, over 100% of the salary differences between ethnic groups is explained by differences in observed productivity. Differences in rewards then reduce the gap. So Hispanic hitters are more productive than white pitchers but this extra productivity is not fully compensated by salary. This is an unusual twist on conventional stories of salary discrimination.

Bodvarsson, Papps and Sessions (2014) load up all player contract types in their model and use intercept shifts to register differences between free agent, arbitration eligible and reserve clause players. As an alternative approach, Holmes (2011) analysed new free agent contracts of hitters signed over 1998 to 2007 giving 511 observations. His dependent variable is log average salary of first year salary. Control variables included age, age squared, experience, three year past OBP and three year past SLG, player speed and zone rating for fielding performance. Holmes did not attempt a Oaxaca-Blinder decomposition but did offer weighted quantile regression estimates of coefficients of ethnicity dummies with black as base category. These are shown in Table 10.

These results show that salary discrimination falls across quantiles with insignificant coefficients at median and above. Either there is a fixed money-equivalent benefit to team owners from discrimination or discrimination is only practiced against lower-end players. As with other papers on this question, Holmes (2011) was unable to assess the likely sources of discrimination and that remains an important task for further research.

TABLE 10

HOLMES (2011) ESTIMATES OF ETHNIC SALARY COEFFICIENTS

Quantile	*Hispanic coefficient*	*White coefficient*
10	0.201***	0.244**
25	0.191*	0.193**
50	0.114*	0.125**
75	0.030	0.121
90	0.044	0.058

The quantile approach was also used by Keefer (2013) and an investigation of salary discrimination against black linebackers. Out of a large set of performance metrics, significant predictors of log salary cap value were starting appearances, solo tackles, quarterback sacks and pass deflections. The model could have included penalty yards as a negative feature of performance but did not do so. Control variables included experience, experience squared and draft round dummies. Keefer performed the Oaxaca-Blinder decomposition, extended to quantile regression, to derive a measure of discrimination.

Keefer (2013) estimated quantile treatment effects. Using quantile regression facilitates measurement of discrimination throughout the salary distribution, not just at the mean. This is important in player labor markets since the distribution of log salary will be non-normal and skewed. Keefer's results show significant levels of discrimination as estimated by [7] throughout the salary distribution. The measures were estimated as 0.096 at the 10% quantile, 0.066 at the median (only significant at 10%) and 0.085 at the 90% quantile.

Once again, studies of discrimination are quite common. One can find many studies examining a host of different sports in North America and around the world. The evidence suggests that discrimination does occur. But such studies must be interpreted with caution given the many issues researchers must address in constructing their models.

VI. CONCLUSION

This paper has shown how scholars have made substantial progress in assessments of monopsony exploitation, labor market efficiency, and discrimination. This progress has been facilitated by improved, longitudinal data sets and improved econometric methods such as quantile regression, extension of the Oaxaca-Blinder decomposition for discrimination and instrumental variables. Studies on pay and performance in sports leagues have come a long way from estimates based on 44 observations in Scully's (1974) pioneering contribution. For European football in particular, developments in sports analytics with richer, online data sources such as www.whoscored.com should enable researchers to include a better set of performance metrics than just goals and assists. If anything, the challenge ahead is to filter out statistical measures that are not meaningful to salary determination.

Papers on so-called *Moneyball* effects have focused on misalignment between effects of individual performances on team output on the one hand and player salaries on the other. This is an interesting line of research to follow.

The findings thus far seem to indicate that as evaluation of players becomes more complex, inefficiencies in player evaluation tend to increase.

Discrimination is a very common topic chosen by researchers and one can find examples of such work using data from a host of different sports. Although such studies appear relatively easy to construct, there are numerous pitfalls that must be avoided if one wishes to reach definitive conclusion. We have made some effort to outline these and illustrate how researchers have addressed these issues.

Sports leagues are not especially open to natural experiments as rules changes tend to affect all teams at the same time *e.g.,* as in new collective bargaining agreements in North American sports leagues (Simmons and Berri, 2011). But where natural experiments can be applied, these should be modelled. Overall, the scope for scholars to develop good research into professional sports labor markets is considerable.

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INVESTMENT IN TALENT AND VISIBILITY IN THE MEDIA: A STUDY OF PROFESSIONAL FOOTBALL IN EUROPE[1]

Pedro GARCÍA-DEL-BARRIO

Juan de Dios TENA HORRILLO

Abstract[2]

In this paper we analyse empirically the factors explaining the degree of media visibility in four major European football leagues, by means of an econometric model in which clubs' visibility in the media is estimated as a function of clubs' and leagues' aggregate wages. Controlling for a number of factors, the analysis enables us to study the way in which a club could improve its media exposure through greater investment in talent. By applying the Blinder-Oaxaca decomposition, we furthermore examine the extent to which differences across football clubs regarding interest in the media is a consequence of changes in resources allocations, or else a reaction to changes in such allocations. Our results suggest that a club's media visibility is greatly determined by its environment, that is, by the domestic competition in which it participates. Finally, we discuss policy implications that may be drawn from these findings.

Keywords: sports industry, professional football, global talent, sport performance, media visibility.

JEL Classification: J31, L21, L82, L83, Z20.

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[2] Article translated from the Spanish by Ciro Arbós.

I. INTRODUCTION

Ever since it made its appearance in economic literature with the seminal articles by Rottemberg (1956) and Neale (1964), sports economics has become established as an important field of analysis in academic research. Currently, not only there are two scientific journals, *Journal of Sport Economics* and *International Journal of Sport Finance,* exclusively devoted to publishing articles on the subject, but we also often find articles on sports economics in non-specialized reviews, which testifies to the increasing interest that this discipline arises.

Such an interest is nevertheless surprising if we consider that the professional sports industry, and particularly that of football, has a low economic relevance in global terms. Kuper and Szymanski (2014) illustrate the fact by pointing out, for instance, that the record revenue of a European professional football club would only amount to a third of the revenue obtained by a "semi-unknown" British company like BBA Aviation, or else that no professional football club is even close to be listed on the FTSE 250. A study of the sports industry size has been carried out, among others, by Humphreys and Ruseski (2008), who address the subject focusing on the case of the USA.

Broadly speaking, two different arguments could be made to vindicate the study of sports economics. The first one is that sport constitutes an experimental field to analyse matters of economic interest. Just to take but two examples, we may mention the studies on the influence of social pressure on cognitive biases (Garicano, Palacios-Huerta and Prendergast, 2005), or on the effect of tax policies on migratory decisions (Kleven, Langlais and Sáez, 2013). The second reason would be the social interest kindled by professional sport. Thus, even though according to Kuper and Szymanski (2014) revenues of professional football clubs are significantly lower than those of a "semi-unknown" company, football teams are a part of our everyday conversations and appear daily on the media. However, and despite this enormous interest, the scarcity of research works focused on the media dimension of professional football is surprising.

In this paper we analyse, by means of a transnational study, the factors explaining the status in the degree of presence in the media of football clubs playing in the top division of four major European Leagues: the English Premier League, the Spanish La Liga, the French Ligue 1, and the Italian Serie A. The fact that we do not focus on revenues –dependent variable in many empirical works– does not imply that we disregard their importance in decision-making processes in this sector; on the contrary, it owes to an attempt to adopt a different approach that may provide a more thorough understanding of the mainsprings of modern sports industry.[3]

[3] In fact, previous studies (*Cf.:* García-del-Barrio, and Pujol, 2007) evidence that media visibility of sportsmen and teams helps to explain the capacity to generate revenues, which in turn explains the economic rationale underlying many decisions made in the sphere of sports.

Specifically, our variable of interest is the degree of media visibility of clubs, which is examined by means of an econometric model as a function of: a couple of variables measuring talent by way of the relative spending on wages in leagues and teams (respectively, proxy variables of talent concentration amassed by the leagues and, within each league, by the different clubs); a club status indicator, measured according to the ELO rating system; as well as competitive balance indicators in each national competition.

The proposed econometric analysis enables us to study the way in which a club could improve its media visibility through an increase in talent investment. Furthermore, by applying the Blinder-Oaxaca decomposition to the model, we will be able to estimate the extent to which differences across football clubs regarding interest in the media owe to varying resources allocations (such as talent, status, or competitive balance), or else to an increased media attention (estimated 'betas') as a reaction to changes in such allocations. Our findings suggest that a club's media visibility is greatly determined by its environment, that is, by the domestic competition in which it participates.

The present article is structured as follows: Next Section includes a general descriptive study of professional football industry, showing the evolution of its main magnitudes, discussing its relationship with talent concentration, and comparing its economic weight with that of other professional sports in the US. In Section third we present the variables used for the empirical analysis, as well as descriptive statistics of such variables. In Section fourth we will proceed to the econometric analysis. Finally, the conclusions are presented in Section fifth.

II. THE PROFESSIONAL FOOTBALL INDUSTRY

This section focuses on a descriptive analysis of the professional football industry in Europe, one of the most paradigmatic sports industries, concerning its relationship with talent hiring, as well as on its comparison with other professional leagues in the US.

Sports industry is part of the entertainment sector, and, as such, it develops in a increasingly global environment. Precisely, the globalization of sports events necessarily calls for attention to the media status of individuals and teams, whose visibility in the media often proves to be a target in itself, and is therefore examined in the present article.

One of our starting assumptions is that media dimension is strongly correlated with sporting talent, being talent a key asset for business development in the entertainment sector. And the same applies to modern professional sports industry, which relies on the talent of sportsmen and women, whether it consists in their skills on the playing field or in appealing personal features that attract the crowd's attention.

As opposed to other studies where the variable of interest is the sport performance of a club, or else certain financial indicators, in the present study we draw attention to the importance of media visibility, which is built upon sporting talent, for revenue generation and business development. Our interest arises from the consideration of increased media attention as one of the distinctive strategical objectives of professional sport in relation to other industries. Accordingly, it is only logical to assume that clubs will hire all the talent they can get in order not only to achieve sporting results (and titles), but also to maximize their visibility in the media and their long-term revenues.

Let us now examine, in a general and descriptive way, some economic aspects of football that contextualise and reveal the global dimension of this sport discipline.

First, it is noteworthy that, despite its small economic size at a global scale, sports industry has a strong presence in the lives of many people. As far as professional football in Europe is concerned, annual revenue figures have steadily grown over the last 20 years, being the estimates for the entire European market, according to data provided by Deloitte ARFF (2018) for 2016-2017, of about 25,500 million euros. More than half of that amount (around 58%) comes from the aggregate revenue of the five major domestic leagues of professional football in Europe, the so-called "Big-5": English Premier League, Spanish La Liga, Italian Serie A, German Bundesliga, and French Ligue 1; we will focus our attention on these five competitions.

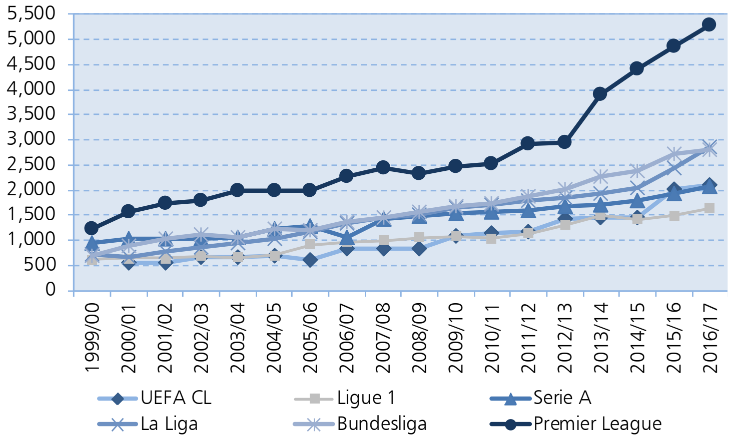
The growth enjoyed by professional football testifies to its great vitality, having even defied the hardest years of economic recession. This is apparent from Figure 1, showing the evolution of annual revenues in each of the five major domestic leagues over the past years; the information is shown together with UEFA Champions League's revenues, which are close to those obtained in French Ligue 1.[4]

Although enquiring into the possible causes underlying the burgeoning development of football industry is beyond the scope of this study, the increase of annual revenues in the major leagues seems to indicate that the sector has taken advantage of the globalization favoured by the new information technologies. Observation of Figure 1 also helps to appreciate the steady progression of

[4] Despite the large revenues obtained by the major professional football leagues, few clubs make a profit. Moreover, many teams often experience financial difficulties, presumably as a result of their tendency to maximize sport outcomes instead of profits. (*Cf.:* Sloane (1971), Késenne (1996), Szymanski and Smith (1997), Garcia-del-Barrio, and Szymanski (2009), among others).

FIGURE 1

EVOLUTION OF TOTAL ANNUAL REVENUES - EUROPEAN PROFESSIONAL FOOTBALL LEAGUES (1999-2000 TO 2016-2017)
(millions of euros)



Sources: Deloitte Football Money League (1997-2018); Deloitte Annual Report of Football Finance (2005-2018); UEFA's financial accounts.

European football leagues in recent times, as well as the widening gap between Premier League's revenue and that of the other domestic leagues.

In short, from this rough descriptive analysis we may conclude that European professional football is a growing sector that has not been slowed down by economic recession and shows good future prospects, probably owing to the globalization of attention both generated and expressed by media visibility (of teams and leagues), which is precisely the focus of attention of our study.

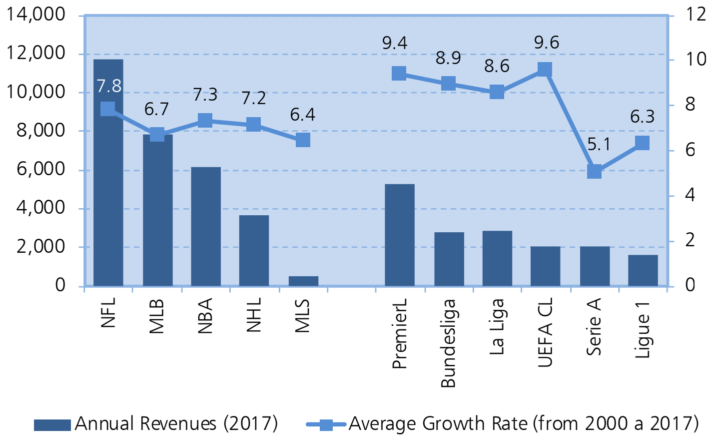
As a complement to the previous description, and in order to provide a global context of the economic situation experienced by European football leagues, it may be appropriate to compare these data with the revenues obtained in the five most popular team-sport competitions in North America. To that end, Figure 2 shows, together with the information about the "Big-5" European leagues, the 2017 annual revenues –in millions of euros– of the major leagues in the USA: National Football League (NFL), Major League Baseball (MLB), National Basketball League (NBL), National Hockey League (NHL), and Major League Soccer (MLS).[5]

[5] Estimates for two of the American leagues (specifically, MLB and MLS) are made per calendar year, whereas all other competitions, as in Europe, establish an accounting period that goes from September to August. It must be noted that, due to a lack of available information, the growth rate of the MLS has been calculated with data from 2008 on. Moreover, estimates for the NHL do not include data from 2004-2005, for the competition was suspended that season on account of a strike.

Since the market size of a country of continental dimensions like the US is not comparable to those of the European countries, comparison in terms of growth rates of annual revenues in each league is more illuminating. That information is also included in Figure 2, which shows average growth rates for the 2000-2017 period (calculated in the currency of each country: euros or dollars). As can be seen, with the exceptions of the French Ligue 1 and Italian Serie A, revenue increase of European professional football has clearly exceeded that of the American professional sport major leagues.

FIGURE 2

TOTAL ANNUAL REVENUES OF PROFESSIONAL SPORT MAJOR LEAGUES- EUROPE *VS.* USA (millions of euros and growth rate in percentage)



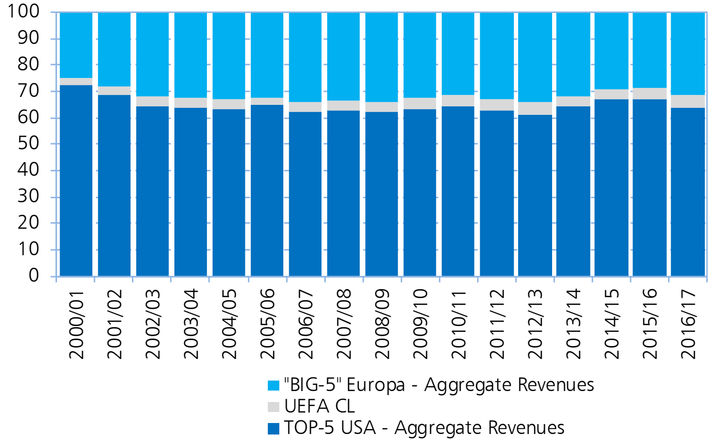
Sources: Deloitte Football Money League (1997-2018); Deloitte Annual Report of Football Finance (2005-2018); www.Statista.com; UEFA's financial accounts.

In spite of its undoubted interest, to examine the factors explaining the levels and evolution of annual revenues in these leagues is beyond the scope of the present article. Other works will surely estimate to which extent divergencies in economic results of sports competitions owe to differences in the competition structures prevailing in one or the other model. There is also abundant bibliography on this issue: actually, football's competitive structure organization falls within the broader discussion of the organisational model of sports competitions (*Cf.:* Hoehn and Szymanski (1999) and Andreff (2011), for instance).

In order to facilitate comparison across major professional leagues in Europe and the US, Figure 3 shows the yearly evolution of market shares (as a percentage of the aggregated amount of annual revenues of the eleven leagues considered: the five most important in each continent, plus the UEFA Champions League).

FIGURE 3

"BIG-5" EUROPEAN FOOTBALL LEAGUES *VS.* "TOP-5" US LEAGUES COMPARATIVE STATUS (percentage of total revenues)



Sources: Deloitte Football Money League (1997-2018); Deloitte Annual Report of Football Finance (2005-2018); www.Statista.com; UEFA's financial accounts.

The analysis of Figure 3 makes some conclusions to stand out more clearly. For instance, the fact that not even including UEFA Champions League's revenue in the aggregated amount for Europe would such amount come close to the sum of revenues of the US leagues.

Having described the context and the literature related to the matters we are dealing with, we now present in next section the variables used for the empirical analysis.

III. ANALYSIS OF DATA AND VARIABLES

This section describes the variables upon which the empirical analysis is carried out, as well as the main descriptive statistics of such variables.

1. Presentation of Variables

For the empirical analysis we use yearly information of clubs playing in the first division of professional football in four of the five major European domestic leagues: Spain (La Liga), France (Ligue 1), England (Premier League), and Italy (Serie A). Our database therefore includes data of twenty teams and seven seasons from each competition; provided that, in a couple of cases, there is no information on wages, our analysis includes a total of 558 observations. (German Bundesliga is excluded from the econometric analysis, since there is no available information on wages from the clubs. However, given its interest, this league is included in the descriptive analysis that follows).

Our dependent (response) variable is a measure of the degree of media visibility enjoyed each season by teams playing in the four aforementioned major leagues. The media visibility index has been elaborated using the approach proposed by MERIT (Methodology for the Evaluation and Rating of Intangible Talent), whose detailed description may be consulted in: www.meritsocialvalue.com. This methodology evaluates the level of media exposure enjoyed by the protagonists of the sporting spectacle (players, teams, competitions, etc.), thus providing an assessment of the potential economic value generated by talent in sports industries.

Media exposure indexes are calculated on the basis of the degree of attention payed by professional journalists and the general public, which is captured by recording the number of news related to a given individual having appeared in the media throughout the world. Measurements are made at specific times during the season, counting the news articles generated in a given period, which in the case of football has a monthly frequency.

The MERIT index values are expressed in relation to the average of the 2,500 players with highest media profile out of a database including more than 5,000 football players. Specifically, the index value of each player is the factor by which the number of news related to that individual multiplies those dedicated to the representative (average) player of the sample each season. By applying a procedure of simple aggregation, based on individual measurements, media exposure indexes for groups or collectives such as clubs or domestic leagues may be obtained. Specifically, the MERIT index for clubs is calculated by adding the individual indexes of the fifteen players with highest media profile in the squad.

One of the strengths of this methodology lies in the fact that sportsmen compete on equal terms in the global media showcase of the sporting events industry. Furthermore, homogeneity of measurement criteria legitimates comparisons of media status across individuals, teams, or institutions of various sporting disciplines (see, for instance, Garcia-del-Barrio [2018], who applies this methodology to the comparison of two very different sports: football and Formula 1).

The main explanatory variables include: wages bill by season (on one hand, the relative wage as a ratio of the total of a league; on the other hand, aggregate wages of each league as a ratio of the total sum of the sample); the ELO index, which is also considered for each club and season; as well as three indicators of the amount of points achieved by the end of the competition, also provided for each league and season. Data on clubs' wages come mostly from *Deloitte Football Money League (1997-2018)* and *Deloitte Annual Report of Football Finance (2005-2018);* other data come from the clubs' financial accounts, which are gathered in databases such as Sabi, Aida, Amadeus and Hoovers. For our part, we have made every effort to achieve the greatest possible homogeneity in the data used.

In this study, clubs' wages may be interpreted as proxy variable of talent (either sporting skills or other qualities), since, as in any labour market, higher productivity is associated to higher retribution. At the same time, the wage bill plays a key role in the hiring of players. Football players belong indeed to a peculiar kind of workers, since some of them stand out for their exclusive and non-replicative skills, which afford them greater bargaining power. Moreover, a relevant aspect when it comes to hiring talent in the current sports industry is that –together with sporting talent– skills unrelated to sport are also important and appreciated by the public. Previous studies have already highlighted on this issue: Garcia-del-Barrio and Pujol (2007); Franck and Nuesch (2012); and Korzynski and Paniagua (2016).

Efforts made to gather information on annual wages enable us to calculate two explanatory variables, the distinction of which is going to be very useful to interpret the findings. On one hand, we are interested in measuring the degree of relative talent in each of the five leagues; on the other hand, we are also able to measure the degree of talent concentration in each team playing in each of these domestic leagues.

As for the ELO ranking system, like that introduced by FIFA on June 10th 2018 as classification method for national football teams, it is based on the sporting attainments achieved in the past. In our case, the ELO ranking used is the one for football clubs.[6] By using this variable, we intend to seize the sporting status of clubs, which depends on factors such as the domestic market size and previous sporting outcomes.

Finally, the alternative competitive balance indicators used in the empirical analysis are derived from the points achieved by teams each season.[7] The

[6] This procedure owes its original design to Emmerich Elo, a physicist of Austro-Hungarian origin, and became popular when it was adopted in 1970 to elaborate the chess players ranking.

[7] As for revenue generation capacity, there is a traditional debate in economic literature on the impact generated by the degree of uncertainty over competition outcomes on the interest aroused among supporters. In a classical article, Neale (1964) relates the degree of competitive balance to uncertainty over outcomes, having opened a debate that has led to several subsequent studies: Humphreys (2002) proposes alternative measurements of competitive balance for various sport disciplines; Pawlowski and Anders (2012) examine the effect of uncertainty over outcomes on attendance to stadiums; Flores, Forrest and Tena (2010) study the impact generated by changes in the degree of competitive balance on football players labour market… Other studies on the subject in the context of European football include: Késenne (2000), Szymanski (2001), and, more recently, Andreff and Scelles (2015).

following indicators are considered: entropy index, Herfindahl index, and standard deviation; all of them drawn from the points of each team by the end of the season. In a following section we will explain how is this estimate made.

2. Descriptive Study of Variables

Table 1 shows the MERIT visibility ranking of the football clubs with highest media profile, for a period stretching from 2009-2010 to 2015-2016 seasons. Table 1 informs of some trends, like the concentration of media attention on just few clubs . In fact, as can be seen, only clubs playing in the Premier League stand out for their media visibility, together with the major clubs of La Liga (Real Madrid and Barcelona), Bundesliga (Bayern Munich), and Serie A (Juventus). Some other clubs, like the PSG from French Ligue 1, have recently succeeded in making a leap forward in terms of media visibility; something they reached by means of a forceful signing policy. The media status of these major institutions is evidently growing with time, a trend that contrasts with that of other clubs, whose media profile has remained stable, or even diminished.

Table 2 shows the descriptive statistics of some significant variables, providing information disaggregated by league (and by season for the two key variables). Disaggregated data by league reveals that the English Premier League pays much higher wages than any other competition, whereas media visibility levels are about similar to those observed in the Spanish La Liga.

TABLE 1

"MERIT" INDEX OF MEDIA VISIBILITY – ANNUAL EVOLUTION AND PERIOD AVERAGE (2009-2010 TO 2015-2016) – "BIG-5" DOMESTIC PROFESSIONAL FOOTBALL LEAGUES

Rank	*TEAM*	*LEAGUE*	*2009 2010*	*2010 2011*	*2011 2012*	*2012 2013*	*2013 2014*	*2014 2015*	*2015 2016*	*Average*
1	Real Madrid	La Liga	138.5	128.4	159.6	134.7	161.9	170.3	192.0	155.06
2	FC Barcelona	La Liga	145.1	140.6	188.6	109.7	116.1	160.2	223.7	154.86
3	Manchester Utd.	Premier League	140.3	88.2	70.4	86.9	84.1	105.2	104.9	97.14
4	Chelsea	Premier League	134.7	56.2	82.7	91.1	70.9	81.5	76.1	84.72
5	Arsenal	Premier League	52.7	51.4	52.2	49.5	52.1	56.8	97.4	58.88
6	Manchester City	Premier League	64.5	53.2	63.5	48.4	43.1	61.8	67.4	57.42
7	Liverpool	Premier League	83.8	45.5	57.3	44.1	53.9	44.3	69.6	56.92
8	Bayern Munich	Bundesliga	9.7	29.4	61.6	93.2	78.4	41.1	69.8	54.72
9	Juventus de Turin	Serie A	53.6	35.5	45.7	57.6	48.2	36.6	74.1	50.18
10	AC Milan	Serie A	66.8	69.8	88.8	36.5	40.6	10.7	14.4	46.80
11	Inter de Milan	Serie A	87.1	60.7	57.9	36.7	24.6	10.7	15.2	41.84
12	Atlético Madrid	La Liga	32.5	32.3	39.8	44.6	61.6	20.5	25.4	36.68

TABLE 1 *(continued)*

"MERIT" INDEX OF MEDIA VISIBILITY – ANNUAL EVOLUTION AND PERIOD AVERAGE (2009-2010 TO 2015-2016) – "BIG-5" DOMESTIC PROFESSIONAL FOOTBALL LEAGUES

Rank	*TEAM*	*LEAGUE*	*2009 2010*	*2010 2011*	*2011 2012*	*2012 2013*	*2013 2014*	*2014 2015*	*2015 2016*	*Average*
13	AS Roma	Serie A	43.5	43.6	42.2	33.7	31.3	19.4	24.3	33.99
14	Paris St-Germain	Ligue 1	4.6	8.4	20.1	47.2	35.1	26.1	70.0	30.21
15	Tottenham	Premier League	27.4	37.6	34.1	41.9	13.9	12.8	36.1	29.12
16	SSC Napoles	Serie A	14.0	26.1	57.0	46.6	28.4	13.0	9.0	27.74
17	Valencia CF	La Liga	49.7	24.4	39.7	27.1	20.4	10.9	13.1	26.47
18	Borus.Dortmund	Bundesliga	8.9	20.3	21.2	62.9	24.2	12.6	23.0	24.74
19	Everton	Premier League	20.4	21.2	18.4	22.6	20.1	11.8	32.8	21.05
20	Sevilla	La Liga	34.2	18.6	25.0	20.8	21.9	8.0	10.9	19.92
21	Schalke 04	Bundesliga	30.7	25.4	35.0	22.8	10.6	6.5	8.2	19.90
22	Lazio	Serie A	6.8	19.7	22.4	23.9	16.3	8.4	13.9	15.91
23	Fiorentina	Serie A	13.5	17.0	17.8	17.4	22.7	12.0	8.0	15.50
24	Sunderland	Premier League	9.4	16.9	18.5	16.5	13.2	6.6	14.7	13.68
25	Athletic de Bilbao	La Liga	8.2	20.6	37.3	12.9	5.1	5.4	5.5	13.57
26	Málaga CF	La Liga	7.8	11.0	29.0	14.0	11.3	9.3	10.7	13.30
27	Udinese	Serie A	9.6	20.3	19.6	15.2	14.5	6.6	4.3	12.89
28	Aston Villa	Premier League	10.7	16.4	15.8	14.4	6.6	7.3	12.0	11.89
29	Olympique Lyon	Ligue 1	16.0	20.8	16.5	10.9	2.2	7.9	7.1	11.63
30	OlympiqueMarsella	Ligue 1	9.8	16.2	14.4	21.3	3.9	6.9	5.8	11.18
31	Vfl Wolfsburg	Bundesliga	14.0	14.2	11.5	6.9	12.4	8.6	10.2	11.12
32	Werder Bremen	Bundesliga	19.6	15.0	13.1	12.7	6.9	4.5	3.8	10.81
33	Bayern Leverkusen	Bundesliga	11.9	15.1	14.9	8.0	10.6	4.4	9.2	10.58
34	Genoa	Serie A	4.7	18.2	14.4	21.7	5.9	4.7	4.0	10.52
35	VfB Stuttgart	Bundesliga	14.6	11.4	10.2	11.1	10.1	5.0	6.8	9.88
36	Stoke City	Premier League	4.5	7.7	16.7	11.5	13.2	5.6	8.3	9.63
37	Hamburger SV	Bundesliga	12.9	12.8	12.6	11.9	6.7	4.7	3.8	9.34
38	OSC Lille	Ligue 1	6.8	13.3	13.6	20.3	3.1	4.1	2.8	9.13
39	Getafe CF	La Liga	7.7	10.5	10.4	13.7	10.5	5.3	3.5	8.82
40	RCD Espanyol	La Liga	0.3	13.7	20.4	10.5	4.8	8.8	0.1	8.39
41	B.Monchengladbach	Bundesliga	3.5	6.6	14.2	10.6	5.5	5.9	7.3	7.64
42	Hannover 96	Bundesliga	3.7	9.2	18.2	8.5	4.4	4.0	3.8	7.41
43	TSG Hoffenheim	Bundesliga	7.0	8.0	12.4	11.0	5.4	3.7	3.2	7.24
44	FSV Mainz 05	Bundesliga	4.3	9.1	7.2	8.8	8.3	4.9	4.5	6.73
45	Girondins Bordeaux	Ligue 1	13.7	6.8	7.9	4.5	1.1	2.7	2.9	5.65
46	Chievo Verona	Serie A	2.2	8.5	9.9	7.8	3.9	3.4	2.9	5.51
47	HSC Montpellier	Ligue 1	2.0	4.1	11.3	12.5	1.6	2.8	3.7	5.41
48	AS Saint-Etienne	Ligue 1	3.4	5.0	4.3	9.3	2.2	4.5	4.8	4.78
49	FC Toulouse	Ligue 1	5.1	3.6	5.3	8.8	3.3	3.1	3.0	4.60
50	FC Lorient	Ligue 1	3.7	5.2	4.7	3.5	1.3	3.9	3.5	3.68

Source: MERIT data collection: www.meritsocialvalue.com

TABLE 2

DESCRIPTIVE STATISTICS OF THE MAIN VARIABLES

	N.	*Mean*	*Std. Dev.*	*Min.*	*Max.*
Media Visibility					
TOTAL	560	19.39654	29.67185	0.13	223.68
By Season					
2009-2010	80	20.06762	33.22802	0.32	145.10
2010-2011	80	20.45887	24.50752	0.47	140.55
2011-2012	80	23.00525	30.82988	1.48	188.56
2012-2013	80	20.43975	23.97724	1.16	134.73
2013-2014	80	17.96825	25.74800	0.59	161.87
2014-2015	80	15.03025	29.60925	1.47	170.30
2015-2016	80	18.80575	37.71482	0.13	223.68
By Domestic League					
La Liga	140	26.84079	44.98978	0.13	223.68
Ligue 1	140	6.13242	8.42768	0.47	70.00
Premier L	140	27.36314	28.75458	2.31	140.33
Serie A	140	17.24979	17.80904	1.16	88.84
Annual Wages					
TOTAL	558	67,881.32	67,972.29	7,648.0	340,367.0
By Season					
2009-2010	79	57,851.26	52,993.19	10,384.2	234,019.0
2010-2011	79	59,218.60	53,622.39	9,731.4	231,868.0
2011-2012	80	62,399.78	55,453.10	12,258.3	250,278.3
2012-2013	80	63,087.97	59,285.26	8,916.0	271,988.1
2013-2014	80	68,101.09	64,072.04	10,038.4	269,500.0
2014-2015	80	75,783.27	75,954.96	10,908.8	340,367.0
2015-2016	80	88,493.65	98,877.87	7,648.0	630,000.0
By Domestic League					
La Liga	139	56,007.18	82,799.43	8,916.0	630,000.0
Ligue 1	140	44,485.51	43,733.97	7,648.0	292,394.0
Premier L	139	111,364.30	68,699.42	27,243.8	322,940.0
Serie A	140	59,894.13	49,619.68	13,000.0	234,019.0
ELO rank					
TOTAL	560	1,678.020	118.0616	1,376	2,087
By Domestic League					
La Liga	140	1,750.329	122.1454	1,545	2,087
Ligue 1	140	1,620.479	91.4222	1,376	1,888
Premier L	140	1,706.900	108.4392	1,506	1,955
Serie A	140	1,634.371	98.2774	1,414	1,930

TABLE 2 *(continued)*

DESCRIPTIVE STATISTICS OF THE MAIN VARIABLES

	N.	Mean	Std. Dev.	Min.	Max.
Entropy					
TOTAL	560	294.9110	1. 067075	292.3367	296.8359
By Domestic League					
La Liga	140	294.3257	0.9137939	292.3367	295.2648
Ligue 1	140	295.9000	0.5893461	295.0275	296.8359
Premier L	140	294.5853	1.1204690	293.1609	296.7657
Serie A	140	294.8329	0.8355213	293.2906	295.8215
Herfindahl (HHI)					
TOTAL	560	5.480367	0.1149321	5.256936	5.747995
By Domestic League					
La Liga	140	5.569552	0.0846747	5.474625	5.747995
Ligue 1	140	5.368756	0.0615650	5.256936	5.463727
Premier L	140	5.504551	0.1125794	5.293052	5.631776
Serie A	140	5.478608	0.0913149	5.382925	5.657483
Standard Deviation (SD)					
TOTAL	560	1.578402	0.1922532	1.162881	1.984142
By Domestic League					
La Liga	140	1.726888	0.1249600	1.580514	1.984142
Ligue 1	140	1.388062	0.1191969	1.162881	1.562263
Premier L	140	1.618369	0.2415144	1.241925	1.823497
Serie A	140	1.580289	0.1477603	1.419646	1.860225

Sources: Deloitte Football Money League (1997-2018); Deloitte Annual Report of Football Finance (2005-2018); Clubs' financial accounts; Other databases: Sabi, Aida, Amadeus and Hoovers.

Analysis of Table 2 also suggests that the sporting status of football clubs in the Spanish league (measured by the ELO ranking) is higher than that of clubs playing in all other domestic leagues considered. As for the competitive (im)balance across leagues, differences do not seem to be too sharp, as proved by the fact that no league simultaneously shows the greatest level of competitive balance according to all three measurements used: entropy, Herfindahl Index (HHI), and standard deviation (SD).

Given the importance of information on wages in our study, Table 3 includes more detailed information about the annual wage bill in the five major domestic leagues starting from the 1995-1996 season, period for which homogeneous information is available.[8]

[8] To facilitate comparisons, Premier League's annual wages are expressed in euros, which leads to apparent oscillations, like that suggested by the wages drop in the 2016-2017 season, which in fact owes to the evolution of exchange rate for the pound against the euro.

TABLE 3

ANNUAL WAGES: ABSOLUTE VALUES AND AS A PERCENTAGE OF TOTAL REVENUES – "BIG-5" DOMESTIC PROFESSIONAL FOOTBALL LEAGUES

Annual wages (Mill. €)	*Total Big-5*	*Ligue 1*	*Serie A*	*La Liga*	*Bundesliga*	*Premier League*
1995-1996	1,046	161	256	175	187	267
1996-1997	1,285	178	317	230	223	337
1997-1998	1,690	222	417	303	278	470
1998-1999	2,046	273	512	342	317	602
1999-2000	2,483	324	660	390	382	727
2000-2001	3,098	414	868	491	447	878
2001-2002	3,653	441	1010	559	553	1,090
2002-2003	3,608	467	884	607	556	1,094
2003-2004	3,692	450	845	608	580	1,209
2004-2005	3,663	437	830	658	576	1,162
2005-2006	*3,964*	541	806	739	608	1,270
2006-2007	4,223	619	722	822	620	1,440
2007-2008	4,811	703	972	900	725	1,511
2008-2009	5,116	722	1,093	939	803	1,559
2009-2010	5,516	791	1,186	942	946	1,651
2010-2011	5,600	789	1,143	997	901	1,771
2011-2012	6,099	842	1,190	1,073	954	2,040
2012-2013	*6,212*	856	1,194	1,041	1,029	2,092
2013-2014	6,773	959	1,202	1,210	1,126	2,276
2014-2015	7,440	953	1,291	1,280	1,246	2,670
2015-2016	8,224	1,019	1,343	1,476	1,341	3,045
2016-2017	8,510	1,078	1,380	1,680	1,478	2,894
Wages / Annual Revenues (%)	*Total Big-5 (%)*	*Ligue 1 (%)*	*Serie A (%)*	*La Liga (%)*	*Bundesliga (%)*	*Premier League (%)*
1995-1996	52.2	58.1	56.6	47.8	50.1	50.0
1996-1997	51.5	60.8	57.5	43.9	50.2	49.2
1997-1998	57.3	68.7	64.2	53.3	54.2	52.5
1998-1999	61.6	69.5	71.7	55.9	54.9	58.8
1999-2000	59.4	53.4	69.2	54.0	56.1	59.6
2000-2001	64.8	64.3	84.5	72.6	50.8	56.4
2001-2002	69.9	68.6	99.3	72.0	53.0	62.4
2002-2003	65.9	67.8	84.8	71.7	50.2	61.1
2003-2004	64.8	68.7	80.3	63.8	54.8	61.2
2004-2005	59.5	62.8	68.1	63.9	46.6	58.8
2005-2006	60.7	59.5	63.1	63.8	50.9	63.7
2006-2007	60.2	63.7	67.9	62.0	45.0	63.4
2007-2008	62.3	71.1	68.4	62.6	50.4	61.9
2008-2009	64.4	68.9	73.2	62.6	51.0	67.0
2009-2010	65.7	73.7	77.4	57.3	56.8	66.6
2010-2011	65.3	75.9	73.6	58.0	51.6	70.4
2011-2012	65.6	74.0	75.0	60.0	51.0	70.0
2012-2013	63.4	66.0	71.0	56.0	51.0	71.0
2013-2014	59.9	64.0	70.7	62.6	49.5	58.4
2014-2015	61.7	67.2	72.1	62.3	52.1	60.7
2015-2016	61.3	68.6	70.1	60.6	49.4	62.6
2016-2017	58.0	65.6	66.5	58.9	52.9	54.6

Sources: Deloitte Football Money League (1997-2018); Deloitte Annual Report of Football Finance (2005-2018); Clubs' financial accounts; Other databases: Sabi, Aida, Amadeus and Hoovers.

Furthermore, since the figures are affected by current financial fair-play UEFA regulations, Table 3 also shows annual wages (average of the twenty clubs in each first division league) as a percentage of annual total revenues (twenty clubs average as well) in each domestic league.

Then, Table 4 includes the wage bill of each domestic league as a percentage of the aggregated sum of wages in all “Big-5” football leagues, thus providing the comparative positioning of each domestic competition.

TABLE 4

WAGES IN EACH LEAGUE AS A PERCENTAGE OF THE AGGREGATE WAGE BILL OF THE FIVE MAJOR (BIG-5) DOMESTIC LEAGUES

League’s Wages / Aggregate "Big-5"Wages (%)	*Total Big-5 (%)*	*Ligue 1 (%)*	*Serie A (%)*	*La Liga (%)*	*Bundesliga (%)*	*Premier League (%)*
2009-2010	100	14.3	21.5	17.1	17.2	29.9
2010-2011	100	14.1	20.4	17.8	16.1	31.6
2011-2012	100	13.8	19.5	17.6	15.6	33.4
2012-2013	100	13.8	19.2	16.8	16.6	33.7
2013-2014	100	14.2	17.7	17.9	16.6	33.6
2014-2015	100	12.8	17.4	17.2	16.7	35.9
2015-2016	100	12.4	16.3	17.9	16.3	37.0
2016-2017	100	12.7	16.2	19.7	17.4	34.0

Sources: Deloitte Football Money League (1997-2018); Deloitte Annual Report of Football Finance (2005-2018); Clubs’ financial accounts; Other databases: Sabi, Aida, Amadeus and Hoovers.

This information is important, and will be used for one explanatory variable of our empirical model (in this case, we show information from the 2009-2010 season on, which is the first season whose figures are recorded in the database of our study).

Supremacy of the Premier League is again observed, as its aggregated wages are much higher than those in all other major leagues; moreover, the gap seems to increase with time. However, strong concentration of media visibility on just a few big clubs –in competitions other than the Premier League– suggests the importance of considering a more disaggregated analysis to address these issues.

As pointed out before, the debate over competitive balance or imbalance, which in turn depends on clubs’ budget balance or imbalance, is a traditional subject in economic literature. In our approach to the problem, we are going to resort to three alternative measurements of sporting performance dispersion.

IV. ECONOMETRIC ANALYSIS

The following model specification is considered:

$$\ln(vm_{ijt}) - \ln(\overline{vm_t}) = \beta_0 + \beta_1 \frac{w_{jt}}{w_t} + \beta_2 \frac{w_{ijt}}{w_{jt}} + \beta_3 \widehat{DC}_{jt} + \beta_4 \widehat{DC}_{jt}^2 + \beta_5 ELO_{it} + u_{ijt} [1] \qquad [1]$$

where subscripts i, j and t respectively refer to club, domestic competition, and season. In this case, data availability allows to consider only four of the five major European football leagues: English Premier League, Spanish La Liga, French Ligue 1, and Italian Serie A. Observations on these leagues cover the period stretching from the 2009-2010 season to the 2015-2016 season. Our dependent variable is a measure of the media visibility of clubs, *vm,* whose calculation procedure has already been described.

Then, explanatory variables include: w, which corresponds to the annual wage bill; $\widehat{DC}$, representing an estimate of competitive imbalance; and *ELO,* which is the *ELO* ranking of the club. Components u and β_i for i=0,…,5 are, respectively, the stochastic error term and the parameters to be estimated.

It must be noted that the dependent variable in expression [1] is measured in terms of deviation from average, which enables to control the possible tendency trend of this variable. On the other hand, given the nature of our explanatory variables, they by definition, cannot show any trend, since their values have always an upper bound.

For the estimate of competitive imbalance in each the leagues, provided a n number of teams in the first division of each league and a proportion of points over the total equal to p_i, three alternatives have been considered: (1) the entropy index: $100 * \sum_{i=1}^{n} (-p_i * \log(p_i))$; (2) Herfindahl index (HHI): $\sum_{i=1}^{n} p_i^2$; and (3) standard deviation (SD) of p_i. In all cases, a higher index value implies higher concentration of the number of points in that competition, and, therefore, greater competitive imbalance.

Interpretation of model [1] suggests that a club's media visibility depends on the relative quality of the competition, which is approximated by weighting its wage bill as a ratio of the aggregate wage bill of all leagues; on the relative quality of the club in the domestic competition it participates in, also approximated by the ratio of its annual wage bill divided by the aggregate wage bill of the competition; on competitive imbalance; and on the ELO index. This last variable is interpreted as a club status indicator, highly correlated with variables such as its past sporting performance or the size of the city where it plays (*Cf.:* Buraimo, Forrest and Simmons, 2007).

Our hypothesis is that a club's media visibility positively depends on the quality of the league it plays in ($\beta_1>0$), as well as on the relative quality of the club itself within that competition ($\beta_2>0$). As for the competitive imbalance variable, the three proposed measures are expected to have a positive impact on media visibility, since they render competition outcomes less foreseeable. In his classical article, Rottemberg (1956) accounts for this idea, known as the uncertainty-of-outcome hypothesis. However, researchers have attempted to verify this hypothesis, with varying results; see, for instance, Peel and Thomas (1992), Forrest *et al.* (2005), and Hogan, Massey and Massey (2017), in relation to stadium attendance; and Buraimo and Simmons (2009) in relation to television audience analysis. As far as we know, there are no previous studies on the impact of competitive imbalance on the media visibility of teams. Nevertheless, it is only logical to think that, as in the cases of stadium attendance and television audience, the influence of this variable on media visibility remains uncertain. Given that model ([1]) allows competitive balance impact to be linear, we have no initial hypothesis on the sign of parameters β_3 and β_4. Finally, ELO index is expected to have a positive impact on our response variable: $\beta_5>0$.

Table 5 shows the results of model [1] estimated by means of the Ordinary Least Square procedure. We have considered a robust estimate of the variance of the parameters, to take into account possible heteroscedasticity and serial correlation; see Rogers (1993). According to our estimates, in line with previous literature, measures of competitive imbalance do not have an obvious significant effect on media visibility, regardless of the variable used to measure the imbalance. Regarding the ELO indicator (of clubs' status) logically has a positive effect on media visibility.

As for our other two variables of interest –relative quality of the league and of the club–, they are significant in all cases. This suggests, on one hand, the possibility of having an impact on the media exposure of a club by modifying the quality of its players, and, on the other hand, the limit imposed to that effect by the relative quality of the national competition in which the club plays. Thus, two clubs of similar quality could generate very disparate media attention if they compete in different leagues. This is a key finding of our study, which will be more thoroughly examined in the rest of the Section.

A key aspect of discriminant analysis is to explain the existing differences in the media attention sparked by different leagues. One possible reason is that such divergences simply owe to different resources allocations; that is, quality

TABLE 5

DETERMINANTS OF MEDIA VISIBILITY OF CLUBS IN THE FIVE MAJOR ("BIG-5") DOMESTIC PROFESSIONAL FOOTBALL LEAGUES IN EUROPE

	(1)	*(2)*	*(3)*
ENTROPY	25.24 (1.41)		
ENTROPY SQUARED	-0.04 (1.41)		
HHI		42.65 (1.41)	
HHI SQUARED		-3.79 (1.37)	
SD			4.75 (1.49)
SD SQUARED			-1.31 (1.27)
RELATIVE QUALITY LEAGUE	3.21*** (6.14)	3.25*** (6.18)	3.26*** (6.26)
RELATIVE QUALITY CLUB	8.66*** (6.96)	8.80*** (7.08)	8.76*** (7.03)
ELO INDEX	0.004*** (6.04)	0.004*** (5.82)	0.004*** (5.84)
Constant	-371.00 (1.41)	-127.62 (1.538)	-11.99*** (4.77)
Number of Observations	558	558	558
R-squared adjusted	0.7049	0.7044	0.7051

Notes: Absolute values of t statistic in brackets. Dependent variable in natural logarithms and deviations from the average. * $p<0.1$. ** $p<0.05$. *** $p<0.01$.

Sources: Deloitte Football Money League (1997-2018); Deloitte Annual Report of Football Finance (2005-2018); Clubs' financial accounts; Other databases: Sabi, Aida, Amadeus and Hoovers.

of players or club status. If such were the case, the media profile of a club could be increased up to the level of any other club from a different competition by increasing the quality of players, which implies hiring more talented individuals (this is what our proxy variable "relative wages" measures). However, another possible explanation for differences between leagues is to attribute them to differences in the estimated parameters 'beta'; otherwise said, even if values of the explanatory variables of the model were identical in two clubs playing in different leagues, differences in media impact would persist if they compete in leagues with varying media attention. An analytic tool particularly useful for this discussion is the Blinder-Oaxaca decomposition, popularized by Blinder (1973) and Oaxaca (1973). This procedure can be implemented in Stata by means of the the 'Oaxaca' command; *Cf.* Jann (2008).

Forecast of the expected media visibility for each league, included in Table 6, grants the highest values to the Premier League, whereas for the French Ligue 1 our analysis predicts a media visibility significantly lower than the rest. The case of Spanish La Liga may seem surprising, for its media visibility forecast is only slightly superior to that of Italian Serie A, while it falls well below that of Premier League. However, it should be noted that the higher aggregate media visibility of Spanish league is determined by two significant outliers: Real Madrid and Barcelona, which keep with the logic of the "winner-take-all" effect.[9] This implies that, when estimates are made for the league average, its final value is lower than what aggregate data suggest.

TABLE 6

FORECAST OF THE NATURAL LOGARITHM OF MEDIA VISIBILITY IN SOMEMAJOR FOOTBALL LEAGUES

La Liga	*Ligue 1*	*Premier League*	*Serie A*
0.27 (2.80) ***	-0.89 (12.9) ***	0.61 (7.54) ***	0.16 (2.16) **

Notes: Absolute values of z statistic in brackets. * p<0.1; ** p<0.05; *** p<0.01.

The following tables show the result of the aforementioned decomposition in 3 different components: (1) differences in explanatory variables (resources allocation effect); (2) differences in estimated coefficients; and (3) interaction between these two previous effects. In the findings shown, SD has been used as competitive imbalance measure, owing to its better performance in the model in terms of the R^2 statistic.

Estimates of the different components of Blinder-Oaxaca decomposition shown in Tables 7, 8 and 9, reveal that Spanish La Liga has a significantly negative differential with respect to the Premier League, which owes both to a lower level of investment in wages and to a lesser effect of explanatory variables on the dependent variable. Of particular interest is the fact that differences between Spanish La Liga and Italian Serie A are exclusively due to investment differentials, whereas those between Spanish La Liga and French Ligue 1 owe to differences in the estimated parameters. This finding suggests that an Italian club could achieve a media visibility similar to that of a Spanish club by increasing the quality of its players, being quality measured in terms of spending on wages. But the same cannot be said of a French club playing in Ligue 1, whose expected media visibility would be lower than that of a Spanish club even if it reached higher investment levels. The finding is especially relevant to understand the effect of the recent moves made by some major European clubs, such as Juventus (Italy) or PSG (France): whereas the former was in a position to extensively increase its media profile by increasing the quality of its squad, the latter is severely constrained by the lesser attention kindled by the domestic championship it participates in.

[9] The winner-take-all phaenomenon is usual in industries like professional sport or entertainment. Frank and Cook (1995) explain that, in such markets, workers at the top of the income distribution systematically perceive much higher remunerations than other workers only marginally less productive. Rosen and Sanderson (2001) underscore that the problem arises when this phaenomenon becomes widespread, affecting the functioning of a growing number of activities and markets.

The Premier League is the competition with highest expected media visibility. Its supremacy owes both to a better resources allocation and to higher value coefficients in comparison with other leagues (Spanish La Liga and Italian Serie A). The findings elicited highlight the great potential of Serie A, which could actually reach the media attention level of Premier League by increasing the quality of its players.

TABLE 7

BLINDER-OAXACA DECOMPOSITION EFFECT OF DIFFERENCES IN RESOURCES ALLOCATION

	La Liga	*Ligue 1*	*Premier League*	*Serie A*
La Liga		1.37	-1.12	0.39
		(3.26)***	(2.45)**	(2.57)**
Ligue 1			-1.84	0.23
			(3.36)***	(0.40)
PremierLeague				0.33
				(0.53)
Serie A				

Notes: Absolute values of z statistic in brackets. * p<0.1; ** p<0.05; *** p<0.01.

TABLE 8

BLINDER-OAXACA DECOMPOSITION EFFECT OF DIFFERENCES IN ESTIMATED COEFFICIENTS

	La Liga	*Ligue 1*	*PremierLeague*	*Serie A*
La Liga		1.54	-1.81	-0.28
		(3.15)***	(2.75)***	(1.39)
Ligue 1			-5.40	-2.39
			(5.51)	(8.45)***
PremierLeague				-0.99
				(2.32)**
Serie A				

Notes: Absolute values of z statistic in brackets. * p<0.1; ** p<0.05; *** p<0.01.

In summary, the study of causes behind the differences in media attention in four of the "Big-5" major national football leagues leads to the conclusion that there are significant differences, owing to domestic championship features beyond control of each club. Whereas Premier League enjoys a favourable position thanks to an intense media response to the quality increase of its

TABLE 9

BLINDER-OAXACA DECOMPOSITION EFFECT OF THE INTERACTION BETWEEN DIFFERENCES IN ESTIMATED COEFFICIENTS AND EXPLANATORY VARIABLES

	La Liga	*Ligue 1*	*PremierLeague*	*Serie A*
La Liga		0.99	2.59	-0.01
		(1.56)	(3.29) ***	(0.03)
Ligue 1			5.74	1.11
			(5.15) ***	(2.30)**
PremierLeague				1.11
				(1.49)
Serie A				

Notes: Absolute values of z statistic in brackets. * p<0.1; ** p<0.05; *** p<0.01.

players, French Ligue 1, at the other end of the scale, is affected by a weak media reaction to the likely quality improvement of the competition.

V. CONCLUSIONS AND FUTURE RESEARCH

A distinctive fact of professional sports industry, in comparison with other economic sectors, is the importance of media visibility for the value of its productive activity. In this paper we have examined some of the factors that determine the media visibility in four of the five major domestic football leagues in Europe.

The findings of our analysis show that both individual talent within a club and aggregate talent in the domestic competition in which the club participates are essential to explain media visibility. This result has obvious policy implications, since it enables –on the one hand– to appraise the degree of responsiveness of public attention to the club's expenditure in signing players, and –on the other hand– helps to differentiate the relevance of a club's individual decisions from those made by the competition in which it participates. This last question is particularly important to appraise the chances of successful investment of a club not belonging to any of the major domestic competitions.

The present study opens up new avenues for future research. Specifically, an interesting issue to be examined is why certain domestic competitions are more appealing to the public than others. Doubtlessly, consideration of media visibility may be useful to answer such question. Another possible contribution from future research would be to analyse to what extent media attention may be focused on only a few clubs within a competition, as well as if such a concentration could harm its own brand image in the long run.

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PRODUCTIVITY AND ITS DETERMINANTS IN THE UEFA CHAMPIONS LEAGUE COMPETITION

Manuel ESPITIA-ESCUER[1]

Lucía Isabel GARCÍA-CEBRIÁN

Ramón SALA-GARRIDO

Abstract[2]

In the present study, results of the international sport competition UEFA Champions League are analyzed from the perspective of productivity of the participant teams. The analysis covers the period stretching between the seasons 2014-2015 and 2017-2018. Efficient frontier analysis will be employed as methodology, which enables to determine, among all participants, the group of teams achieving highest productivity values, given the available resources. Efficient teams are therefore a model for all other teams, which may identify the aspects to be improved in order to reach the level of the most productive teams. Variables pertinent to game development are considered in the analysis, including desirable and undesirable outputs from a competitive perspective.

Keywords: efficiency analysis, DEA, productivity, Malmquist-Luenberger index, football teams.

JEL classification: M10, Z20.

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[2] Article translated from the Spanish by Ciro Arbós.

I. INTRODUCTION AND MOTIVATION

From the point of view of production and productive processes, the output of the activity performed by football teams is obtained at the time of the game, whereas activities programmed for all other working days consist in trainings, practices, trials, and tests. Such output is obtained in a 90 minutes competition between two teams of eleven players. It is thus a human resources intensive activity, whose use is regulated, implying a high degree of specialization for the fulfillment of assigned tasks and performed in a space shared by the players of rival teams, which obviously have conflicting objectives. The particular technology of each team is incorporated by means of its management, trainings, preparations for games, lineups design, and game direction by the technical staff and by players interpreting the coach's orders and carrying them out in the course of the game.

In the world of football, individual performance of players is often measured by simple ratios, such as *Most Valuable Player* (MVP)[3], whose statistics are published by CIES. Individual performance is also often assessed through the quotient:

$$Performance = \frac{output}{time} \quad [1]$$

which may be interpreted as a player's effectiveness measurement by registering the number of certain kind of actions (output) performed per minute. In football, the most important action is to score a goal, but actions that consist in assisting teammates so they may score are also necessary.

Taking as example data from a reduced number of players who performed in the first division of the Spanish league during the 2017-2018 season, the equation [1] has been estimated from data shown in Table 1.

Considering findings shown in Table 1, it may be observed at once that the most effective player in terms of goal scoring during the 2017-2018 season was Cristiano Ronaldo, for he shows the highest ratio value. However, if we estimate assists per minute played, using equation 1 as well, we obtain a different result, since Messi is markedly the most effective player, followed by Griezmann.

It should therefore be noted that, when considering more than one output variable for analysis, findings are not robust. Accordingly, a combination of outputs needs to be included when measuring the performance of individual

[3] CIES Football Observatory estimates MVP on the basis of the following variables: Steals, Interceptions, Passes, Ball carrying, Assists, and Shots.

TABLE 1

DATA ON MINUTES, GOALS, ASSISTS, AND PERFORMANCE OF 6 PLAYERS FROM THE FIRST DIVISION OF SPANISH FOOTBALL LEAGUE (2017-2018 SEASON)

Player	*Minutes*	*Goals*	*Assists*	*Goals/Min*	*Assists/Min*
Messi	2,996	34	12	0,01135	0,00401
Cristiano R	2,277	26	7	0,01142	0,00307
Griezmann	2,530	19	9	0,00751	0,00356
Rodrigo	2,695	16	7	0,00594	0,00260
Muriel	1,604	17	2	0,01060	0,00125
William Jose	2,779	15	4	0,00540	0,00144

players. In turn, a ratio estimated by dividing the combined outputs by the time devoted to their realization would not anymore afford a rigorous interpretation. Conversely, the relationship between the combined inputs employed to perform a set of moves may be interpreted as an approach to the proper use of resources. Then we proceed to calculate the performance measure as:

$$Performance = \frac{f(outputs)}{h(inputs)} \qquad [2]$$

which agrees with the intuitive idea of productivity.

Provided that sporting outcomes are assigned to teams, and that individual players appraisals are mostly of technical interest, performance measures for clubs as a whole are also needed. To that end, the quotient presented in [2] could apply, but, besides, numerator could include variables such as fouls committed against the opposing team, offside offences by strikers, and even goals scored by the opposing team, which in no way improve the sport success of the team, but result from its inputs management.

The analysis carried out in the present study refers to teams having participated in the UEFA Champions League in seasons 2014-2015 through 2017-2018. Its interest lies in the fact that it is an international tournament in which there may be a certain homogeneity between participating clubs, since they have all achieved positive results in their domestic competitions. Estimates are made on the basis of games played both in the group stage and the elimination rounds. The number of teams participating in the group stage are 32, distributed in eight groups where each team plays home and away against the other three teams. Elimination rounds are also played according to the home and away games system, except for the single-match final. A total of 250 games are played by season; teams that do not get past the group stage play six games, whereas finalists play up to thirteen (www.uefa.com).

TABLE 2

GENERAL COMPETITION RESULTS BY SEASON, FROM 2014-2015 TO 2017-2018

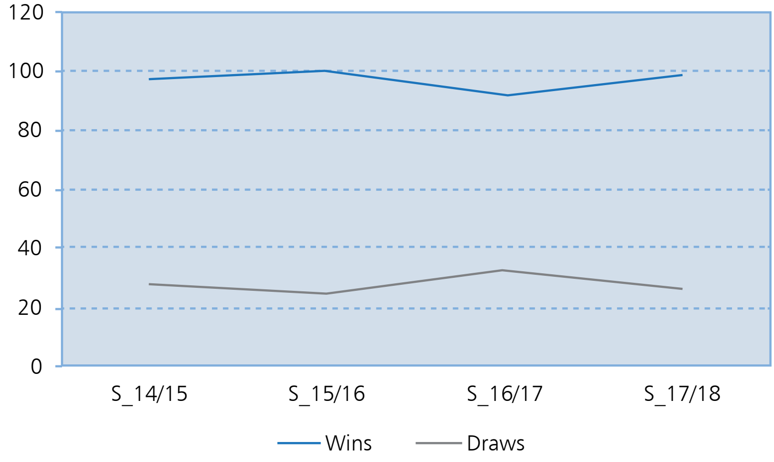
14-15 Season	*Games Played*	*Wins*	*Losses*	*Draws*	*Goals For*	*Goals Against*
Total	250	97	97	56	361	361
Max	13	11	5	4	33	24
Min	6	0	0	0	1	5
15-16 Season	*Games Played*	*Wins*	*Losses*	*Draws*	*Goals For*	*Goals Against*
Total	250	100	100	50	347	347
Max	13	9	6	4	30	21
Min	6	0	1	0	1	6
16-17 Season	*Games Played*	*Wins*	*Losses*	*Draws*	*Goals For*	*Goals Against*
Total	250	92	92	66	380	380
Max	13	9	6	5	36	24
Min	6	0	1	0	0	2
17-18 Season	*Games Played*	*Wins*	*Losses*	*Draws*	*Goals For*	*Goals Against*
Total	250	99	99	52	401	401
Max	13	9	6	5	41	19
Min	6	0	1	0	1	4

As can be seen in Table 2, the 2015-2016 season shows the highest number of wins, whereas the highest number of goals was scored in the 2017-2018 season, when the highest scoring team achieved its top results; seasons 2014-2015 and 2016-2017 show the highest number of goals scored. The highest number of draws occurred in the 2016-2017 season, which could be interpreted as a greater balance between teams, since less wins occurred, whereas the top winning team won the highest number of games in the 2014-2015 season. The competition winner usually shows the highest number of wins each season, between nine and eleven in the seasons considered.

As for undesirable outputs, the number of games lost (whose value is equal to that of games won) has fluctuated around 100, having dropped to a minimum of 92 in the 2016-2017 season; losses in the rest of seasons considered amount to 97, 100, and 99.

FIGURE 1

RESULTS EVOLUTION BY SEASON. WINS (LOSSES) AND DRAWS



Provided that a win generates higher output in any match, data observed in Figure 1 do not seem to suggest output improvement throughout the seasons considered. This finding may owe to the fact that output volume is limited by game, since there is a regulated upper bound that remains constant. Advance to next round is determined by points in the group stage and by wins in the elimination round, or else by the number of goals scored in cases of equal points or draw. Equality in the output obtained distinguishes this sector from other economic sectors, where technology incorporated as capital asset is essential to increase output over time, a situation that does not apply to the labor-intensive technology used by football teams.

Productivity analysis in the Champions League competition is of considerable interest, since behavioral patterns may be drawn from that could advise changes in the activity planning of clubs. Resources consumed to achieve a certain sporting output are relevant, for, in spite of the popular belief that there is no limit to the use of financial resources to acquire all sorts of other resources, the signing of quality players is not only restricted by the limited capacities of clubs, but also by financial Fair Play programs implemented by UEFA regulations.

The present analysis focuses on evaluating productivity changes in teams participating in the UEFA Champions League (UCL), in the presence of undesirable outputs. Among outputs generated by the competitive system of football games, we find the so-called undesirable outputs for teams, that is, undesired results obtained in the competition. Games lost are a good example of undesirable output, as they fail to provide income to the team. Malmquist-Luenberger Productivity Index (MLPI), instead of the traditional Malmquist Productivity Index (MPI), has been employed for analysis. The study is structured as follows: after introduction, methodology is presented in next section, and then findings in the subsequent section, followed by a closing conclusions and recommendations section.

II. METHODOLOGY

The intuitive idea of productivity is represented by the quotient between the output obtained by an organization and the amount of input consumed. However, this definition applies only to those processes in which the organization obtains a single product by means of a single productive resource.

As pointed out by Grosskopf (1993), productivity is a matter of long-standing concern, and different approaches have been adopted to measure it; noteworthy approaches include, on one hand, the one proposed by authors considering productivity growth and technical progress to be synonyms, and, on the other hand, that of the research current considering both elements different. The present study is in line with the latter, according to which productivity growth is the net change in output due to change in efficiency[4] and technical change; for its part, change in efficiency is interpreted as modification of the existing gap between an observation and its production frontier, whereas technical change is understood as changes in the production frontier itself (Grosskopf, 1993). From these definitions it may be in turn concluded that the approach adopted to measure and appraise efficiency should be based on frontiers.

The frontiers approach is based on real data from a sample of units concerning the amount of inputs used and outputs obtained. Production frontier is the productive processes envelopment of the analyzed sample, departing from the assumption that no real observation may be found above the boundary thus established, and that, therefore, observations may only be found on the frontier itself and below. Various approaches of envelopment

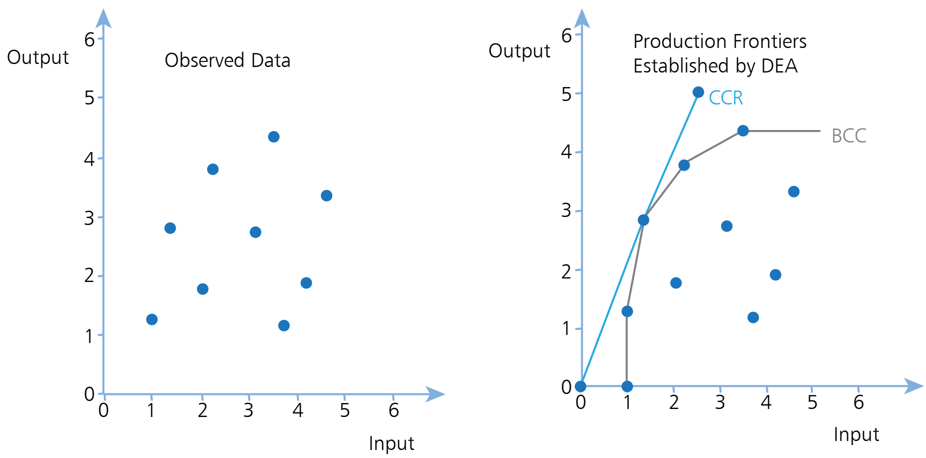
[4] The concept of efficiency to which we refer in this study is that of technical efficiency, which must be distinguished from allocative efficiency. Technical efficiency reflects an organization's ability to achieve the highest production level with given available resources (output oriented), or to minimize inputs consumption when yielding a certain output (input oriented). Allocative efficiency takes account of inputs costs, and is achieved when a higher output level is reached at a lower cost, or else when, provided a certain inputs cost, the highest possible amount of output is attained.

calculation on the basis of real data as frontier have been proposed; in this study, the so-called Data Envelopment Analysis (DEA) will be employed, which proposes the construction, from real data of the sample to be analyzed, of deterministic nonparametric frontiers, that is, no previous hypotheses are made on the functional form of that frontier, and all possible real data deviations from the frontier are considered to result from inefficiency. Thus, units delimiting the production frontier are considered efficient, whereas those found below that boundary are considered inefficient.

Production frontier construction by means of the envelopment is shown in Figure 2. In fact, two different frontiers have been represented, corresponding to two different versions of the DEA approach, which was first introduced by Charnes, Cooper and Rhodes in 1978. In their approach, authors assume constant returns to scale, and that first version is therefore known as DEA-CCR model. Later, Banker, Charnes, and Cooper (1984) proposed a second version of DEA, assuming variable returns to scale; thus, efficiency measurement according to such hypothesis is referred to as DEA-BCC model.

FIGURE 2

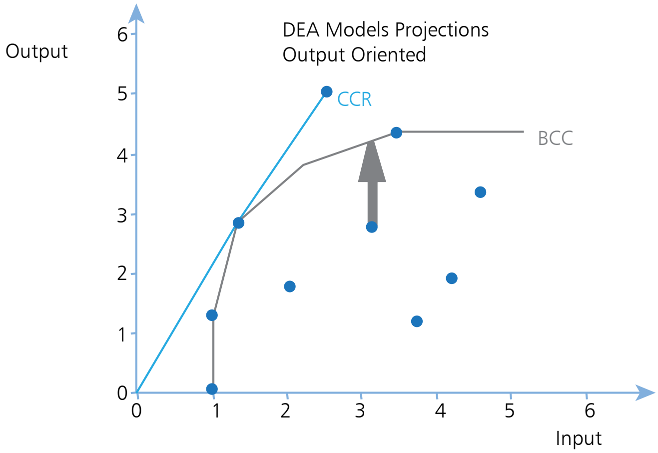
GRAPHIC INTERPRETATION OF DATA ENVELOPMENT ANALISYS METHODOLOGY



Once the envelopment has been delimited, inefficiency of each unit is estimated as the distance between its position in the graph and the efficient production frontier. In Figure 3, which is output oriented, it can be observed that such distance takes an upward direction, since it indicates the output increase to be generated so that the analyzed organization becomes efficient.

FIGURE 3

GRAPHIC REPRESENTATION OF INEFFICIENCIES, OUTPUT ORIENTE



To enable efficiency estimates in cases where productive processes are multi-input and multi-output, the DEA approach proposes a mathematical formulation that consists in solving a linear programming problem for each unit, whose result is an efficiency index concurrent with the distance separating it from efficient border.

Under the assumption of constant returns to scale and output orientation, which is the DEA version employed in this work for estimates, mathematical formulation of the linear programming problem for the same time period (t) is as shown in equation [3]:

$$
\begin{aligned}
& Max\, D_o^t\left(y^t, x^t\right) = \theta \\
& s.a: \\
& \sum_{j=1}^{n} \lambda_j x_{ij} \leq x_{ij0} \qquad i = 1, \ldots, m \\
& \sum_{j=1}^{n} \lambda_j y_{rj} \geq \theta y_{rj0} \qquad r = 1, \ldots, s \\
& \lambda_j \geq 0 \qquad j = 1, \ldots, n
\end{aligned}
\qquad [3]
$$

The θ score or efficiency value must fall between $[1,\infty)$. However, for comparison with input-oriented models, the inverse of θ is usually calculated so that efficiency ratio falls between (0,1], as has been done in the present study.

Efficiency is a static concept measuring the use of resources in an organization at a given time by comparison with a set of units. But, sometimes, it is of interest to know the evolution of efficiency over time in the organization, which leads to the concept of productivity. Although there are several indexes based on the DEA approach to evaluate change in productivity, the best known and most used is the Malmquist Productivity Index (MPI).

One possible formulation of Malmquist index is presented in formula [4]:

$$MIP_0\left(y^t,x^t,y^{t+1},x^{t+1}\right)=\left[\frac{D_o^{t+1}\left(y^{t+1},x^{t+1}\right)}{D_o^t\left(y^t,x^t\right)}\frac{D_o^t\left(y^{t+1},x^{t+1}\right)}{D_o^{t+1}\left(y^t,x^t\right)}\right]^{1/2} \qquad [4]$$

where $D_o^t\left(y^t,x^t\right)$ is the efficiency ratio or distance to efficient frontier at time t and $D_o^{t+1}\left(y^{t+1},x^{t+1}\right)$ has the same meaning, but for time $t+1$.

An equivalent formulation of Malmquist index is presented in formula [5], where it has been decomposed in two parts:

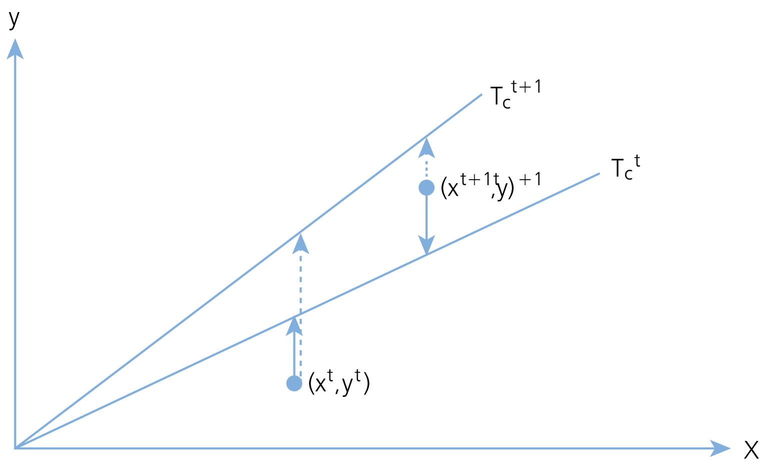
$$MIP_0\left(y^t,x^t,y^{t+1},x^{t+1}\right)=\frac{D_o^{t+1}\left(y^{t+1},x^{t+1}\right)}{D_o^t\left(y^t,x^t\right)}\left[\frac{D_o^t\left(y^{t+1},x^{t+1}\right)D_o^t\left(y^t,x^t\right)}{D_o^{t+1}\left(y^{t+1},x^{t+1}\right)D_o^{t+1}\left(y^t,x^t\right)}\right]^{1/2} \qquad [5]$$

The first term in equation [5] shows change in efficiency between periods (MECH), whereas the second term shows technical change (MTCH) between periods t and ($t+1$).

Frontiers for periods t and $t+1$ are represented in Figure 4 under the assumption of constant returns to scale, together with two input and output observations corresponding to these two periods. The solid line arrow is the graphic representation of efficiency ratio, or distance between each observation and the frontier corresponding to period t, whereas the dotted line arrow represents those same values for period $t+1$. Technical change, which is the distance between frontiers, is estimated from these values; in the case represented in Figure 4, technical change implies technical progress, because, given a certain amount of input, frontier points corresponding to period $t+1$ imply a greater amount of output. The solid line arrow for period t observation and the dotted line arrow for period $t+1$ observation represent distances to their efficient frontiers, and are the terms employed to estimate change in efficiency.

FIGURE 4

DECOMPOSITION OF CHANGE IN PRODUCTIVITY ACCORDING TO MALMQUIST INDEX



When evaluating efficiency in organizations, outputs are usually considered the result of inputs transformation through a productive process, a production deemed beneficial for the organization; however, productive processes may also result in the so-called undesirable outputs, that is, they may be detrimental rather than beneficial for efficiency.

Production theory postulates the existence of a technological reference providing a thorough description of all technologically feasible relationships between inputs and outputs. A Decision-Making Unit (DMU) is supposed to use an input vector $x=(x_1,\ldots,x_N)\in\Re_+^N$ to produce an output vector $y=(y_1,\ldots,y_M)\in\Re_+^M$; in that process, a set of undesirable outputs $=(b_1,\ldots,b_I)\in\Re_+^I$ is generated, where P(x) describes the production technology:

$$P(x)=\{(y, b): x \text{ can produce } (y, b)\} \quad [6]$$

Formally, the reference set of outputs satisfies the following hypotheses, according to Chung, Färe and Grosskopf (1997) and Ball *et al.* (1994): i) constant returns to scale, which means that outputs increase in the same proportion as inputs [Equation 7]; ii) high disposability, that is, undesirable outputs may be reduced without necessarily reducing desirable outputs [Equation 8]; iii) low disposability of undesirable outputs, implying that, for a given input level, undesirable outputs can only be reduced if desirable outputs are simultaneously reduced as well [Equation 9]; and iv) desirable and undesirable outputs are jointly yielded [Equation 10].

$$P(\lambda x) = \lambda P(x),\ \lambda > 0 \qquad [7]$$

$$(y,b) \in P(x)\ \ e\ y' \leq \textit{and implies that } (y',b) \in P(x) \qquad [8]$$

$$(y,b) \in P(x)\ \ y\ 0 \leq \theta \leq 1 \textit{ implies that } (\theta y,\ \theta b) \in P(x) \qquad [9]$$

$$\textit{If } (y,\ b) \in P(x)\ y\ b{=}0 \textit{ then } y{=}0 \qquad [10]$$

Estimates of change in productivity in the presence of undesirable outputs in a productive process are based on the calculation of the Malmquist Luenberger Index (MLPI), developed by Chung, Färe and Grosskopf (1997). This approach uses the function of directional distance to efficient frontier, instead of the output distance function employed in conventional MPI, thus including undesirable outputs.

Directional distance function is defined as:

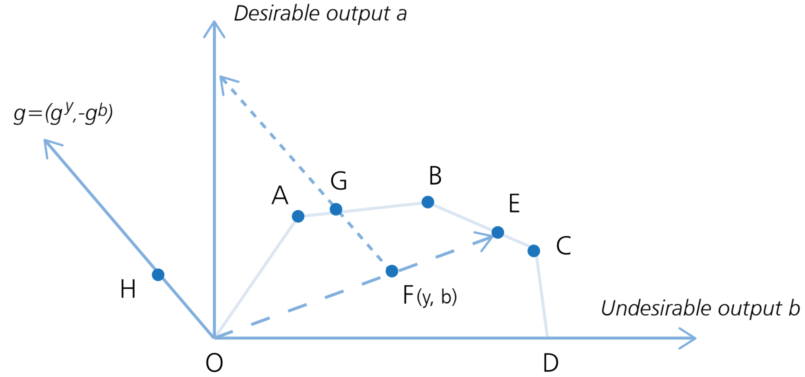
$$\overrightarrow{D_o}\left(x,y,b;g\right) = \sup\{\beta : \left(y,b\right) + \beta g \in P\left(x\right)\} \qquad [11]$$

where g is the direction vector where outputs $g=(g^y,\ -g^b)$ are scaled, so that $g^y \in \mathfrak{R}_+^M$ and ${}^b \in$ ^{I} . In this case, $g=(1,-1)$, so desirable outputs increase, whereas undesirable outputs are reduced.

The directional distance function has two advantages. On the one hand, it aims to increase desirable outputs while reducing undesirable outputs; on

FIGURE 5

DIRECTIONAL DISTANCE FUNCTION IN THE PRESENCE OF UNDESIRABLE OUTPUTS



the other hand, it prevents computational problems associated with output efficiency estimates as a solution to a nonlinear programming problem.

Figure 5 represents efficiency calculation by means of the directional distance function in the presence of undesirable outputs

The area under the curve in Figure 5 represents the set of production possibilities. Points OABC show the efficient frontier. Unit F, located below that frontier, is inefficient and generates, respectively, desirable and undesirable outputs (y, b). Considering the conventional distance function, unit F efficient output would be located in point E of production set P(x), and would therefore correspond to the OF/OE ratio. If desirable and undesirable outputs were to increase by an OF/OE factor, unit F would then become efficient. If directional distance function were scaled in the direction increasing desirable outputs and reducing undesirable ones, it would be cast on point G. In that case, the relationship would be OH/OG, where OG is the ray from the origin (0,0) to $g = (g^y, -g^b)$.

The linear programming problem to be solved in order to estimate efficiency ratios through directional distance in the presence of undesirable outputs, is the following:

$$\begin{aligned}
&\overline{D}_0^t\left(x_{k'}^t, y_{k'}^t, b_{k'}^t; g_{k'}^t\right) = Max\,\beta \\
&s.a.: \\
&\sum_{k=1}^{K} \lambda_k^t y_{km}^t \geq \left(1+\beta\right) y_{k'm}^t, \qquad m = 1,2,\ldots,M \\
&\sum_{k=1}^{K} \lambda_k^t b_{ki}^t = (1-\beta) b_{k'i}^t, \qquad i = 1,2,\ldots,I \\
&\sum_{k=1}^{K} \lambda_k^t x_{kn}^t \leq x_{k'n}^t, \qquad n = 1,2,\ldots,N \\
&\lambda_k^t \geq 0, \qquad k = 1,2,\ldots,K
\end{aligned} \qquad [12]$$

where desirable outputs growth directions are $g^y = \beta\, y_{k'm}^t$, whereas undesirable outputs directions are: $-g^b = -\beta\, b_{k'i}^t$. Otherwise said, efficiency ratio is estimated as distance to frontier points representing a reduction of undesirable outputs.

To estimate change in productivity in the presence of undesirable outputs, Chung, Färe and Grosskopf (1997) define MLPI as:

$$MLPI_t^{t+1} = \left[\frac{\left(1+\vec{D}_0^t\left(x^t,y^t,b^t;g^t\right)\right)}{\left(1+\vec{D}_0^t\left(x^{t+1},y^{t+1},b^{t+1};g^{t+1}\right)\right)} * \frac{\left(1+\vec{D}_0^{t+1}\left(x^t,y^t,b^t;g^t\right)\right)}{\left(1+\vec{D}_0^{t+1}\left(x^{t+1},y^{t+1},b^{t+1};g^{t+1}\right)\right)} \right]^{1/2} \quad [13]$$

MLPI may be decomposed in two factors similar to those in which MPI is decomposed: change in efficiency (MLECH, Equation 14) and technological change (MLTCH, Equation 15).

$$MLECH_t^{t+1} = \frac{\left(1+\vec{D}_0^t\left(x^t,y^t,b^t;g^t\right)\right)}{\left(1+\vec{D}_0^t\left(x^{t+1},y^{t+1},b^{t+1};g^{t+1}\right)\right)} \quad [14]$$

$$MLTCH_t^{t+1} = \left[\frac{\left(1+\vec{D}_0^{t+1}\left(x^t,y^t,b^t;g^t\right)\right)}{\left(1+\vec{D}_0^t\left(x^t,y^t,b^t;g^t\right)\right)} * \frac{\left(1+\vec{D}_0^{t+1}\left(x^{t+1},y^{t+1},b^{t+1};g^{t+1}\right)\right)}{\left(1+\vec{D}_0^t\left(x^{t+1},y^{t+1},b^{t+1};g^{t+1}\right)\right)} \right]^{1/2} \quad [15]$$

MLPI calculation requires, for each DMU analyzed, solving four linear programming problems similar to those presented in formula 12 (see Annex 1).

As for comparability between MPI and MLPI, the following considerations need to be taken into account:

- MLPI is defined in such a way that, when direction g is (g^y, g^b) instead of (g^y, g^b), it coincides with MPI (Chung , Färe and Grosskopf , 1997).

- The conventional distance function used to obtain MPI is a special case of the directional distance function used to obtain MLPI. The relationship between them is: $\vec{D}_o(x,y,b;g) = (1/D_o(x,y,b)) - 1$ (Chung, Färe and Grosskopf, 1997).

- According to Managi (2003), an MPI generalization based on directional distance function is the Luenberger Productivity Index (LPI), proposed by Luenberger (1992) and Chambers, Chung and Färe (1996) and based on the shortage function. A key advantage of LPI is that it does not require a choice between input or output orientation, as opposed to MPI (Epure, Kerstens and Prior, 2011). However, input and output oriented MPI indexes provide identical findings with constant returns to scale, which implies that the orientation adopted is redundant (Kortelainen, 2008). Since constant returns to scale have been assumed in our empirical application, orientation selection was irrelevant. Therefore, MPI-LPI combination turns into MLPI index, which suggests increased productivity when its value is above 1, and reduced productivity when its value is below 1.

Taking these specifications into account and following Chung, Färe and Grosskopf (1997), in the present study MLPI has been adopted to estimate productivity changes in the analyzed football teams.

III. FINDINGS

In this work, football teams having participated in the group stage and elimination rounds of the UEFA Champions League have been adopted as study sample, and evolution of their productivity during the games played has been analyzed.

In the sphere of sport, output is related to results achieved in competitions. Provided that the UEFA Champions League is a round robin kind of tournament, the number of games played has been considered as an output variable, since it is an indicator of the stage reached by each team. On the other hand, teams having reached the same competition stage may have shown a different pattern of wins, draws, and losses; accordingly, the output variable here referred to as *money bringing games* has also been considered, and is estimated as the sum of all wins plus a third of all draws; such weightings are based on the revenue distribution model implemented by UEFA. Furthermore, lost games have also been considered and registered as undesirable outputs, for this variable does not produce sporting outputs and, consequently, does not generate revenues for teams, which therefore attempt to minimize its magnitude. Moreover, teams may beat their opponents by a short or a large goal difference, and differences in goals for and against are considered as tiebreaker in elimination rounds; thus, goals for and against have also been introduced as output variables, the latter as the inverse of the original variable.

All moves performed in games, differentiating between offensive and defensive moves, have been considered as input representative variables. Both kinds of move are game actions intended to attain the objective pursued by the player's own team, or else to prevent the opposing team to attain its objective; therefore, all actions are relevant to achieve the final objective, which is contingent and shared by both competing teams.

Input and output variables have been taken of each complete season. Data were provided by Opta Sport for our study period, stretching between seasons 2014 and 2018, in order to work with more homogeneous information.[5]

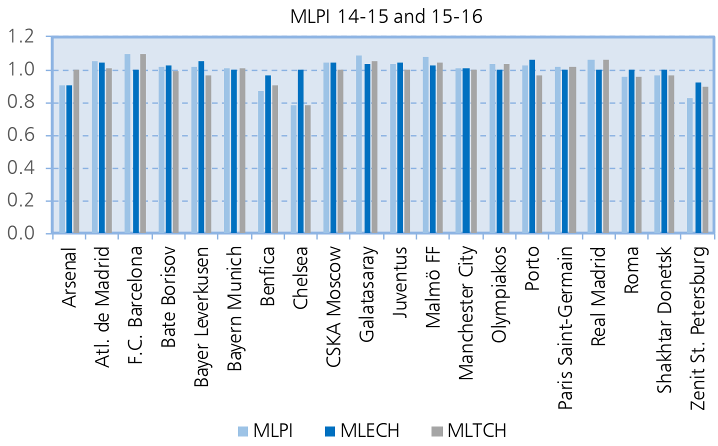
Data on efficiency from the 2014-2015 season are taken as initial reference for analysis; from these findings, we have proceeded to study the evolution in productivity of teams having participated in the UEFA Champions League for consecutive seasons until the 2017-2018 season.

Ten teams out of a total of 38 have participated in the UEFA Champions League throughout the four-seasons period studied (Atlético de Madrid, Barcelona, Bayern Munich, Benfica, CSKA Moscow, Juventus, Manchester City, Porto, Paris Saint-Germain, and Real Madrid). In this subset of teams having continuously participated in all editions considered, three play in the Spanish league and two in the Portuguese league, whereas each of the remaining five teams plays in a different league, namely, German, French, English, Italian, and Russian leagues. In the last ten seasons, 14 finalists and 26 semifinalists belonged to this subset of teams.

Besides these ten teams present in all four seasons analyzed, three more teams participated in three consecutive seasons: Arsenal and Bayer Leverkusen in

FIGURE 6

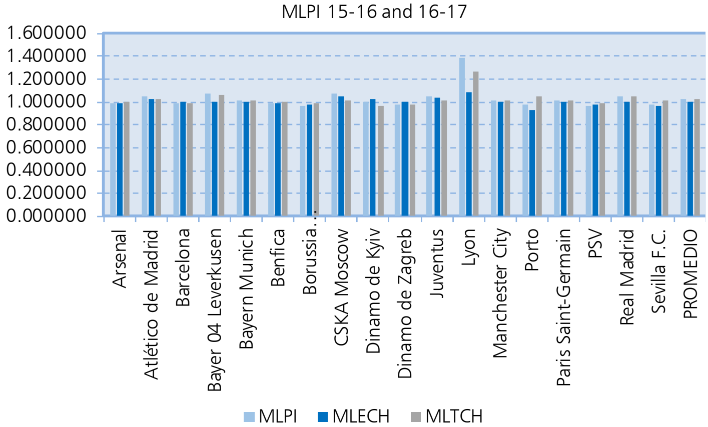
EVOLUTION OF PRODUCTIVITY (MLPI), EFFICIENCY (MLECH), AND TECHNICAL CHANGE (MLTCH) IN THE 2015-2016 SEASON WITH RESPECT TO THE 2014-2015 SEASON



[5] In 2014 data quantification criteria changed, since Opta Sport acquired Geca Sport, a Spanish company providing the data on football teams; hence the need to unify data quantification criteria, which were harmonized according to the usual methodology employed by Opta Sport.

FIGURE 7

EVOLUTION OF PRODUCTIVITY (MLPI), EFFICIENCY (MLECH), AND TECHNICAL CHANGE (MLTCH) IN THE 2016-2017 SEASON WITH RESPECT TO THE 2015-2016 SEASON



seasons 2014 through 2017, and Sevilla in seasons 2015 through 2018. These teams play, respectively, in English, German and Spanish domestic leagues.

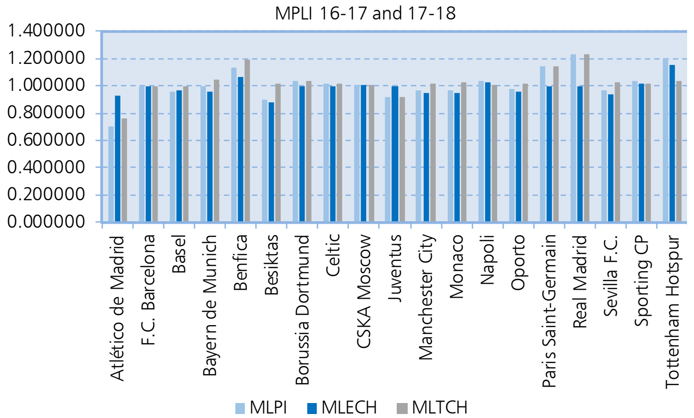
Given that information on at least two consecutive seasons is required to calculate the Malmquist Luenberger index, findings refer to productivity evolution of teams having participated in two consecutive editions between the seasons 2014-2015 and 2017-2018. Findings are shown in Annex 2 and summarized in figures 6, 7, and 8.

Considering mean values obtained, it may be concluded that productivity index increased in seasons 2016-2017 and 2017-2018, due to an increase in both index components in the former season, and to an increase in technical progress compensating reduced efficiency in the latter season. As can be observed, productivity and technical change indexes decreased in the 2015-2016 season, whereas efficiency index experienced a slight increase. These findings owe to different behavioral patterns of individual indicators in each pair of consecutive seasons studied.

Analysis by teams reveals a regression in the technical progress index for more than half of the teams (11) in the 2015-2016 season with respect to the previous season, which may be therefore considered an overall effect. However, five teams showing reduced technical progress index (Bate Borisov, Bayer Leverkusen, CSKA Moscow, Juventus, and Porto) counterbalance such regression with an increase in efficiency index resulting in a productivity increase.

FIGURE 8

EVOLUTION OF PRODUCTIVITY (MLPI), EFFICIENCY (MLECH), AND TECHNICAL CHANGE (MLTCH) IN THE 2017-2018 SEASON WITH RESPECT TO THE 2016-2017 SEASON



On the other hand, all clubs showing technical progress improvement maintain or improve their efficiency as well, which implies that they achieve substantial savings in resources consumption, as opposed to the rest of teams.

Teams having improved their productivity during the 2016-2017 season with respect to the 2015-2016 season have experienced an increase both in efficiency and technical progress; accordingly, differences in adequate use of resources with respect to all other teams have also increased.

Finally, only four teams from the sample show technical regression in the 2017-2018 season with respect to the previous one (Atlético de Madrid, F.C. Barcelona, Basel, and Juventus); provided that, moreover, their ratio is close to the unit, average for the entire competition is higher than one. These four teams present reduced productivity because, even if some of them keep their efficiency level, it is not enough to offset technical regression. As for the rest of teams, those showing reduced efficiency experience a decrease in productivity because, in spite of showing increased technical progress, it does not offset the efficiency drop. Only nine teams from the sample (Benfica, Borussia Dortmund, Celtic, CSKA Moscow, Napoli, Paris Saint-Germain, Real Madrid, Sporting CP, and Tottenham Hotspur) increased their productivity in the 2017-2018 season with respect to the previous season. It can therefore be said that any value below one for any index component reveals a reduced productivity in that season.

Teams having remained stable in the competition throughout the studied period belong to a group of teams that seem to have a clearly defined objective of continued participation in the competition. Thus, they are most likely to

FIGURE 9

EVOLUTION IN PRODUCTIVITY OF TEAMS HAVING PARTICIPATED IN THE COMPETITION ALL SEASONS STUDIED

Productivity	*S 15-16 o 14-15*	*S 16-17 o 15-16*	*S 17-18 o 16-17*	*Evolution*
Atl. de Madrid	1.0505	1.0501	0.7061	
F. C. Barcelona	1.0990	0.9903	0.9944	
Bayern Munich	1.0119	1.0190	0.9946	
Benfica	0.8738	0.9918	1.1319	
CSKA Moscow	1.0395	1.0768	1.0063	
Juventus	1.0383	1.0552	0.9160	
Manchester City	1.0095	1.0188	0.9668	
Porto	1.0278	0.9790	0.9778	
Paris S. G.	1.0143	1.0144	1.1435	
Real Madrid	1.0598	1.0474	1.2257	
Average	1.0224	1.0243	1.0063	

reach the final stages and to develop a style of play that may afford them results in line with their objective and reflecting a positive evolution of productivity determinants. Notwithstanding, it must be noted that such determinants are obtained in competition and do not exclusively depend on the skills of the team, being conditioned by the opposing teams.

For this subset of teams, Figure 9 shows a growing tendency in the average evolution of productivity. CSKA Moscow, Paris Saint-Germain and Real Madrid are the only teams whose productivity growth shows values above the unit in all seasons. Benfica follows a pattern of reduced productivity in all seasons, save for the 2017-2018 season, when a significant increase is registered. The cases of F.C. Barcelona and Porto deserve special mention, since their productivity increases in the 2015-2016 season but decreases in the following seasons, probably owing to changes in technical staff and the playing system.

Figure 10 exhibits the efficiency trend, which on average in the 2017-2018 season is under one. Half of the teams improve or keep their efficiency in the seasons studied. Atlético de Madrid, Bayern Munich and Manchester City show

FIGURE 10

EVOLUTION IN EFFICIENCY OF TEAMS HAVING PARTICIPATED IN THE COMPETITION ALL SEASONS STUDIED

Productivity	*S 15-16 o 14-15*	*S 16-17 o 15-16*	*S 17-18 o 16-17*	*Evolution*
Atl. de Madrid	1.0407	1.0273	0.9228	
F. C. Barcelona	1.0000	1.0000	1.0000	
Bayern Munich	1.0000	1.0000	0.9562	
Benfica	0.9622	0.9876	1.0639	
CSKA Moscow	1.0431	1.0565	1.0031	
Juventus	1.0395	1.0340	1.0000	
Manchester City	1.0072	1.0089	0.9507	
Porto	1.0611	0.9317	0.9603	
Paris S. G.	1.0000	1.0000	1.0000	
Real Madrid	1.0000	1.0000	1.0000	
Average	1.0154	1.0046	0.9857	

reduced efficiency in the 2017-2018 season, and only Benfica and Porto present two values below the unit in the period studied.

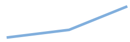
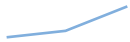
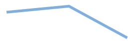
Figure 11 shows evolution in technical change, which, on average, is positive in all seasons studied. However, only Bayern Munich, Manchester City, Paris Saint-Germain and Real Madrid experience technical progress in all editions considered.

Among teams having rotated in seasons studied, no prevailing tendency has been detected, since both increased and reduced productivity has been observed.

Finally, it is noteworthy that some teams experience technical progress while others undergo regression in the same season. The finding reveals that production frontiers for both consecutive periods cross each other, so that, in the second season, the reference unit for efficiency calculation is closer to coordinate axis (progress) in some cases, while the opposite (regression) is observed in other cases. Provided that findings of technical progress values are related to the underlying technology of football clubs, it may be of interest to verify if a team remains in the same situation throughout all seasons studied.

FIGURE 11

EVOLUTION IN TECHNICAL PROGRESS OF TEAMS HAVING PARTICIPATED IN THE COMPETITION ALL SEASONS STUDIED

Productivity	*S 15-16 o 14-15*	*S 16-17 o 15-16*	*S 17-18 o 16-17*	*Evolution*
Atl. de Madrid	1.0094	1.0222	0.7652	
F. C. Barcelona	1.0990	0.9903	0.9944	
Bayern Munich	1.0119	1.0190	1.0401	
Benfica	0.9081	1.0043	1.2879	
CSKA Moscow	0.9966	1.0192	1.0032	
Juventus	0.9989	1.0205	0.9160	
Manchester City	1.0023	1.0098	1.0170	
Porto	0.9687	1.0508	1.0182	
Paris S. G.	1.0143	1.0144	1.1435	
Real Madrid	1.0598	1.0474	1.2257	
Average	1.0069	1.0198	1.0411	

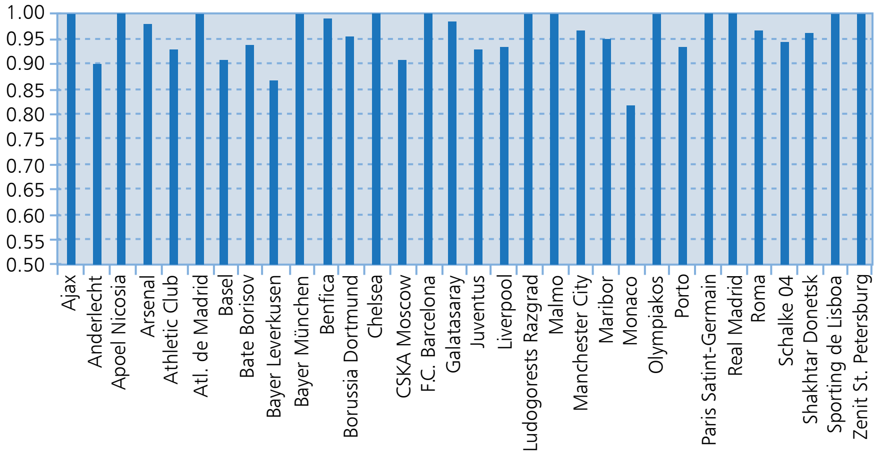
Among teams having participated in the UEFA Champions League all seasons studied, Bayern Munich, Manchester City, Paris Saint-Germain and Real Madrid show constant technical progress. As for the rest, Atlético de Madrid, Benfica, CSKA Moscow and Porto show technical progress in two seasons, whereas Barcelona and Juventus show progress in only one season; still, no team experiences constant technical regression. In our study sample, three teams participated in the competition for three consecutive seasons, for which two consecutive Malmquist Luenberger indexes have been estimated. Among them, Sevilla shows constant technological progress; Arsenal presents a slight technological regression in seasons 2015-2016 and 2016-2017; and Bayer Leverkusen experienced regression in season 2015-2016 and progress in season 2016-2017. In the light of these findings, it may not be concluded that teams remain always in the same zone of technological change, but it does seem that technical progress depends on continuity in the competition rather than on increased productivity.

Efficient frontier configuration in the 2014-2015 season may be observed in Figure 12. Teams reaching unit value, a total of thirteen, are efficient;

among them, we find those having played the final that season (Barcelona and Juventus), together with other teams showing more modest sporting results. As for the rest, it may be concluded that they do not efficiently take advantage of available resources. Monaco, Bayer Leverkusen and Anderlecht show the lowest efficiency ratios of all 32 teams participating in the UEFA Champions League that season.

FIGURE 12

EFFICIENCY AND EFFICIENT FRONTIER OF ALL TEAMS IN THE 2014-2015 SEASON



First, findings suggest that efficient performance is not related to continuity in the competition: out of thirteen efficient teams in season 2014-2015, only five (Atlético de Madrid, F.C. Barcelona, Bayern de Munich, Paris Saint-Germain and Real Madrid) stayed in the competition all seasons studied, and four (Chelsea, Malmö F.F., Olympiakos and Zenit St. Petersburg) participated the following season. On the other hand, some teams having played in the UEFA Champions League between 2014 and 2018 were not efficient in their first season.

It may be of interest to analyze the efficiency evolution of teams having enjoyed continuity in the competition throughout all seasons studied, together with their baseline efficiency level. The five efficient teams in season 2014-2015 show a change in efficiency equal to one in all seasons, and productivity variations exclusively owe to technical change, which is mostly technical progress. In conclusion, it can be said that teams progressively adapt to changes in efficient frontiers: they do not lose efficiency, even if frontiers improve. In short, they do not become more efficient, but they consume fewer and fewer resources. As for teams that participated in the competition from 2014 to 2018, but were not efficient during the first season, they mostly show increased efficiency, and thus a growing improvement in the use of resources.

But it is helpful to connect efficiency, productivity, and technical change findings with evidences on how the productive process of analyzed football teams has been carried out.

In this regard, a remarkable aspect of Real Madrid is the fact that it has experienced technical progress throughout the seasons. It is thus not surprising that it has succeeded in winning the competition three consecutive times. This may be explained as the result of a team technology developed to achieve the final result. Such technology could be specified as greater motivation and cooperation between players, better preparation for games, a more adequate use of elements configuring the squad, or a better understanding between players and coach to realize teamwork actions in each game. Technical staff, represented by the coach, would be the key element to define and develop the team's own technology; thus, the figure of the coach could explain the evolution of registered productivity.

As may be observed in Annex 2, six coaches have been changed in every pair of seasons studied. It is noteworthy that coaching change in Chelsea would be a plausible reason for the considerable drop in its technical progress index in the 2015-2016 season, when it shows the lowest score among all teams of the sample, both in technical progress and productivity. Moreover, this team has not succeeded in participating in the following Champions League editions.

In the 2016-2017 season, Sevilla changed its coach, which also led to reduced productivity. It is interesting that the outgoing coach was hired by Paris Saint-Germain, which implied increased technical progress for the team and, accordingly, increased productivity with respect to the previous season.

In the last season studied, Bayern Munich and Sevilla changed their coaches, which implied reduced productivity, basically owing to change in efficiency in both cases.

IV. CONCLUSIONS AND RECOMMENDATIONS

In this study, findings on productivity evolution of teams having participated in the competitive stage of UEFA Champions League between the seasons 2014-2015 and 2017-2018 are presented. Findings were estimated on the basis of DEA analysis, having defined efficient frontier and its evolution throughout consecutive seasons, and reveal relevant circumstances of the competition.

In summary, in the 2015-2016 season there was a productivity drop owing to a reduced technical change coefficient which was not counterbalanced by the increased efficiency coefficient; in the 2016-2017 season, increases in productivity were observed, associated with efficiency and technical progress indicators; in the 2017-2018 season, technical progress induced increased productivity, despite an efficiency drop.

Analysis by teams reveals that CSKA Moscow, Real Madrid and Paris Saint-Germain increased their productivity in all seasons, whereas other teams show reduced productivity, for instance, Benfica, which has participated in all seasons studied and experienced a productivity drop in all of them, except for the last one. F.C. Barcelona and Porto increased their productivity in the 2015-2016 season, but show the opposite tendency in all other seasons.

Real Madrid, winner of three of the four editions analyzed, experienced technical progress season after season, having reached its peak in the last season examined. It could be interpreted that this aspect has contributed to its success over the last editions. Coordinated behavior of team and coach was determining to achieve such results. However, it is not the only team showing this evolution of productivity determinant ratios.

Technical progress may be due to the style of play and preparations for games, whose key elements are the coach and the entire technical staff. However, the coaching effect seems to exert unclear influence on the increased productivity of teams, since both productivity improvements and regressions are observed in teams after a change of coach. A clear impact on productivity indicators is only observed in few specific cases, like that of Real Madrid. Atlético de Madrid and Juventus are the only teams not having changed their coaches throughout the entire analyzed period.

As overall conclusion deriving from our analysis, it could be said that the competitive process developed over the UEFA Champions League competition is highly demanding for all participating teams, for it is especially difficult to maintain a constant positive evolution of productivity determinants. But even if positive evolution is achieved, sporting success of teams is not guaranteed, being therefore a necessary but not sufficient condition. Teams having participated throughout the entire analyzed period show, on average, constant productivity improvement.

Productivity improvements are related to characteristic effects of team technology, that is, a single objective shared by all team members, which include not only players, but also the technical staff. This productivity determinant was key to all ten teams having participated in the competition over all seasons studied. A steady increase of that effect was observed in four teams, as well as in averages by season.

Competitive framework varies from season to season, which renders reproduction of a successful model difficult if high levels of productivity determinants are not reached. Every new edition is therefore a new challenge for all participants, though well-established teams repeatedly participating in the competition seem to be more familiar with it. Technical staffs are rarely stable in the direction of teams reaching the final stages of the competition.

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ANNEX 1

LINEAR PROGRAMMING PROBLEMS TO BE SOLVED WHEN CALCULATING PRODUCTIVITY EVOLUTION IN THE PRESENCE OF UNDESIRABLE OUTPUTS

Problems A1 and A2 are solved for DMUs in the same period (t and $t+1$, respectively); the other two problems, A3 and A4, are solved for mixed periods. Linear problems to be solved are the following:

$$
\begin{aligned}
&\overline{D}_0^{t}\left(x_{k'}^{t}, y_{k'}^{t}, b_{k'}^{t}; g_{k'}^{t}\right) = Max\ \beta \\
&s.t.: \\
&\sum_{k=1}^{K} \lambda_k^t y_{km}^t \geq \left(1+\beta\right) y_{k'm}^t, \qquad m = 1,2,\ldots,M \\
&\sum_{k=1}^{K} \lambda_k^t b_{ki}^t = (1-\beta) b_{k'i}^t, \qquad i = 1,2,\ldots,I \\
&\sum_{k=1}^{K} \lambda_k^t x_{kn}^t \leq x_{k'n}^t, \qquad n = 1,2,\ldots,N \\
&\lambda_k^t \geq 0, \qquad k = 1,2,\ldots,K
\end{aligned}
\qquad [A1]
$$

$$
\begin{aligned}
&\overline{D}_0^{t+1}\left(x_{k'}^{t+1}, y_{k'}^{t+1}, b_{k'}^{t+1}; g_{k'}^{t}\right) = Max\ \beta \\
&s.t.: \\
&\sum_{k=1}^{K} \lambda_k^{t+1} y_{km}^{t+1} \geq \left(1+\beta\right) y_{k'm}^{t+1}, \quad m = 1,2,\ldots,M \\
&\sum_{k=1}^{K} \lambda_k^{t+1} b_{ki}^{t+1} = (1-\beta) b_{k'i}^{t+1}, \quad i = 1,2,\ldots,I \\
&\sum_{k=1}^{K} \lambda_k^{t+1} x_{kn}^{t+1} \leq x_{k'n}^{t+1}, \qquad n = 1,2,\ldots,N \\
&\lambda_k^{t+1} \geq 0, \qquad k = 1,2,\ldots,K
\end{aligned}
\qquad [A2]
$$

ANNEX 1 *(continued)*

LINEAR PROGRAMMING PROBLEMS TO BE SOLVED WHEN CALCULATING PRODUCTIVITY EVOLUTION IN THE PRESENCE OF UNDESIRABLE OUTPUTS

After taking the partial derivative of these demand curves with respect to,

$$
\begin{aligned}
&\bar{D}_0^{t+1}\left(x_{k'}^t, y_{k'}^t, b_{k'}^t; g_{k'}^t\right) = Max\,\beta \\
&s.t.: \\
&\sum_{k=1}^{K} \lambda_k^{t+1} y_{km}^{t+1} \geq \left(1+\beta\right) y_{k'm}^t, \quad m = 1,2,\ldots,M \\
&\sum_{k=1}^{K} \lambda_k^{t+1} b_{ki}^{t+1} = \left(1-\beta\right) b_{k'i}^t, \quad i = 1,2,\ldots,I \\
&\sum_{k=1}^{K} \lambda_k^{t+1} x_{kn}^{t+1} \leq x_{k'n}^t, \quad n = 1,2,\ldots,N \\
&\lambda_k^{t+1} \geq 0, \quad k = 1,2,\ldots,K
\end{aligned}
\qquad [A3]
$$

$$
\begin{aligned}
&\bar{D}_0^{t}\left(x_{k'}^{t+1}, y_{k'}^{t+1}, b_{k'}^{t+1}; g_{k'}^t\right) = Max\,\beta \\
&s.t.: \\
&\sum_{k=1}^{K} \lambda_k^{t} y_{km}^{t} \geq \left(1+\beta\right) y_{k'm}^{t+1}, \quad m = 1,2,\ldots,M \\
&\sum_{k=1}^{K} \lambda_k^{t} b_{ki}^{t} = \left(1-\beta\right) b_{k'i}^{t+1}, \quad i = 1,2,\ldots,I \\
&\sum_{k=1}^{K} \lambda_k^{t} x_{kn}^{t} \leq x_{k'n}^{t+1}, \quad n = 1,2,\ldots,N \\
&\lambda_k^{t} \geq 0, \quad k = 1,2,\ldots,K
\end{aligned}
\qquad [A4]
$$

ANNEX 2

FINDINGS ON CHANGE IN PRODUCTIVITY AND ITS COMPENENTS OF FOOTBALL TEAMS HAVING PARTICIPATED IN THE UEFA CHAMPIONS LEAGUE (SEASONS 2014-2015 TO 2017-2018)

	Season 2015-2016 over 2014-2015				Season 2016-2017 over 2015-2016				Season 2017-2018 over 2016-2017		
Team	MLPI (t-1,t)	MLECH (t-1,t)	MLTCH (t-1,t)	Team	MLPI (t-1,t)	MLECH (t-1,t)	MLTCH (t-1,t)	Team	MLPI (t-1,t)	MLECH (t-1,t)	MLTCH (t-1,t)
Arsenal	0.9041	0.9057	0.9983	Arsenal	0.9911	0.9913	0.9998				
Atl. de Madrid	1.0505	1.0407	1.0094	Atl. de Madrid	1.0501	1.0273	1.0222	Atl. de Madrid	0.7061	0.9228	0.7652
F.C. Barcelona	1.0990	1.0000	1.0990	F.C. Barcelona	0.9903	1.0000	0.9903	F.C. Barcelona	0.9944	1.0000	0.9944
								Basel	0.9568	0.9617	0.9949
Bate Borisov	1.0137	1.0227	0.9912								
Bayer Leverkusen	1.0144	1.0531	0.9632	Bayer Leverkusen	1.0693	1.0038	1.0653				
Bayern Munich	1.0119	1.0000	1.0119	Bayern Munich	1.0190	1.0000	1.0190	Bayern Munich	0.9946	0.9562	1.0401
Benfica	0.8738	0.9622	0.9081	Benfica	0.9918	0.9876	1.0043	Benfica	1.1319	1.0639	1.2879
								Besiktas	0.8933	0.8832	1.0114
				Borussia	0.9687	0.9810	0.9875	Borussia	1.0371	1.0000	1.0371
								Celtic	1.0164	1.0000	1.0164
Chelsea	0.7873	1.0000	0.7873								
CSKA Moscow	1.0395	1.0431	0.9966	CSKA Moscow	1.0768	1.0565	1.0192	CSKA Moscow	1.0063	1.0031	1.0032
				Dynamo K	0.9992	1.0277	0.9723				
				Dynamo Z	0.9783	1.0000	0.9783				
Galatasaray	1.0906	1.0380	1.0507								
Juventus	1.0383	1.0395	0.9989	Juventus	1.0552	1.0340	1.0205	Juventus	0.9160	1.0000	0.9160
				Lyon	1.3844	1.0909	1.2690				
Malmö	1.0750	1.0268	1.0470								

ANNEX 2 *(continued)*

FINDINGS ON CHANGE IN PRODUCTIVITY AND ITS COMPENENTS OF FOOTBALL TEAMS HAVING PARTICIPATED IN THE UEFA CHAMPIONS LEAGUE (SEASONS 2014-2015 TO 2017-2018)

	Season 2015-2016 over 2014-2015				Season 2016-2017 over 2015-2016				Season 2017-2018 over 2016-2017		
Team	MLPI (t-1,t)	MLECH (t-1,t)	MLTCH (t-1,t)	Team	MLPI (t-1,t)	MLECH (t-1,t)	MLTCH (t-1,t)	Team	MLPI (t-1,t)	MLECH (t-1,t)	MLTCH (t-1,t)
Manchester City	1.0095	1.0072	1.0023	Manchester City	1.0188	1.0089	1.0098	Manchester City	0.9668	0.9507	1.0170
								Monaco	0.9710	0.9503	1.0217
								Napoli	1.0312	1.0226	1.0084
Olympiakos	1.0354	1.0000	1.0354								
Porto	1.0278	1.0611	0.9687	Porto	0.9790	0.9317	1.0508	Porto	0.9778	0.9603	1.0182
Paris SG	1.0143	1.0000	1.0143	Paris SG	1.0144	1.0000	1.0144	Paris SG	1.1435	1.0000	1.1435
				PSV	0.9626	0.9749	0.9873				
Real Madrid	1.0598	1.0000	1.0598	Real Madrid	1.0474	1.0000	1.0474	Real Madrid	1.2257	1.0000	1.2257
Roma	0.9548	1.0000	0.9548								
Shaktar	0.9635	1.0021	0.9615								
				Sevilla	0.9801	0.9705	1.0099	Sevilla	0.9634	0.9413	1.0235
								Sporting CP	1.0331	1.0154	1.0174
								Tottenham	1.1964	1.1551	1.0358
Zenit SP	0.8267	0.9244	0.8943								
Average	**0.9945**	**1.0063**	**0.9876**	**Average**	**1.0320**	**1.0048**	**1.0260**	**Average**	**1.0085**	**0.9888**	**1.0304**

ANNEX 3

COACH CHANGES IN TEAMS HAVING PARTICIPATED IN THE UEFA CHAMPIONS LEAGUE BETWEEN 2014 AND 2018

Coaches	2014/2015	2015/2016	Coaches	2015/2016	2016/2017	Coaches	2016/2017	2017/2018
Arsenal	A. Wenger	A. Wenger	**Arsenal**	A. Wenger	A. Wenger			
Atl. de Madrid	D. Simeone	D. Simeone	**Atl. de Madrid**	D. Simeone	D. Simeone	**Atl. de Madrid**	D. Simeone	D. Simeone
F.C. Barcelona	L. Enrique	L. Enrique	**F.C. Barcelona**	L. Enrique	L. Enrique	**F.C. Barcelona**	L. Enrique	A. Valverde
Bate Borisov	A. Yermakovic	A. Yermakovic	**Bayer Leverkusen**	R. Schmidt	R. Schmidt	**Basel**	U. Fisher	R. Wicky
Bayer Leverkusen	R. Schmidt	R. Schmidt	**Bayer Munich**	P. Guardiola	P. Guardiola	**Bayer Munich**	Ancelotti	Sagnol/ Heynckens
Bayer Munich	P. Guardiola	P. Guardiola	**Benfica**	R. Vitoria	R. Vitoria	**Benfica**	R. Vitoria	R. Vitoria
Benfica	J. Jesus	Benfica	**Borussia**	D. Hecking	D. Hecking	**Besiktas**	S. Günes	S. Günes
Chelsea	J. Mourinho	J. Mourinho/ S. Holland	**CSKA Moscow**	L. Slutskiy	V. Goncharenko	**Borussia**	T. Tuchel	T. Tuchel/P. Bosz/P. Stöger
CSKA Moscow	L. Slutskiy	L. Slutskiy	**Dynamo K**	O. Luzhny	O. Luzhny	**Celtic**	B. Rodgers	B. Rodgers
Galatasaray	H. Hamzaouglu	Tafarel/ Denizli/Atik	**Dynamo Z**	Z. Mamic	Z. Kranjkar/ Sopi/Petev	**CSKA Moscow**	V. Goncharenko	V. Goncharenko
Juventus	M. Allegri	M. Allegri	**Juventus**	M. Allegri	M. Allegri	**Juventus**	M. Allegri	M. Allegri
Malmö	A. Areide	A. Areide	**Lyon**	B. Genesio	B. Genesio	**Manchester City**	P. Guardiola	P. Guardiola

ANNEX 3 *(continued)*

COACH CHANGES IN TEAMS HAVING PARTICIPATED IN THE UEFA CHAMPIONS LEAGUE BETWEEN 2014 AND 2018

Coaches	2014-2015	2015-2016	Coaches	2015-2016	2016-2017	Coaches	2016-2017	2017-2018
A. Areide	A. Areide	**Lyon**	B. Genesio	B. Genesio	**Manchester City**	P. Guardiola	P. Guardiola	
Manchester City	M. Pellegrini	M. Pellegrini	**Manchester City**	M. Pellegrini	P. Guardiola	**Monaco**	L. Jardim	L. Jardim
Olympiackos	Michel/V. Pereira	M. Silva	**Porto**	Lopetegui/J. Peseiro	Nuno	**Napoli**	M. Sarri	M. Sarri
Porto	Lopetegui	Lopetegui/J. Peseiro	**Paris SG**	L. Blanc	U. Emery	**Porto**	Nuno	S. Conceiçao
Paris SG	L. Blanc	L. Blanc	**PSV**	P. Cocu	P. Cocu	**Paris SG**	U. Emery	U. Emery
Real Madrid	C. Ancelotti	R. Benitez/ Z. Zidane	**Real Madrid**	Z. Zidane	Z. Zidane	**Real Madrid**	Z. Zidane	Z. Zidane
Roma	R. Garcia	R. Garcia	**Roma**	R. Garcia	L. Spalleti	**Sevilla**	Sampaoli	Berizzo/ Montella
Shaktar	M. Lucesku	M. Lucesku	**Sevilla**	U. Emery	Sampaoli	**Sporting CP**	Nerizzo/ Montella	Montella/ Caparros
Zenit SP	Villa-Boas	Villa-Boas				**Tottenham**	M. Pochettino	M. Pochettino

SPORTS FINANCE: REVENUE SOURCES AND FINANCIAL REGULATIONS IN EUROPEAN FOOTBALL

Luis Carlos SÁNCHEZ

Ángel BARAJAS

Patricio SÁNCHEZ-FERNÁNDEZ

Abstract[1]

The purpose of this study is to examine how the evolution of revenue sources and economic control measures has affected European football. Turnovers in European football have experienced strong growth, especially as far as television rights and commercial revenue are concerned. Such growth did not prevent clubs from undergoing financial difficulties, which led UEFA and national leagues to impose stricter financial controls. These events brought about an overall increased profitability for European clubs, as well as divergent developments in debt and expenditure on wages, which were furthermore concurrent with the fact that sporting successes concentrate in the strongest teams, both in continental and national competitions.

Keywords: television rights, commercial revenue, regulation, financial fair play, competitive balance.

JEL classification: F15, G32, L51, L83, M21.

[1] Article translated from the Spanish by Ciro Arbós.

I. INTRODUCTION

Unaffected by economic crises, professional sport industry has experienced sustained growth, as evidenced by its three-fold growth rate increase in British and French markets, according to data provided by AT Kerney (2015). Professional sport is becoming a major entertainment business: its turnover in the United States amounted to 69,000 million dollars in 2017, according to PwC (2018), having thus overtaken film industry.

The leading professional sport is football, accumulating 43% of total turnover (AT Kerney, 2011). In professional sport, most of the revenue comes from yearly celebrated competitions, though certain events celebrated every number of years, such as the Olympic Games or football world championships, generate a high turnover as well. Even though football is a globally established sport, European leagues generate most of the revenue. American football and baseball together account for 25% of sport global turnover (AT Kerney, 2011), a figure far below that reached by football alone. However, the yearly competitions obtaining higher revenue are the American football (NFL) and baseball leagues (MLB), owing to the fact that both competitions absorb a very high percentage of the revenue generated in their respective sports. Thus, among the 100 leagues with higher revenue in the world, according to Wikipedia, the NFL is the only American football league included, and only three other baseball leagues are listed together with the MLB; on the other hand, 58 football leagues are amongst the 100 competitions obtaining higher revenue.

Football organization greatly differs from that of American sports. Whereas leagues such as the NFL or the MLB have private owners exclusively managing their sport business in their own market, in football, international competitions played between national teams and between clubs are especially important besides national leagues.

American professional leagues have profited since their inception from the huge United States market, a country with 300 million inhabitants and high purchasing power, as opposed to European countries, whose markets are much smaller in size. This circumstance not only affects football, but all sorts of products and services, disadvantaging European companies. In order to counteract such disadvantage, the European Economic Community was created in 1957 with the purpose of achieving a common market for European countries. However, the common market has only had an impact on the professional sports sector in recent decades. The transformation of clubs into commercial enterprises has led them to profit from free movement of capital, and the “Bosman ruling” triggered the establishment of a true common market for players.

American professional leagues have decision-making centralizing bodies in which all club owners participate. Their level of integration goes as far as to share revenue between all clubs, including revenue from television rights, sponsorship, and even from gate receipts. Furthermore, leagues apply a "luxury tax" that penalizes clubs with higher budgets while benefiting those of limited resources, and impose wage caps intended to counteract the bargaining power of stars. This cartel-like management of leagues without direct competition in their sport at the national –and almost the international– level facilitates economic sustainability of clubs.

On the other hand, in European football competitions there are no such centralized decisions. Clubs participating in leagues vary according to a system of promotions from or relegation to inferior competition categories; there are no wage caps, and revenue distribution is limited to a centralized negotiation of television rights, without this implying an equal share in most cases. All of this brings about fierce competition between clubs participating both in the same league and in other European leagues for the highest possible revenue enabling them to recruit the best talent in order to stay in the football elite, even at risk of incurring financial deficits that might lead them to bankruptcy. To avoid such deterioration, various economic controls on clubs have been implemented.

The purpose of this study is to examine how the evolution of revenue sources and economic control measures has affected European football. Firstly, we will provide a context for the economic liberalization and market creation measures having affected the professional football sector. Secondly, we will examine the evolution of revenue from the perspective both of its sources and its distribution among clubs depending on their size and the importance of the European competition they participate in. Regarding economic control, we will analyze measures provided for by UEFA and major European leagues. Last, we will consider the effects of this process on sporting competitions and the financial situation of clubs.

II. THE IMPACT OF THE ECONOMIC LIBERALIZATION CONTEXT ON FOOTBALL

Europe has experienced a sustained economic liberalization process. European football developed unaffected by that process until the implementation of free movement of capital, services, and workers, which brought about important changes. The economic globalization process has affected all sectors. In the case of sport, it has affected European football to a greater extent than American professional sports, as Andreff (2008) points out.

1. Movement of Capital

The possible influence of free movement of capital on football seemed remote before the 1980s. At that time, European teams belonged to membership clubs, save for the United Kingdom, where clubs were capital companies. However, the functioning of British clubs did not greatly differ from that of continental clubs, since the English federation gave priority to the sporting facet of clubs, as provided for by *Rule 34,* established in 1892. That rule limited the number of dividends to be distributed among shareholders, prohibited remuneration for managers, and stipulated that a club's assets, in the event of liquidation, must be transferred to another local sporting entity. *Rule 34* was amended in 1981 to enable higher remunerations for club owners at first, and thereupon to definitively remove such limitations, which favored the entry of investors in football, as detailed by Sánchez (2006).

In Italy, all professional football clubs were mandatorily made into capital companies by an act passed in 1981 (Baroncelli and Caruso, 2011). In 1984, France imposed transformation into capital companies to all clubs having incurred losses in two consecutive financial years (Dauncey and Hare, 1999); at first, it was stipulated that membership clubs remained shareholders of the capital companies, but exclusive control by investors was later permitted. In Spain, transformation of football clubs into capital companies was imposed by the 1990 Sport Act, which required all clubs to become sporting limited companies (SAD, in its Spanish initials), save for those enjoying a sound financial position at the time. Most German clubs have turned into capital companies even though they had no legal obligation to do so, following a process that began in the late 1990s and speeded up in the following decade, as explained by Rhode and Breuer (2017).

At first, this transformation process did not cause abrupt changes in property in most cases. The first owners of English clubs turned into capital companies were closely linked to the club, for they were mostly local entrepreneurs and professionals. In Spain, some clubs transformed into sporting limited companies initially had up to 20,000 shareholders. In Portugal and Germany, clubs retained their legal identity within the new capital companies managing their professional teams, and held most of the shares.

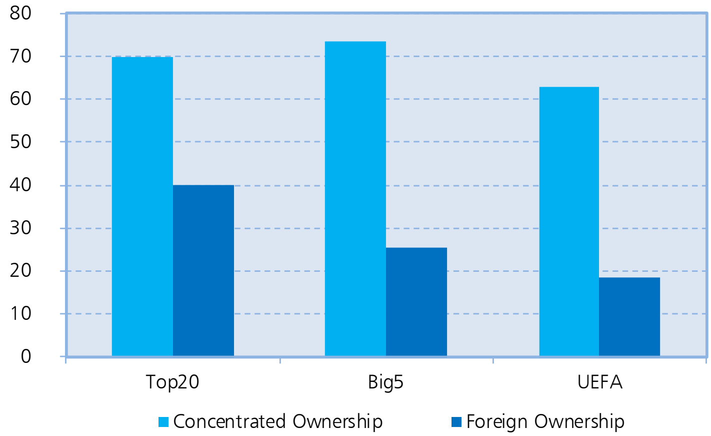
However, a process of property concentration developed over time in European football, which enabled a reduced number of owners to control a growing number of clubs. This process has speeded up in recent years: in the last decade, the percentage of European first division clubs with concentrated ownership increased from 54% in 2006 to 64% in 2016.

Such property concentration is developing regardless of the size of clubs. In the 2015/16 season, 70% of the 20 clubs with higher revenue in Europe and 73% of clubs from the five major leagues showed concentrated ownership.

Conversion of clubs into capital societies, together with capital movement liberalization, favored an opening-up to foreign investors, who have taken over many clubs. In most cases, they have acquired majority stakes. Foreign investment has focused on the biggest clubs (see Figure1), which are more attractive on account of their larger number of followers throughout the world, as pointed out by Morrow (2003).

FIGURE 1

PERCENTAGE OF CLUBS UNDER FOREIGN OR CONCENTRATED OWNERSHIP IN 2016



Source: UEFA (2018) and authors' own compilation.

2. Movement of Workers

Even though Article 39 of the Treaty of Rome (1957) already established free movement of workers within the European Community, European football clubs had limited capacity to sign foreign players due to restrictions imposed by national federations. This situation came to an end abruptly when, in 1995, the European Court of Justice ruled in favor of Jean-Marc Bosman, declaring such limitations illegal.

This ruling revolutionized the European market for players, leading to an increase in players' mobility, as foretold by Maguire and Stead (1998). Accordingly, whereas in 1986 only 9.1% of players from the five major European leagues were foreigners, that percentage raised up to 46.7% twenty years later.

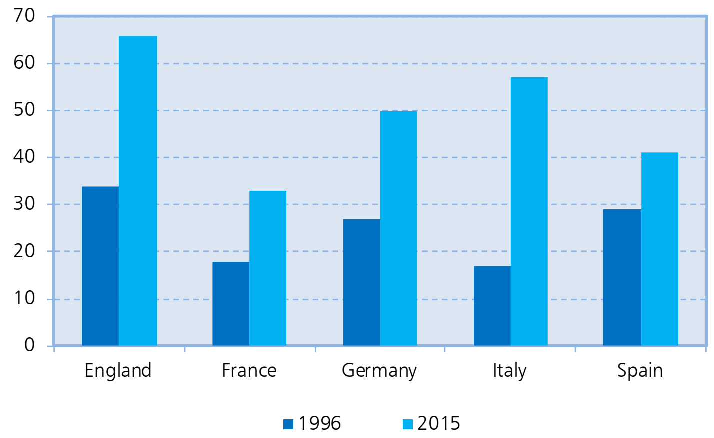
This strengthened the most financially powerful clubs, which were thereafter able to sign players unrestrictedly. Thus, for instance, Arsenal had at some point up to 97% of foreign players in its squad. By virtue of the numerous dual citizenship agreements between European countries, recruitment of talent has gone beyond European borders. Consequently, 46% of players having participated in the America Cup and 66% having played in the Africa Cup in 2015 belonged to European clubs.

This process has also favored numerous transfers of players from minor leagues to clubs from major leagues. Whereas in 2011 clubs participating in the so-called Big5 leagues (Premier League, La Liga, Bundesliga, Serie A, and Ligue 1) spent 507 million euros on players, compared with the 224 million spent by all other leagues in the world, in 2018 differences have increased markedly, having the Big5 leagues spent 2,188 million euros that year, compared with the 395 million spent by all other leagues across the world, according to FIFA (2018).

But mobility of players has not only affected the Big5 leagues. The rest of European leagues have seen their best players migrate, but they have also profited from free movement of workers by recruiting players from other countries. For that reason, percentages of foreign players in European leagues do not excessively differ, as shown in Figure 2.

FIGURE 2

PERCENTAGE OF FOREIGN PLAYERS IN EUROPEAN LEAGUES



Sources: Bourg and Gougueet (2001), and Poli, Ravenel and Besson (2016).

III. REVENUE SOURCES IN EUROPEAN FOOTBALL

1. Changes in Revenue Sources

Recurrent revenue of football clubs comes from fee charges for attendance to stadiums, television rights, and commercial and advertising agreements. Until recent decades, the main revenue source for clubs was gate receipts. For that reason, Santiago Bernabeu decided to build a stadium with a seating capacity of 100,000, whereas the old stadium could only hold 25,000. His idea was that, the bigger the stadium, the higher the revenue, which would enable the club to have a better squad.

In the 1970s, advertising and sponsorship revenues became significant. Until then, clubs rarely had advertising spaces in stadiums, but the decision to include sponsors on team jerseys opened the way for commercial revenue. In the 1970s, Bayern Munich introduced the use of the Adidas logo on team uniforms. The sportswear company Admiral reached an agreement with Leeds whereby team jerseys exhibited their logo and the company began to sell replica Leeds jerseys, the club retaining a percentage of sales revenue. Shortly after, other sportswear manufacturers adopted this strategy, such as Umbro, Bukta, or Le Coq Sportif.

Companies soon realized that sponsorship meant more than sales increases, for their brand itself could profit from the positive image associated with sport (Jeanrenaud, 2006). But European football was initially reluctant to sponsorship, until the German league authorized advertising on jerseys in the 1970s; the rest of competitions followed suit. Thus, Liverpool signed a contract with Hitachi in 1979. That same year, Juventus signed an agreement with the household appliances firm Ariston. Advertising on team jerseys was introduced three years later in Spain, when Real Madrid signed an agreement with the household appliances company Zanussi.

Clubs also realized soon that, besides jerseys, they could sell all sorts of products associated with their emblems and colors. Initially, agreements were reached whereby clubs surrendered their image rights to companies, as was the case of Real Madrid and the firm Dorna in 1990, the contract having amounted to 18 million euros. Later, the clubs themselves began to license their products directly.

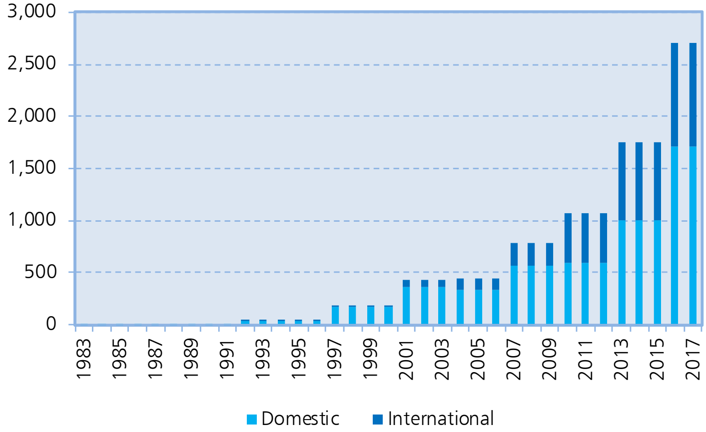
More recently, clubs have begun to obtain revenue for assigning the name of their stadium to commercial brands. Whereas American sport had been long surrendering the *naming rights* of its stadiums, European football had little experience. The increased importance of this revenue source was illustrated by the agreement between Arsenal and Emirates airline, whereby the club surrendered the name rights of its new stadium for a 15-year period for 100 million pounds.

Besides regulations imposed by football federations, requirements made by television companies also hindered the growth of commercial revenue for clubs. For instance, in the early 1980s the BBC and ITV refused to broadcast the games of teams exhibiting advertising on their jerseys. At the time, European televisions had great bargaining power due to the limited number of broadcasters.

Sector liberalization favoring the entry of new private operators and technological progress enabling television broadcasts via satellite or the Internet completely altered the situation. Whereas in 1983 televisions paid 2.6 million pounds to broadcast Premier League games, the current contract negotiated by the English league for the national television market brings an annual return of 1,712 million pounds. Likewise, in the 1980s the possibility of a foreign television paying to broadcast English football was not even considered; today, international television companies pay out a third of the total perceived by the English league for television rights.

FIGURE 3

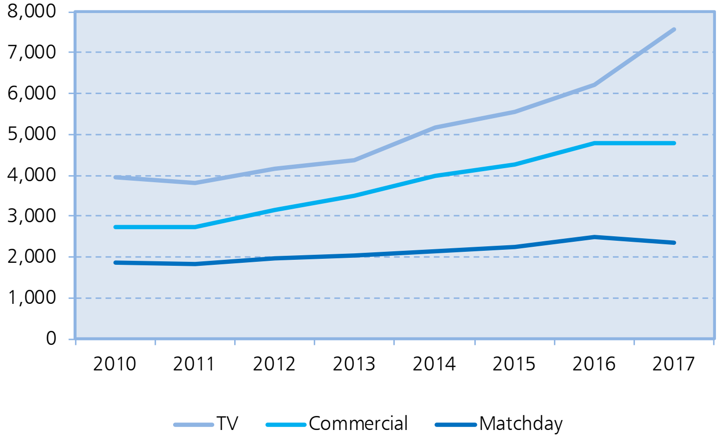
PREMIER LEAGUE TV RIGHTS (millions of pounds)



Sources: Authors' own compilation.

FIGURE 4

EVOLUTION OF TURNOVER SOURCES IN THE BIG5 LEAGUES (millions of euros)

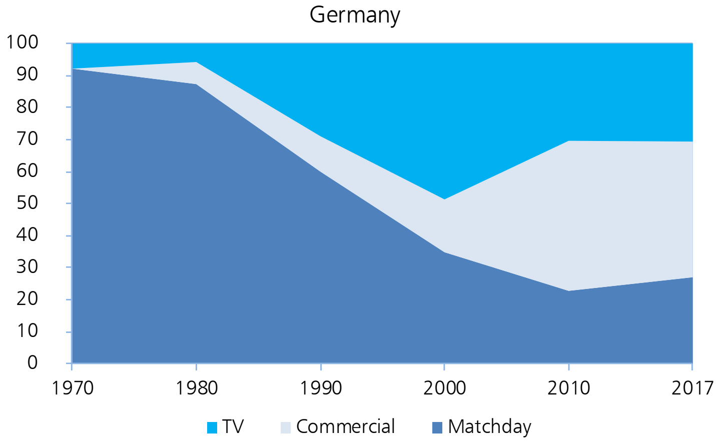


Sources: Authors' own compilation based on data provided by Deloitte (2012-2018).

In the group of major European leagues, the so-called Big5, commercial and television rights revenues have significantly increased over the last few years, while revenue from stadium attendance has stagnated.

FIGURE 5

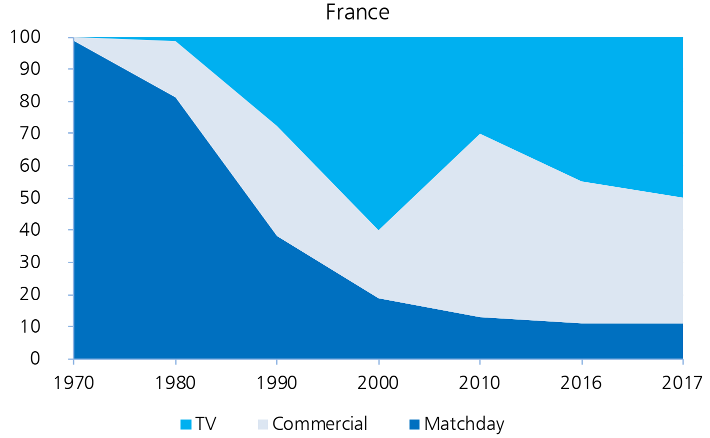
TURNOVER SOURCES IN FRENCH AND GERMAN LEAGUES (in percentage)



Sources: Authors' own compilation based on Andreff (2000), Frick (2006), and Deloitte (2012-2018a).

FIGURE 5 *(continued)*

TURNOVER SOURCES IN FRENCH AND GERMAN LEAGUES (in percentage)

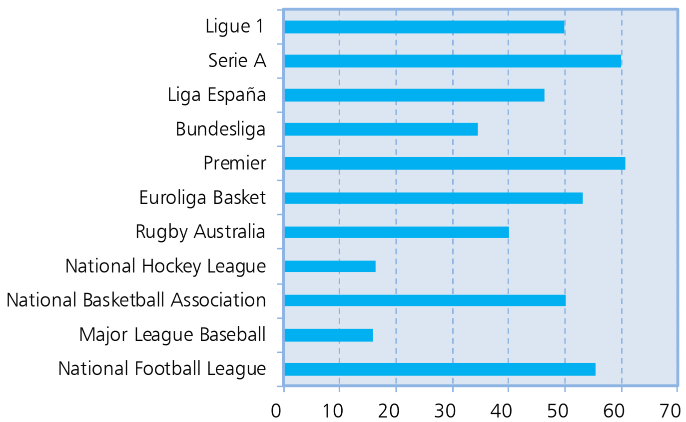


Sources: Authors' own compilation based on Andreff (2000), Frick (2006), and Deloitte (2012-2018a).

Commercial revenue has multiplied in absolute terms over the last decades. In relative terms, its weight grew until the turn of the century, when its percentage over total revenue from turnover (player transfers excluded) stabilized.

FIGURE 6

PERCENTAGE OF REVENUE FROM TELEVISION RIGHTS OVER OPERATING REVENUE



Source: Authors' own compilation.

That is not to say that television rights entail a decrease in revenue from gate receipts, though a substitution effect can be assumed; Forrest, Simmons and Szymanski (2004) show that such effect is limited. Frick and Prinz (2006) even suggest a positive effect, for television increases the number of competition followers.

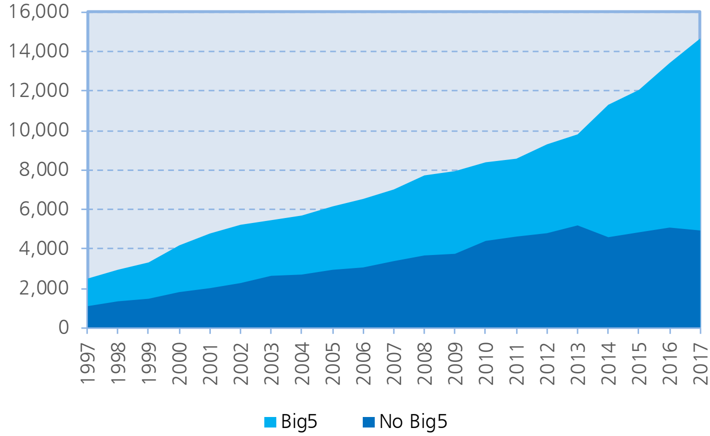
Revenue from television rights has definitely become the primary revenue source for European football. An evident relation between the size of a league and the importance of its television rights in terms of revenue is not to be found when comparing different competitions, as shown in Figure 6.

2. More Money for the Powerful

European football had a turnover of more than 25,000 million euros in 2017, according to Deloitte (2018a). However, turnover is far from being uniform, concentrating in major leagues and clubs. Turnover concentration is a long-standing situation. Clubs participating in the Big5 leagues have experienced a much greater growth than clubs from any other European competition. Even if all leagues have increased turnover, that of major leagues has grown by 437% since 1997. The rest have only increased their revenue by 360%. Furthermore, this gap has particularly broadened from 2014 on, as can be observed in Figure 7, major leagues having speeded up their growth whereas the rest have become stagnated.

FIGURE 7

BUSINESS TURNOVER EVOLUTION (millions of euros)



Sources: Authors' own compilation based on UEFA (2010-2018).

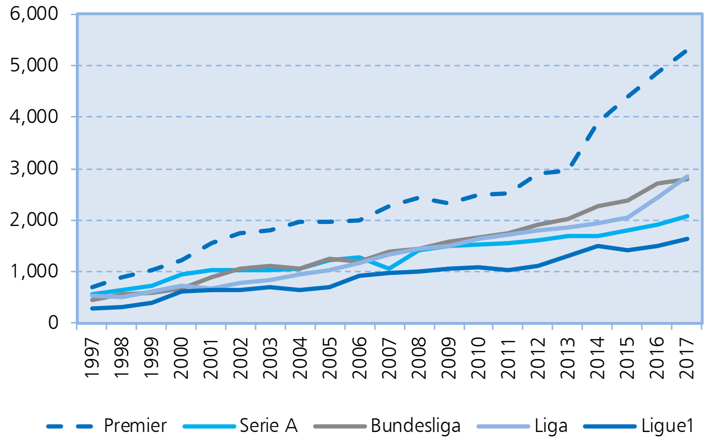
Turnover evolution in all Big5 leagues has been similar, as can be observed in Figure 8. Premier League has continued to prevail since the 1990s, and French league is still the smallest among major leagues. Italian league shows the slowest growth rate.

Just as major leagues have grown most, major clubs from those leagues have also experienced the greatest growth. Already in 2005, turnover was highly concentrated in the 20 clubs with higher revenue (which we will call 'Top20'), whose turnover was similar to that of all other 78 clubs participating in the Big5 leagues together, and to that of almost 700 clubs from all other European leagues.

Concentration has been intensified since 2011. From then on, Top20 turnover has by far exceeded that of all other clubs from Big5 leagues. Two years later, turnover of leagues other than Big5 leagues stagnated, having thus further decreased their relative weight over total turnover of European football industry.

FIGURE 8

EVOLUTION OF BIG5 LEAGUES TURNOVER (millions of euros)

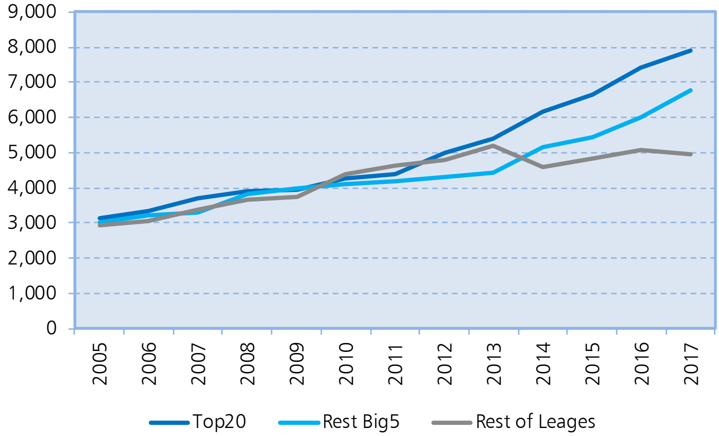


Sources: Statista (2018).

As shown in Figure 10, whereas in 2005 European leagues other than Big5 leagues represented a third of total turnover, today they hardly represent a quarter. The market share lost mostly goes to the 20 most powerful clubs, the rest of Big5 clubs being excluded from profit. Thus, Top20 have increased their market share from 35% in 2005 to 40% in 2017.

FIGURE 9

TURNOVER EVOLUTION
(millions of euros)

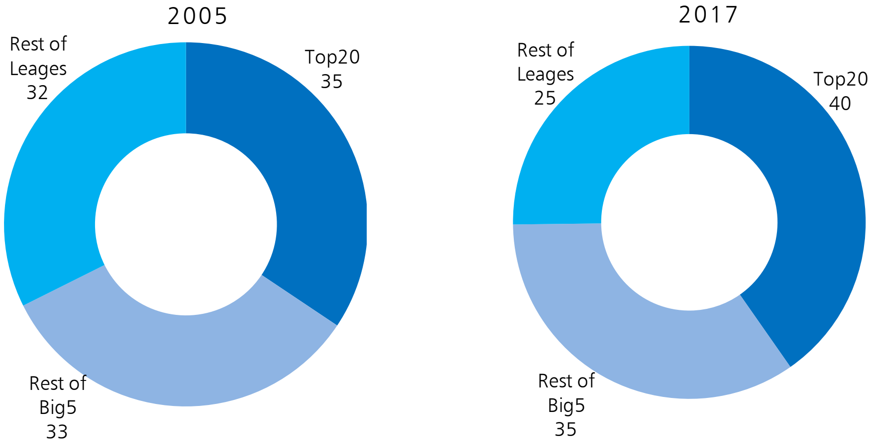


Sources: Authors' own compilation based on UEFA (2010-2018) and Deloitte (2010-2018a; 2005-2018b).

Popularization of European competitions through the greater number of games played in the UEFA Champions league after introduction of the group stage, and popularization of the broadcasting of games from other national

FIGURE 10

PERCENTAJE OVER TOTAL TURNOVER OF EUROPEAN FOOTBALL



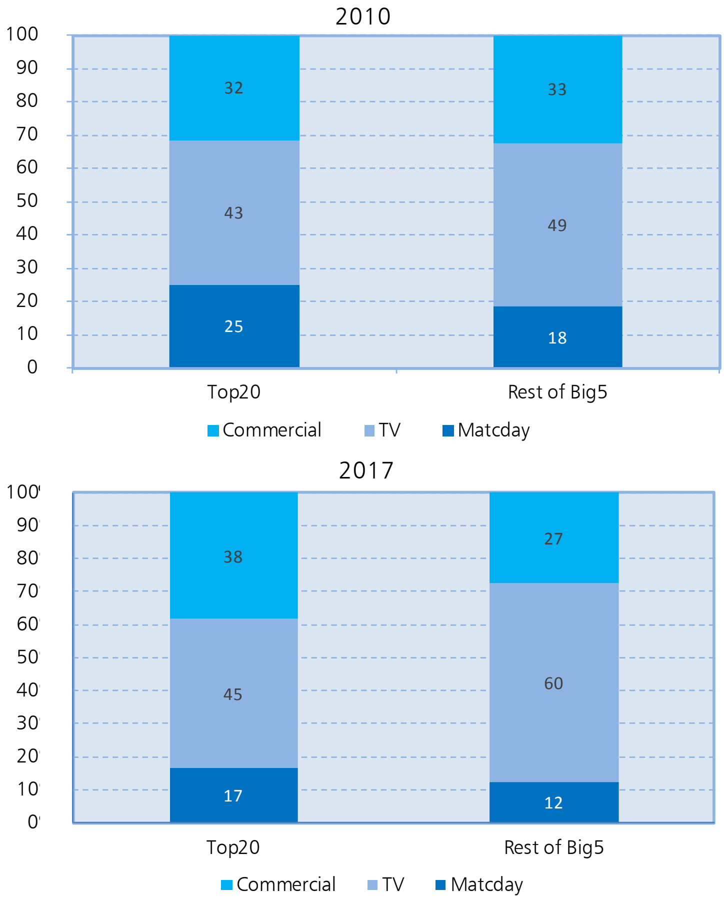
Sources: Authors' own compilation based on UEFA (2010-2018) and Deloitte (2010-2018a; 2005-2018b).

leagues by means of new television broadcasting systems, has led major clubs to spread their popularity far beyond their own countries or towns. In Asia, the United States and some European countries, fans rather follow Big5 leagues than their own domestic leagues, according to data provided by YouGov (2015), Nalbantis and Pawlowski (2017), and JD Sport (2018).

Such greater popularity arises greater commercial interest among advertisers and franchisees of sport merchandising. But only major clubs make a profit from such interest. On the other hand, increase in television rights benefits all

FIGURE 11

EVOLUTION OF COMMERCIAL REVENUE SOURCES AS A PERCENTAGE OVER THE TOTAL



Sources: Authors' own compilation based on Deloitte (2010-2018a; 2005-2018b).

clubs, owing to a collective negotiation system. This situation translates into differences in the weight of each revenue type between Top20 clubs and all the rest. Whereas in 2010 the weight of commercial revenue over total revenue was quite similar in both groups, today the importance of commercial revenue has increased for Top20 clubs but decreased for all other clubs from major leagues.

3. The Impact of European Competitions

There exists no international league competition. Since 1955, clubs coordinate participation in national competitions with participation in club competitions organized by UEFA. Initially, competitions adopted a knock-out system, and, though organized by UEFA, television rights were owned by clubs.

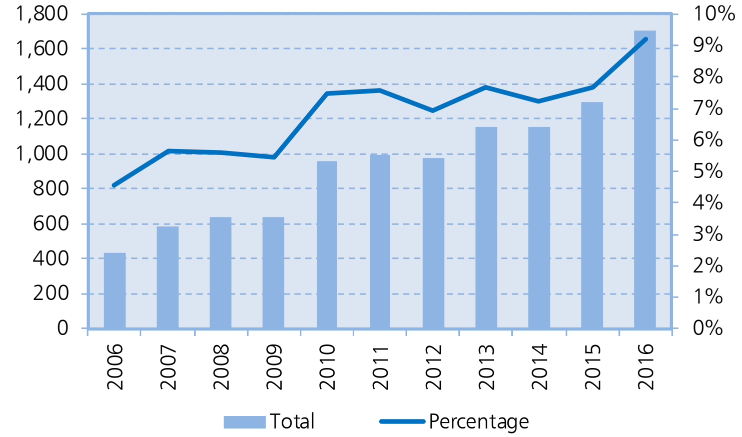
In 1992, UEFA created the UEFA *Champions League.* The main innovation was to include a two-group stage in which the four teams in each group played a short league to qualify for the finals. But the greatest change was introduced in 1997, when participation of two clubs from the most important national leagues was permitted (until then only one club per country could participate), and the group stage was enlarged to include six groups. Thus, the number of games increased from the 29 played in the first European Cup to 125 under the new format. The greater presence of strong teams after removal of the one-per-country limit and of teams participating in the group stage increased the number of attractive matches, which led to revaluation of television rights. A true pan-European product was thus designed, which became established when, in 1999, the number of participating clubs from major leagues increased up to four per country. Furthermore, television rights are centrally negotiated by UEFA.

The inception of both Champions League and UEFA Europa League has made a real change in the football industry. The sums received by clubs for participating in these tournaments experienced exponential growth as compared with previous competitions organized by UEFA. Consequently, their percentage over European football total revenue is also increasing. Today, more than 9% of the revenue obtained by European clubs comes from competitions organized by UEFA.

Such growth has benefited leagues other than the Big5 to a greater extent, since in 2005 they perceived 29% of the money generated by UEFA, and today they get 37%. On the contrary, whereas in 2005 the 20 biggest teams obtained more than half of the revenue from European competitions, today they have a smaller share (43%), though the size of the "cake" is much bigger. Differences are due to the fact that clubs from minor leagues obtain from UEFA

FIGURE 12

REVENUE FROM EUROPEAN COMPETITIONS, IN TOTAL (IN MILLIONS OF EUROS) AND AS A PERCENTAGE OF TOTAL REVENUE OF CLUBS



Sources: Authors' own compilation based on data provided by UEFA.

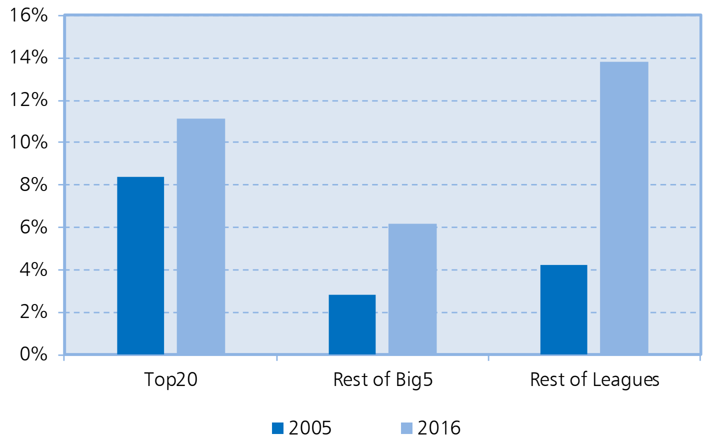
competitions a much higher revenue than that generated by their television markets. Thus, for instance, Swiss clubs received six times as much money from UEFA than from their national televisions for the purchase of Champions League broadcasting rights in the 2014-2015 season. Other examples include the case of Dutch clubs, which obtained five times as much, or of Portuguese clubs, which obtained four times as much, according to Oliver & Ohlbaum Associates (2016).

A distinction should be made between revenue from European competitions and its importance for clubs in budgetary terms. Although clubs from minor leagues get a thinner slice of the cake of European competitions, that revenue represents a bigger portion of their total turnover than in the case of major clubs. On the other hand, revenue from European competitions is less important for smaller clubs participating in Big5 leagues than for all other clubs, given that it represents 11% for Top20 clubs and almost 14% for clubs participating in leagues other than Big5 leagues.

Such revenue distribution might significantly vary following implementation of the new distribution model adopted by UEFA for its competitions. Until now, revenues from Champions League were distributed as follows: a fixed 30% for all participants; 30% depending on sporting outcomes; and 40% depending on the *market pool.* The *market pool* is the share of money received by clubs according to the size of their markets, estimated from the value of the television

FIGURE 13

REVENUE FROM EUROPEAN COMPETITIONS AS A PERCENTAGE OF TOTAL REVENUE



Sources: Authors' own compilation.

broadcasting contract in each country. Under the new distribution system, first implemented for the present season, the fixed reward for qualifying is reduced to 25%, distribution of 30% depending on sporting outcomes is maintained, and the *market pool* is only assigned a 15% of the total. A new distribution element is therefore included, based on team results coefficients over the last ten years and the number of European titles won in history. In principle, this system should benefit clubs participating more regularly in the competition, which are precisely the major clubs. On the other hand, clubs from major leagues (with a high market pool) only occasionally qualifying will be penalized, as well as clubs from all other leagues to a lesser extent, given the slight reduction of the fixed percentage for qualifying.

IV. ECONOMIC CONTROL MEASURES

In spite of sustained revenue growth, European football clubs have suffered from repeated economic crises having caused heavy losses and chronic indebtedness that seemed inherent to sport and affected all competitions, as explained by Lago, Simmons and Szymanski (2006), Andreff (2007), Hamil and Walters (2010), and Barajas and Rodríguez (2009, 2010 and 2014).

But despite such poor economic results, football clubs show a high survival rate. Storm and Nielsen (2012) link this fact with a phenomenon called *soft* *budget constraints,* consisting in operations in which expenditure incurred is higher than initial revenue, counting on the high probability of an external benefactor covering the difference between exceeding costs and initial revenue. This phenomenon was originally explained by Kornai (2003) to describe socialist economies.

Dietl and Franck (2007) claim that disperse ownership of clubs hindered management control and resulted in poor economic performance. Andreff (2015) considers that the lack of such restrictions was the main cause for mismanagement in European football, as opposed to American professional sports, where such problems could indeed arise between a principal and an agent.

On the other hand, Sánchez, Barajas and Sánchez-Fernández (2017) observe that concentrated ownership in European football helps avoiding problems associated with the cleavage between owners and managers, but might also increase the incentives for owners to take advantage of stakeholders, who would act as benefactors in the case of economic difficulties.

Andreff (2007), Frank (2014), and Barajas, Castro-Limeres and Gasparetto (2017) maintain that economic control by supervisors was the best tool to reverse the situation. Supervision had always existed, but had little success. Regulation and supervision of football championships used to lie with the football federation of each country. Although economic structure requirements were always included, most regulations referred to sporting aspects. The

TABLE 1

EUROPEAN FOOTBALL ECONOMIC CONTROL AND SESSIONS (2014)

Competition	*Supervising Body*	*Year of implementation/ Actualization*	*Primary criterion*	*Club Sale control*
Champions/ Europa League	UEFA (acts as federation and organizer)	2004 (licenses)	Defaults	No
		2014 (FFP)	Break-even	
Liga LFP	League	2011	Break-even and wage costs	No
Premier	League	2013	Break-even and wage costs	Yes
Ligue 1	Mixed (League and Federation)	1984	Defaults	Yes
Bundesliga	League	2001	Liquidity	Yes
Serie A	Federation	1981	Defaults	No

Sources: Authors' own compilation.

German football federation established financial situation evaluation criteria in the 1960s. Other federations began also to include certain requirements, though somewhat lax, and virtually no sanctions where imposed despite the serious financial deterioration that would affect European football in the following decades.

At the end of the last century, the top divisions of major European leagues began to be directly organized by clubs instead of by federations. Economic supervision of clubs continued to lie with federations until the beginning of the 21st Century, when leagues began to assume that role in most countries. The establishment of UEFA financial regulations for clubs participating in European competitions turned to be a salutary shock fostering greater supervision throughout European football. Table 1 presents an outline of the main European bodies for financial supervision of clubs. They will be explained in detail in the following sections.

1. UEFA Economic Control

In 2002, UEFA determined that clubs must get a license to participate in European competitions. The goal of this license was to improve management standards of clubs lacking financial transparency and investment on talent pools, while economic instability and defaults abounded. In 2004, licensing requirements were first established, which were classified in five groups: sport-related, financial, legal, infrastructure, and personnel qualification requirements.

A 2009 UEFA report revealed that more than half of the 650 European clubs did not make a profit. This caused clubs to become heavily indebted, often to other clubs, and led to financial failure of clubs throughout the continent. That same year, UEFA established a financial control system that came to be known as Financial Fair Play (FFP), aimed at preventing teams from incurring relevant losses and helping them break even. The licensing system came into force on June 1st 2010, so that a license was first required to participate in European competitions for season 2011-2012. The break-even requirement included in Financial Fair Play was implemented for participation in the 2014-2015 season. Each regulation is supervised by a different body: The Licensing Committee and the Club Financial Control Body.

1.1. Licenses

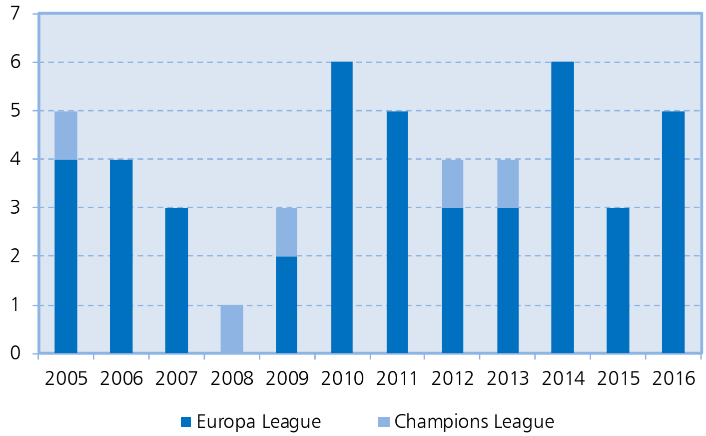
The licensing process for participation in European competitions includes financial requirements. One of them is to have appointed a qualified finance officer (article 29 of UEFA Club Licensing and Financial Fair Play Regulations). Clubs must also submit all information regarding their financial statements to UEFA (arts. 47-48), and prove to have no overdue payables towards other football clubs, employees, social security or tax authorities by March 30th (arts. 49-50).

If the audit report on the annual accounts of a club expresses doubt about compliance with the principle of going concern, or if net equity is found to be negative, the club must submit financial forecasts demonstrating its ability to continue as a going concern until the end of the season. Forecasts must include a budgeted profit and loss account, budgeted cash flow, a description of possible risks affecting future financial results, and the rationale for all assumptions made to elaborate forecasts.

In the first ten years following implementation of the licensing system, 49 clubs having qualified for a European competition were finally excluded because they failed to obtain a UEFA license. In five cases clubs were excluded from the Champions League, whereas in the rest of cases they were denied participation in the Europa League, as shown in Figure 14. These clubs came from 21 different countries, including some participating in one of the Big5 leagues, such as Portsmouth, RCD Mallorca, Rayo Vallecano, Parma, and Genoa.

FIGURE 14

NUMBER OF CLUBS EXCLUDED FROM EUROPEAN COMPETITIONS IN DEFAULT OF A LICENSE



Sources: UEFA (2015).

Out of 722 clubs participating in the top divisions of European leagues, 448 (67%) were granted a license, 100 (14%) had their applications turned down, and 174 did not apply for a license. In two-thirds of all cases, the primary ground for license refusal was the persistence of overdue payables towards employees or other football clubs, or else of tax obligations.

1.2. Financial Fair Play

UEFA monitors clubs having obtained a license to ensure that they meet two key additional requirements. The first one is to prove that they have no overdue payables towards other football clubs, employees, social security or tax authorities after license has been granted, specifically between June 30th and September 30th (arts. 65-66).

The second requirement is to comply with the break-even rule, detailed in articles 58 to 64 of UEFA Club Licensing and Financial Fair Play Regulations, which provide that difference between relevant income and relevant expenses must have been positive over the last three financial years, or, if negative, it must not exceed 5 million euros. If this requirement is not fulfilled, the club must substantiate that such deficit is covered by surplus achieved in the two preceding financial years. The 5 million euros break-even deficit may increase up to 30 million if excess is covered by contributions from owners or related parties. In the event of unfulfillment, the club and UEFA may reach an agreement to implement the necessary measures to correct deficit.

Relevant income includes various concepts, such as operating and financial income, revenue from player transfers, and from disposal of fixed assets. Relevant expenses include operating and financial expenses, dividends, and amortization of the book value of contracts signed with players. Income and expenses from non-football operations, non-monetary credits and debits, expenditure on youth development and women's football activities, finance costs attributable to the construction or substantial modification of tangible fixed assets, and tax income and expense are not included. Profit and loss on disposal or amortization of both tangible and intangible fixed assets are also excluded, except for those related to the book value of players. Furthermore, transactions with parties related to club ownership are valuated according to fair value.

Additionally, a club must submit the projected break-even information for the current season when the auditor is uncertain about compliance with the principle of going concern, when net equity is negative, when showing a break-even deficit for the two seasons preceding the last concluded season, when sustainable debt indicator (excluding debt incurred for the construction or improvement of sporting facilities) exceeds 30 million euros or is 7 times higher than average relevant income in any of the two preceding financial years, or else when negative balance in player transfers exceeds 100 million euros.

In the first season under Financial Fair Play regulations, 15 clubs failed to meet the break-even requirement. 14 came to an agreement with UEFA to correct break-even deficit. Dynamo Moscow was the first club to be excluded from European competitions due to non-compliance with Financial Fair Play. In the following season four clubs were unable to fulfill the break-even requirement, whereas there was only one case in the 2016-17 season. UEFA also reached an agreement with those five clubs to correct break-even deficit.

2. Financial Supervision in Spain

The 1990 Sport Act already granted the competence of financial supervision of professional clubs to the Liga de Fútbol Profesional (LFP). However, the league first took action in 2014. That year, LFP implemented additional financial controls, so that supervision became both retrospective, past seasons being monitored, and preventive, since budgets for the following season were supervised before season start.

2.1. Ex post Supervision

The first obligation of clubs is to present the information necessary for supervision. Documents required include, among others, interim finance statements, a list of liabilities arising from player transfer and acquisition activities, and lists of payable overdues towards both employees and public administrations.

Clubs must fulfill various requirements detailed in articles 11 to 24 of Professional Football League Financial Control Regulations. Relevant requirements include to have no liabilities arising from player transfer activities towards any other club from any league (art. 16), towards employees (art. 17), or towards Public Administration (art. 18). Moreover, relevant income must exceed relevant expenses, or deviation must be acceptable (art. 20); first squad-related expenses, technical staff included, must be below 70% of relevant income (art. 22); and net debt cannot exceed the amount of relevant income for the season (art. 23). Relevant income and expenses are defined in a way similar to definitions included in UEFA regulations, and, in case of unfulfillment, league and club will agree on the necessary corrective measures.

2.2. Ex ante Supervision: Wage Cost Limitation

Before season start, LFP also monitors budgets for revenue and expenditure, cash flow, investments and disinvestments, and club financing, which must be elaborated as indicated in articles 8 to 48 of budgeting regulations.

In their budgets, clubs must adjust and limit squad costs in order to achieve break-even, that is, to avoid incurring losses. The wage bill is the largest item of club expenditure (Barajas and Rodríguez, 2010). Moreover, it is a variable which can be monitored ex ante, since contracts with new players must be deposited in headquarters, and LFP has the power to deny inscription of new players if it entails exceeding the prescribed limits.

This wage cap is different to that of American professional leagues. In the LFP, each club sets its own limit. LFP estimates limits by adding up the accounting results of a club for the two preceding seasons and its projections for the current season, together with computable contributions (articles 59 to 70 of budgeting regulations). From that amount, repaid computable contributions to increase squad costs, and overdue, fixed, and enforceable credits from the preceding season are deducted. In short, control is intended to ensure that the projected budget is met and balanced results are obtained. This is achieved by monitoring the largest expenditure item bore by clubs: squad wages.

3. Financial Supervision in England

Supervision of English clubs traditionally lied with the football federation, even after creation of the Premier League in 1992. However, control implementation by UEFA led clubs to extend requirements, even if they did not participate in European competitions. The ongoing economic difficulties experienced by several clubs in spite of a growing television rights revenue led Premier League to implement additional requirements and to strengthen supervisory standards.

Premier League limits possible losses of participating clubs by means of the "Profit and Sustainability" rules (articles E.53 to E.60 of Premier League Regulations). Losses accumulated in the three preceding seasons cannot exceed 105 million pounds. If losses are below that limit, but exceed 15 million, club administrators must warrant acquisition of sufficient resources to cover that deficit. The league places particular emphasis on valuation of club transactions with related parties at fair prices, given the sponsorship-related precedents.

Limits are made more flexible in the case of clubs having reached the Premier League in the two preceding financial years, and estimates exclude expenditure on infrastructures and youth sectors developments.

Furthermore, clubs must certify that they have no liabilities, especially towards other clubs and tax liabilities. Premier League has implemented additional controls for clubs included in FFP to prevent new revenue from television rights contracts to result in a race for new recruitments aggravating the financial difficulties which had already led clubs to bankruptcy. Control is primarily focused on increases in the wage bill in order to ensure sustainability of clubs. Thus, Premier League sets a common wage cap for all clubs; as provided for in articles E.18 to E.20 of Premier League Regulations for the 2018-2019 season, the wage bill should not exceed 81 million pounds overall, or that of the preceding year in 7 million pounds, or else the wage bill of season 2012-2013 in 33 million. There are exceptions to limits, for instance, if a club demonstrates that increase in wages is covered by operating revenue, excluding revenue from centralized television rights contracts agreed upon by Premier League. This measure is intended to prevent clubs from increasing their squad costs by raising the price of television rights in contracts won by Premier League.

Acquisition of a Premier League club requires previous authorization from the league, which may be denied on various grounds; for instance, if the new owner is banned from entry to the United Kingdom, or his assets stranded according to British or European Union regulations (art. F.24), or else if a buyer directly or indirectly holds any class of share of another club's stock (art. G.10).

4. Financial supervision in France

Financial control of French clubs is exerted by the *Direction Nationale du Contrôle de Gestion* (DNCG) (Andreff, 2018). It is a body created in 1984 and composed of representatives of the French professional league, the French football federation, as well as of clubs, players, coaches, etc.

DNCG legally and financially monitors French clubs in order to ensure they comply with regulations of national and international competitions, to evaluate changes in the shareholding structure of clubs, and to control the activity of sports agents.

In order to fulfill their obligations, clubs are requested to submit their accounting statements, a briefing on contractual conditions for squad players, and detail of all payable overdues, as well as to report all ongoing lawsuits in which they are involved. Failure to submit information and irregular accounting carry sanctions ranging from economic penalties to dismissal of sporting managers, and also including relegation to inferior divisions and prohibition of new player registrations.

The selling of a club requires authorization from the DNCG; required documentation to that effect includes the agreement of sale, a three-year business plan, *due diligence* reports, and an independent report assessing the good repute of buyers.

5. Financial Supervision in Germany

Financial control in the Bundesliga is exerted by the German Football League (DFL), which grants the license to register in the professional league. It is one of the oldest systems in Europe, dating back to 1960, when the German Football Federation implemented it. Requirements for licensing are not only finance-related, legal and infrastructure criteria being also applied.

Clubs must submit to the league their audited annual accounts, an estimate of revenue and expenditure, and proof of having no overdue payments towards players, other clubs, and tax and social security authorities. Cash flow forecast must justify availability of sufficient liquidity to meet all payment commitments and finance day-to-day operations in the following 18 months. The federation may modify forecasts submitted if it considers them to be unrealistic. In case of negative own funds and positive cash flow forecast, license will be granted, though certain conditions could be imposed. In case of forecast cash flow deficit, licensing could be subject to the fulfillment of certain requirements.

Furthermore, Bundesliga controls club ownership. Since 1998, clubs may set up joint-stock commercial companies to develop their activities in professional football, but only provided that the sporting club retains a majority holding. Thus, investors can only acquire 49.99% of club shares. This rule, known as “50+1”, makes an exception for investors committed to club support for over 20 years, who are allowed to possess more than half of the capital. Nevertheless, the Austrian multinational Red Bull managed to take control of RB Leipzig, even though it has preserved a formal structure of membership club.

6. Financial Supervision in Italy

Supervision of Italian clubs lies with the *Commissione di Vigilanza sulle Società di Calcio Professionistiche,* a body subordinate to the Italian Football Federation. It is competent to collect all documents and financial data for evaluating clubs, to look over and ensure that data provided reflect the real economic situation of clubs, and to propose to the federation the necessary decisions in order to protect club assets.

Clubs must certify they have no payable overdues towards tax authorities, employees, or other clubs. Moreover, Italian supervisors examine certain financial ratios, basically including production value to net financial debt, net equity to assets, and total revenue to total debt. According to the degree of fulfillment regarding budgets, and the evolution of such ratios, the commission may make recommendations, and even impose sanctions.

V. EFFECTS ON THE FINANCIAL SITUATION

Evolution of revenue sources and regulations brings about different management models depending on the size both of clubs and leagues. Expenditure on wages, indebtedness, and profitability are some of the key factors to be considered in order to appraise the financial situation of clubs. In this section, changes in European football are examined.

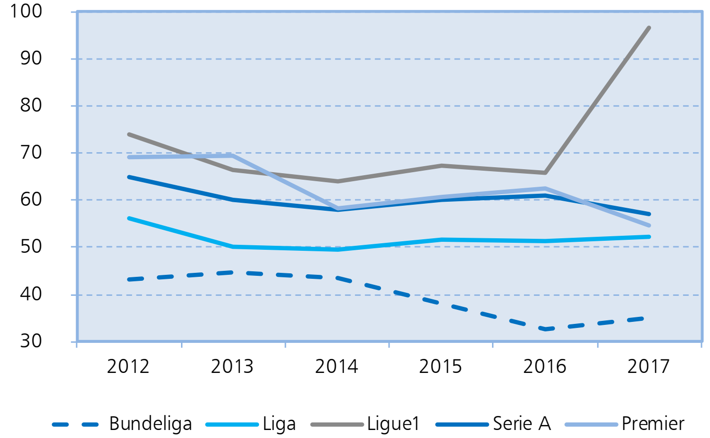
1. Expenditure on Wages

Spending on squad wages is the most relevant expenditure incurred by football clubs. Five years ago, the wage bill was higher in financially weaker clubs. Thus, expenditure on squad wages by Top20 clubs[2] represented a lower percentage over turnover. The rest of clubs from Big5 leagues spent more on wages than Top20 clubs, but less than all other European clubs. Currently, the rest of clubs from Big5 leagues have lowered their wage bill ratio to levels similar to those of Top20 clubs, probably due to stricter economic control of their management. On the contrary, all other European teams have followed the opposite trend, having increased expenditure on wages as a percentage over turnover. These clubs have not managed to adjust their wage bill to economic slowdown, probably owing to competition with major leagues for talent recruitment.

[2] For these time comparisons, data used are not from Top20 clubs by year, but from those clubs more often ranked in the Top20 during the period studied.

FIGURE 15

EXPENDITURE ON WAGES AS A PERCENTAGE OF TURNOVER

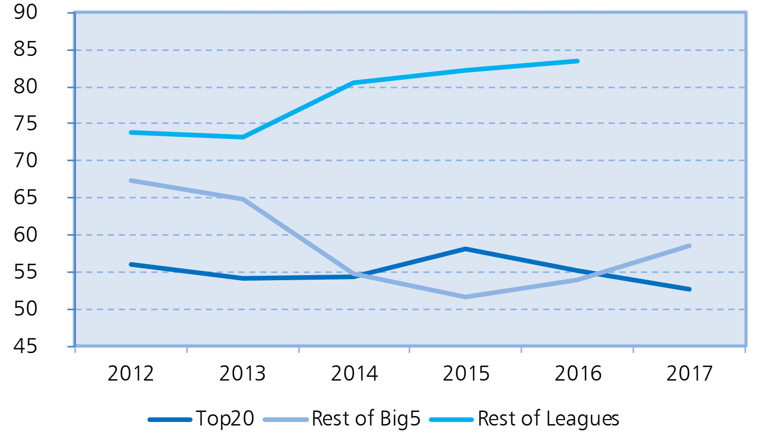


Sources: Authors' own compilation based on data provided by Deloitte (2012-2018a), DNCG (2013-2018), DFL (2014-2018), FIGC (2013-2018), and LFP (2015-2018).

Although different leagues initially had different wage ranges, Figure 15 shows a progressive convergence of wage bills, probably due to increased financial supervision. The only exception is the French league, which, far from reducing expenditure on wages, showed a quite significant increase last season.

FIGURE 16

EXPENDITURE ON WAGES AS A PERCENTAGE OF TURNOVER



Sources: Authors' own compilation based on data provided by Deloitte (2012-2018a), UEFA (2012-2018), and Sánchez, Barajas and Sánchez-Fernández. (2017).

2. Indebtedness

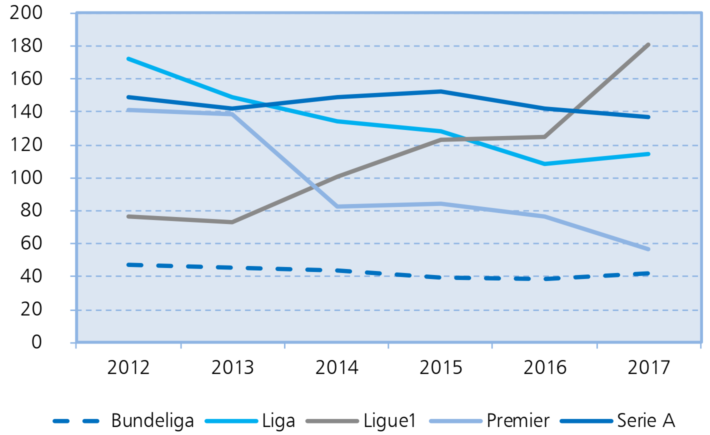
In major European leagues clubs have reduced their debts –estimated with respect to turnover– coinciding with enhanced financial supervision. Reduction was most remarkable in Spanish La Liga and English Premier League, which are the competitions having exerted tighter financial control in recent years.

Reduction in Italian and German leagues was much more moderate, though they started with greatly differing situations. Bundesliga was by far the least indebted league in 2012, and has continued to be so in recent years. On the other hand, Italian league shows a high level of debt during that period. French league breaks the debt relief trend, having experienced a very sharp increase that led it to become the most indebted league among Big5 in 2017. These three leagues have merely maintained their financial supervision structures, as opposed to Spanish and English leagues, which have updated them, a fact that might have influenced such diverging trends.

Debt performance in European football has greatly differed depending on the size of clubs. Debt of Top20 clubs increased at about the same rate as turnover, debt ratio having thus remained stable in recent years. On the other hand, the rest of clubs from Big5 leagues have significantly reduced their debt as a percentage of turnover, as opposed to all other European clubs, whose debt ratio has increased. In this case, such ratio might have been affected by stagnation in their business.

FIGURE 17

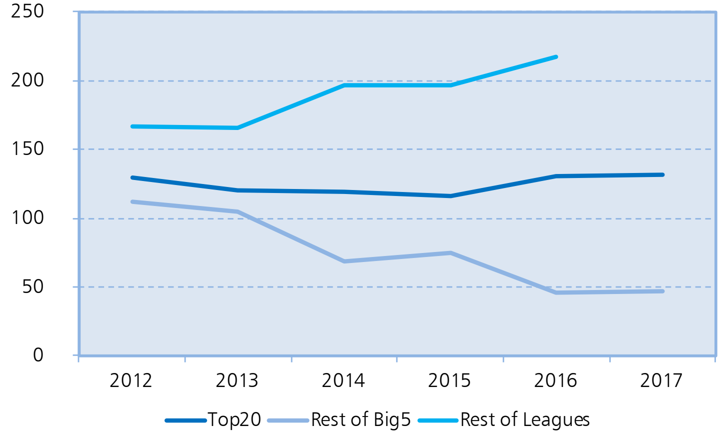
TOTAL LIABILITY AS A PERCENTAGE OF TURNOVER



Sources: Authors' own compilation based on data provided by Deloitte (2012-2018a), DNCG (2013-2018), DFL (2014-2018), FIGC (2013-2018), and LFP (2015-2018).

FIGURE 18

TOTAL LIABILITY AS A PERCENTAGE OF TURNOVER



Sources: Authors' own compilation based on data provided by Deloitte (2012-2018a), UEFA (2012-2018), and Sánchez, Barajas and Sánchez-Fernández (2017).

3. Profitability

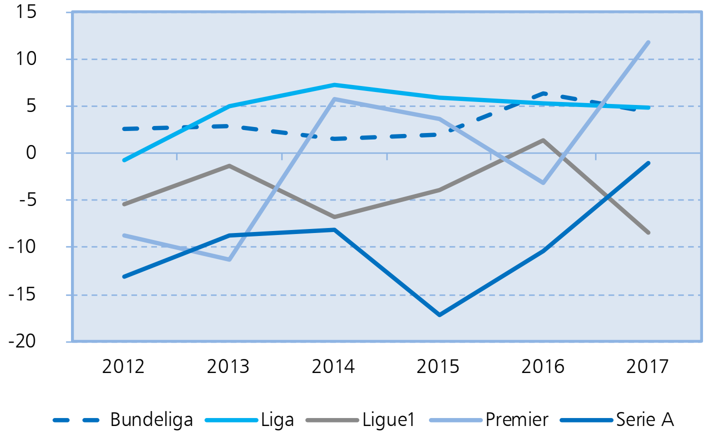
Almost all major leagues increased their profitability over these last years. Spanish La Liga[3] and English Premier League remarkably increased returns, having overtaken Bundesliga in terms of profitability, which six years ago was the only competition to obtain positive results. Serie A also increased returns after having reached a low in the 2014-2015 season. Despite this improvement, Italian league was the only one, together with French league, to show losses in 2017. French league has experienced uneven evolution only to become the competition showing the lowest profitability ratio over turnover at the end of the 2017 accounting year.

Enhanced financial supervision after implementation of UEFA regulations and control tightening in some national leagues has led to increased profitability for all European clubs, regardless of their size. Thus, whereas both bigger and smaller clubs incurred losses in 2012, six years later clubs participating in Big5 leagues make a profit on average. Returns evolution in Top20 clubs has been similar to that shown by the rest of clubs from Big5 leagues. On the other hand, all other European teams improved profitability, which nevertheless continues to be negative.

[3] See Table 8 in Mareque, Barajas and López-Corrales (2018).

FIGURE 19

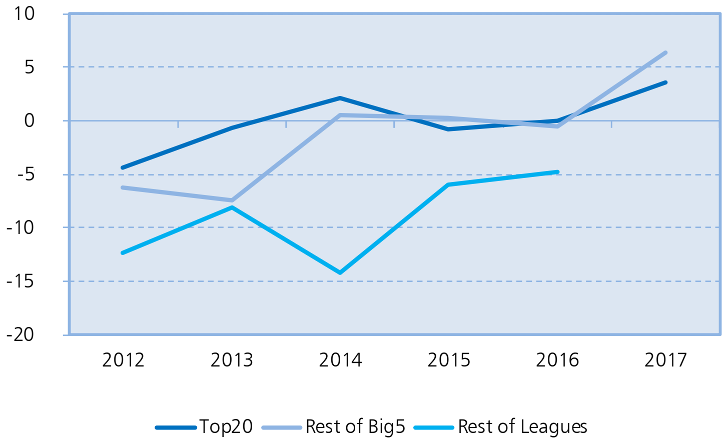
PERCENTAGE OF NET BENEFITS OVER TURNOVER



Sources: Authors' own compilation based on data provided by Deloitte (2012-2018a), DNCG (2013-2018), DFL (2014-2018), FIGC (2013-2018), and LFP (2015-2018).

FIGURE 20

PERCENTAGE OF NET BENEFITS OVER TURNOVER



Sources: Authors' own compilation based on data provided by Deloitte (2012-2018a), UEFA (2012-2018), and Sánchez, Barajas and Sánchez-Fernández (2017).

VI. EFFECTS ON SPORTING COMPETITION

1. The Emergence of a European Elite

In year 2002, a group of European football clubs organized to demand more money from federations, on the understanding that they were taking advantage of their players to obtain large revenues. The public request of clubs was a percentage of national team competitions organized by UEFA and FIFA, but there was indeed the unstated threat of organizing a European league among them and turning their backs on national federations, following the model of American sport. Some authors, like for instance Hoehn and Szymanski (2010), consider that this is the path to be followed by European football. Eventually, the so-called G14 managed to have federations share their revenue and led UEFA to reorganize its competitions in order to render them more attractive for the strongest teams, thus discouraging clubs to create their own continental league.

The G14, actually comprising 18 clubs, included the strongest clubs in Europe, and therefore the most attractive for a possible supranational league. English, Italian, German, Spanish, and French leagues had each three representatives; Dutch league had two representatives, and Portuguese league, one. In 2005, the list of the 18 clubs with higher revenue belonging to the European elite was headed by Premier League, from which 8 clubs were included, followed by Italy with 4 clubs; only one club did not participate in one of the five major leagues.

But already by 2010, no club included in the group came from outside the five major leagues. In 2017, clubs from Premier League amounted to half of the group members. This evolution entails a decoupling between economic and sporting power, since not all those nine clubs can participate in European competitions organized by UEFA due to the existing limitations regarding the number of participating clubs per country. Currently, the first club from a league other than big five leagues ranks number 30 on the higher revenue clubs list.

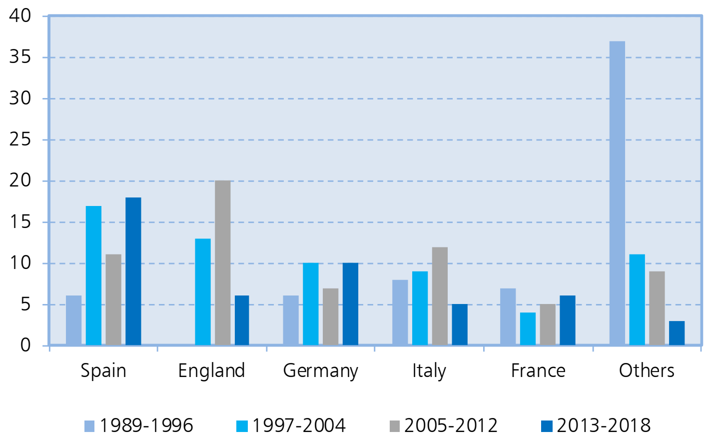
Despite the growth of English league, European football elite is quite stable. Six clubs have always been included on the higher revenue list since 2005: Chelsea, Real Madrid, FC Barcelona, Bayern Munich, Manchester United, and Arsenal. Given that five more have permanently been ranked among the first 20 clubs, we may conclude that more than half of the clubs that form part of the European economic elite have not changed over more than a decade.

This revenue growth trend in Big5 leagues, as opposed to all other leagues, is leading to concentration of European elite in clubs from Big5 leagues at the expense of other traditional clubs participating in smaller leagues. Increased resources allocation by European competitions to clubs from leagues other than Big5 leagues has not been enough to reverse that situation.

The enormous capacity of elite clubs to obtain revenue from European competitions and their commercial and sponsorship activities strengthens their

FIGURE 21

NUMBER OF PARTICIPANTS BY COUNTRY IN THE QUARTER-FINALS OF EUROPEAN CUP/CHAMPIONS LEAGUE



Source: Bolotny (2006) and authors' own compilation.

condition to retain a leading position. Moreover, FFP implemented by UEFA has seemingly been unable to undermine such dominance, and stricter regulations imposed by Premier League and La Liga have not harmed the most powerful clubs. On the other hand, failure to update supervision in Italy and France has not helped their clubs to join the European elite in terms of revenue level.

All of this has affected sporting competitions. Before 1997, only league champions from each country participated in the former European Cup. This model helped teams from smaller leagues reach the final stages of the competition. The new format of Champions League, which entails participation of more clubs from the most powerful leagues and free movement of players, has strengthened clubs from the five major leagues in sporting and financial terms. As can be observed in Figure 21, participation of clubs from smaller leagues in the quarterfinal stage has dramatically fallen; moreover, in the last two editions (2016-2017 and 2017-2018) not even one club from smaller leagues has participated. This also affects chances of winning the competition. Merely two clubs from leagues other than Big5 leagues won the championship between the 1989-1990 and the 1996-1997 seasons, and only one did so between the 1997-1998 and the 2003-2004 seasons; furthermore, no club from smaller leagues has neither won the competition nor reached the final since the 2003-2004 season.

2. Impact of Revenue and Financial Control on Competitive Balance

Despite the existing consensus on the financial unsustainability of European football discussed in section 4, various studies warn about possible negative effects of the economic control on clubs. Already before its implementation, Sass (2012) and Preuss, Haugen and Schubert (2014) forecasted, on the basis of a theoretical model, that new regulations would bring about a deterioration of competitive balance. On the contrary, Grabar and Sonin (2018) have developed a theoretical model according to which economic control would improve competitive balance; the authors suppose that debt-to-budget ratio would be similar for all clubs provided a balanced situation, although data presented in subsection 5.2. show that, in fact, there exist significant differences.

Peters and Szymanski (2014) argue that financial sustainability can be also reached by imposing wage caps, as in American sports, whereas Franck (2014) finds it impossible given the open character of European football, where teams are subject to promotions and relegations, and the existence of a multitude of European leagues greatly differing in size.

Deterioration of competitive balance in European leagues was an already existing trend before implementation of FFP by UEFA and the tightening of national regulations, as shown by Bloching and Pawlowski (2013). Birkhäuser, Kaserer and Urban (2017) find that FFP implementation reduced competitive balance in seasons 2004-2005 and 2014-2015 in all Big5 leagues, whereas contributions by club owners improved competitive balance of clubs. Both measures are related, since FFP limits possible funding from club owners.

Freestone and Manoli (2017) suggest that, after FFP implementation, no competitive balance deterioration is to be verified in Premier League, a result confirmed by Plumley, Ramchandani and Wilson (2018), who also examined the evolution in all other four major leagues; having likewise found no deterioration in Italian Serie A, they nevertheless observe a negative evolution of competitive balance in Spain, Germany, and France. This latter study takes as reference for the beginning of FFP implementation the 2011-2012 season, whereas Birkhäuser, Kaserer and Urban (2017) consider actual implementation to have begun in the 2013-14 season, arguing that, in that season, many clubs continued to be in breach of regulations, which led UEFA to impose the first sanctions. Mareque, Barajas and López-Corrales (2018), Dimitropoulos (2016), and Dimitropoulos, Leventis and Dedoulis (2016) consider a transition period followed by full implementation from June 2013 on. Thus, it seems reasonable to take 2014 as the year of change.

Now, if we analyze competitive balance evolution in the four seasons both preceding and following season 2014 by means of the Herfindahl Hirschman Index, we find some differences with respect to findings provided by Plumley, Ramchandani and Wilson (2018). Findings are similar regarding both the fact of Premier League being unaffected by FFP ($t(6)= -0.456$, $p= 0.664$) and deterioration of competitive balance in France ($t(6)= -2.348$ $p= 0.057$) and Spain ($t(6)= -2.268$, $p= 0.064$); on the other hand, results differ with respect to Italian Serie A, where deterioration indeed occurred after FFP implementation ($t(6)= -2.548$, $p= 0.044$), as well as to German Bundesliga, where no change has been verified ($t(6)= -0.694$, $p= 0.514$). One possible explanation for such discrepancies is that German clubs anticipated to FFP implementation, whereas Italian clubs virtually took no measures affecting competitive balance until new regulations had already entered into force. Furthermore, it should be borne in mind that each league applies its own distinct economic control, as discussed in section 4, a fact that might also affect competitive balance.

There is much debate on whether FFP limits to club owner contributions have affected the competition. Whereas Szymanski (2014) finds that such contributions do not harm the competition and have always existed one way or another, Müller, Lammert and Hovemann (2012) and Schubert and Hamil (2018) assimilate them to a financial doping responsible for competition adulteration.

In this context, Sass (2016) and Birkhäuser, Kaserer and Urban (2017) blame UEFA Financial Fair Play for failure to achieve competitive balance; on the contrary, Franck (2018) blames revenue increase from television rights and participation in continental competitions. Carreras and García (2018) suggest that such revenue increase from television rights will entail increased financial inequalities between clubs and, consequently, deterioration of competitive balance. But this forecast does not take account of the effects of FFP, which exacerbates financial inequality by preventing clubs from incurring deficits. Thus, revenue evolution and FFP implementation not only have resulted in increased dominance of major leagues in European competitions, but also in reduced competitive balance in those leagues.

In any case, this should not be interpreted as a demerit of FFP regulations, since their main goal is to ensure financial sustainability of clubs and to prevent competition over sporting results from rewarding those clubs willing to take excessive financial risks. In the short term, this diverts away resources from clubs in a position to increase their spending at the cost of losses or contributions by owners, which affects competitive balance; but, in turn, it does not penalize clubs placing their long-term sustainability before short-term results. This does not seem to be less equitable or fair than having greater competitive balance.

VII. CONCLUSIONS

Football is the most popular sport, but European football leagues achieve lower turnover than American sports leagues. Originally, European leagues were characterized by: a) small markets; b) management by national federations, not by clubs; c) membership associations as legal form of most clubs; d) and a pyramid system consisting of promotions and relegations. This latter feature is the only one remaining. Today, leagues are organized by clubs themselves, most are joint-stock commercial companies, and application of European common market rules, together with the growing importance of international competitions, are leading to the creation of a pan-European football market.

Revenue sources of clubs have changed, television rights and commercial revenues having increased their importance with respect to gate receipts revenue. Clubs have thus become less dependent on local markets and more international market-oriented. Sharp increase in turnover of European football has not implied uniform distribution among all clubs. The most powerful clubs from major European leagues are the main beneficiaries of this growth. Increased turnover has been greatly determined by the rise of European competitions organized by UEFA, which have emerged as a key revenue source for clubs.

Since there is no centralized organization with stable members distributing revenue in European football, the need to obtain sporting results that bring in revenue and help avoiding relegation to lower divisions has led many clubs to incur large losses. The low mortality rate of clubs, often saved by supporters, public administrations, or debtors, had fostered unsustainable management, which jeopardized the competition itself, as clubs committed to responsible management were penalized. This led UEFA to impose economic control, which was also implemented or increased by national leagues within their scope of action.

What are the consequences of the economic liberalization process, revenue increase, and implementation of financial control? We have observed three of financial nature and two affecting competition. Firstly, reduction or restraint of expenditure on wages with respect to revenue in the strongest leagues; all other leagues continue to suffer from wage inflation, probably because they have not profited from revenue increase as major leagues have, and therefore suffer from their competition for talent recruitment. Secondly, a similar effect regarding volume of debt-to-revenue ratio: reduction in the strongest leagues, and increase in smaller leagues. Thirdly, increased return on sales, which has affected all leagues regardless of their size. The two consequences for sporting competitions are dominance of clubs from major leagues over clubs from smaller leagues in continental competitions, and, at the same time, deterioration of competitive balance in major leagues.

Economic integration processes leading to the creation of larger markets bring about business consolidation or concentration processes. Control of their own sport field by American leagues was made possible by the existence of a huge market. The European economic integration process has also led to the creation of a large market for football clubs, the importance of local markets having thus decreased while pan-European revenue multiplies. Integration has also favored growth of pan-European competitions, and centralized economic controls affecting all European clubs have been consequently implemented. All these measures have led to concentration of economic and sporting power in the biggest leagues and clubs. The ensuing possibility of European football adopting a structure similar to American sports leagues is to be verified over time.

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PART III

Economic Relevance of Sport and Physical Activity in the Society

SPORTS PARTICIPATION AND SPORT PUBLIC POLICIES IN SPAIN

Fernando LERA LÓPEZ

María José SUÁREZ FERNÁNDEZ

Abstract[1]

The purpose of this article is to provide an overview of the recent evolution of sports participation and associated variables in Spain, as well as of public policies developed in the sphere of sport. The article is structured into three parts: First, a descriptive analysis of the evolution of sporting habits in Spain over the past few decades is carried out. Secondly, a review of the economic literature on factors associated with the sports participation of Spanish population is provided. Moreover, an econometric analysis of regular sports participation probabilities is also carried out on the basis of the last four *Surveys of Sporting Habits* from years 2000, 2005, 2010 and 2015. Thus, changes in the relative importance of variables associated with sports participation may be identified. Thirdly, the structure of policies promoting sport in Spain is described, and recent evolution of public expenditure on sport reviewed, both generally at national scale and specifically according to the type of administration considered.

Keywords: sport, public policies, sport economics, Spain, public expenditure.

JEL classification: C25, Z20, Z28.

[1] Article translated from the Spanish by Ciro Arbós.

I. INTRODUCTION

More than 40 years have passed since, in 1975, sports participation levels were first subject to analysis in Spain. However, interest in studying its evolution within the European context has only considerably increased over the past ten to fifteen years, ever since sports participation became widespread among the population, and therefore an activity of unquestionable economic and social relevance. Accordingly, whereas in 1975 only 22% of the Spanish population reported practicing some kind of sport, last 2017 data show that such percentage has raised up to 54% (European Commission, 2018). All of this has turned sport into an important sector in our economy, as revealed by the fact that, already in 2008, it represented 2.3% of Spanish Gross Domestic Product (Lera-López *et al.,* 2008).

But besides such sports participation increase in quantitative terms, a number of noteworthy qualitative changes have taken place. First, frequency of sports participation has significantly increased, since it is currently associated with health and personal well-being. Thus, between 2010 and 2015, the percentage of Spaniards practicing sport every week increased from 37% to 46.2%, with a weekly average of 321 minutes (Ministry of Education, Culture and Sport, MECD, 2015). Secondly, the number of individuals practicing more than one sport has also increased, amounting to 79% of sport practitioners in 2015 (MECD, 2015). This latter feature is closely related to the former, for greater variety of sporting practice tends to be associated with greater regularity.

The growing social and economic importance of sport in Spain has brought about various studies aimed at thoroughly analyzing determinants of sporting practice and their evolution over time in the scientific fields of economics and health. Furthermore, the economic and social importance of sport has evolved hand in hand with a growing political concern to promote it, favored by a general environment encouraging healthy habits. Let us consider, for example, that recent estimates for Spain suggest that inactivity-related treatments represent 6.9% of Spanish total expenditure on health, amounting to 6,600 million euros (International Sport and Culture Association and Centre for Economics and Business Research, 2015). A certain peculiarity of our sporting system should be moreover noted, namely, that amateur sport promotion and encouragement of physical activity are competences assumed and developed by the Autonomous Communities (Lera-López and Lizalde-Gil, 2013).

The present study is first intended to address the evolution of sports participation in Spain from 1970 to present day, with a focus on the 2000-2015 period, by means of simple descriptive analyses. Secondly, the most relevant factors associated with sports participation and their development over time are considered within the framework of such sport evolution. To that end, key studies on sports participation determinants at national scale are first discussed, a discussion followed by the development of empirical models enabling to determine the most relevant factors associated with regular sports participation throughout the 2000-2015 period. Last, public policies and investments in sport are analyzed, which certainly help explain the development of sport in Spain.

II. EVOLUTION OF SPORTS PARTICIPATION IN SPAIN

As pointed out in the introduction, sports participation in Spain has significantly increased between 1975 and 2015, first and last year for which national statistical information is available. As can be observed in Table 1, sports participation increased 143% in Spain over 40 years, having mounted up to 53.5% of the Spanish population. The remarkable increase over the last 10 years is also quite noteworthy, showing a 34% growth rate, and especially that of the last five years, when, despite the serious economic crisis, practice increased by 8.5 percentage points in absolute terms. These figures are very similar to those included in the 2017 Eurobarometer, which estimates 54% for Spain, a percentage equal to European average (European Commission, 2018).

TABLE 1

EVOLUTION OF SPORTS PARTICIPATION IN SPAIN BETWEEN 1975 AND 2015 (percentage values)

Participation Rate	*1975*	*1980*	*1985*	*1990*	*1995*	*2000*	*2005*	*2010*	*2015*
Total	22	24	34	35	39	38	40	45	53.5
One sport	15	15	17	18	23	22	24	25	21

Sources: Collected by authors based on information provided by the *Survey of Sporting Habits* in Spain from 2000 to 2015 (MECD, 2015).

Focusing on the last 20 years, Table 2 shows the evolution of sports participation frequency in Spain, which evidently lacks linear variation partly due to changes in the questionnaire of the 2015 *Survey of Sporting Habits.* Thus, the percentage of people practicing sport daily in 2015 is equal to that of 2005, ten years before, and represents a substantial drop with respect to year 2010. However, when considering the static situation by year, we observe that 87% of all sport practicioners practice at least once a week, exception made of 1990 data, a figure revealing a high frequency of practice in Spain.

TABLE 2

FRECUENCY OF SPORTS PARTICIPATION IN SPAIN
(percentage values)

	1990	*2000*	*2005*	*2010*	*2015*
Daily (every day or almost every day) *	31	49	49	57	49
At least once a week **	28	38	37	37	38
Less frequently	41	13	14	6	13

Notes: * Three or more times a week in surveys prior to the 2015 survey. (**) Once or twice a week in surveys prior to the 2015 survey.

Sources: Collected by authors based on García Ferrando and Llopis Goig (2011), and MECD (2015).

Regarding sports infrastructures, Table 3 shows the evolution in percentage of people practicing sport in each kind of facility.

TABLE 3

WHERE DOES THE SPANISH POPULATION PRACTICE SPORT?
(percentage values)*

Type of facility	*1980*	*1990*	*2000*	*2005*	*2010*	*2015*
Public facilities **	33	40	54	51	51	31
Open spaces of free use	43	40	38	43	45	46
Private sport clubs	25	25	17	20	18	12
Teaching centers	11	11	10	13	5	16
Private facilities	--	7	8	8	13	23
Home	9	9	7	8	11	19
Work	2	1	2	1	1	2

Notes: * Values represent the percentage of population having reported practicing sport in a place and/or facility; since one same individual might practice sport in more than one place, percentages may exceed 100%. ** Includes public gyms and other public facilities or sporting clubs..

Sources: Collected by authors based on García Ferrando and Llopis Goig (2011), and MECD (2015).

As can be observed, in 2015 there was an increase in home sports participation, associated with growing availability of sports equipment in households, as well as in private sports facilities, associated with a possible increased offer, at the expense of public facilities and private sport clubs (non-profit seeking). On the other hand, the use of open spaces continues to be relevant.

Table 4 shows the evolution of sports participation by age. Two relevant features can be observed. First, sports participation in Spain has noticeably

TABLE 4

SPORTS PARTICIPATION RATE BY AGE
(As a percentage of the population of each group)

Age range	*1980*	*2000*	*2010*	*2015*
15-24	52	58	60	83
25-34	34	45	54	73
35-44	13	35	44	65
45-54	8	28	34	53
55-64	4	20	30	44
65 and over	--	12	19	20

Sources: Collected by authors based on Lera-López and Lizalde-Gil (2013), and MECD (2015).

increased in all age segments over the last 35 years, especially among people over 45. Secondly, sports participation rate decreases with age, probably owing to physical, biological, and time limitations.

Analyzing differences by gender (Table 5), a steady decrease in such differences can be observed in Spain. Furthermore, the gap seems to have remained stable at national scale during the hardest years of economic crisis, and shows a remarkable improvement in 2015, once the crisis was overcome.

TABLE 5

EVOLUTION OF SPORTS PARTICIPATION BY GENDER

	2000	*2005*	*2010*	*2015*
Male	62.4	61.1	60.5	54.7
Female	37.6	38.9	39.5	45.3
Difference male - female	24.8	22.2	21.0	9.4

Source: Collected by authors based on MECD (2015).

Regarding the kind of sport practiced by the Spanish population, Table 6 shows the ten most frequently practiced sports in Spain. Comparison between sports reveals a growth trend for gymnastics, cycling, foot race, and bodybuilding, together with paddle tennis. On the other hand, swimming, football, and basketball experience regression, even though the former two sports still occupy the first places in the ranking.

TABLE 6

THE TEN MOST PRACTICED SPORTS IN SPAIN
(percentage values –at least once a year–)

Sport	*2005*	*Sport*	*2010*	*Sport*	*2015*
Swimming	33	Gymnastics **	35	Gymnastics **	35
Football *	27	Football *	25	Cycling	21
Gymnastics **	26	Swimming	23	Swimming	20
Cycling	19	Cycling	20	Football *	20
Hiking, mountaineering	12	Foot race	13	Hiking, mountaineering	17
Foot race	11	Hiking, mountaineering	9	Foot race	16
Basketball	9	Basketball	8	Bodybuilding	11
Tennis	9	Tennis	7	Paddle tennis	9
Athletics	7	Athletics	6	Tennis	8
Bodybuilding	7	Paddle tennis	6	Basketball	6

*Notes:** Includes regular (11 players) and indoor football. ** Includes gymnastics, pilates, spinning, aerobic, etc.

Sources: Collected by authors based on García Ferrando and Llopis Goig (2011), and MECD (2015).

Finally, Table 7 provides information on the reasons adduced by people for practicing or not practicing sport, though comparison over time was not possible. The primary observation is that lack of time is the main reason, followed at a considerable distance by lack of interest and by age or health reasons (both reasons are usually related to each other). Also noteworthy is the low importance accorded to the lack of adequate sporting facilities or financial resources, which is consistent with widespread sports participation in Spain.

TABLE 7

REASONS FOR NOT PRACTICING SPORT AT ALL OR FOR NOT PRACTISING IT MORE OFTEN, YEAR 2015

	1st reason	*2nd reason*
Lack of adequate facilities nearby	4.8	5.7
Age reasons	12.0	8.7
Health reasons	12.2	11.8
Economic reasons	4.9	5.4
Lack of sport practice partners	2.4	4.3
Lack of time	47.8	38.0
Lack of interest	15.9	26.2

Source: MECD (2015).

III. FACTORS ASSOCIATED WITH SPORTS PARTICIPATION IN SPAIN AND THEIR EVOLUTION OVER TIME

In this section, we will first review the existing economic literature on the sports participation of Spanish population, focusing on studies conducted at national scale. Such review allows for identification of variables considered in previous studies and their effects on the decision to practice sport or to perform physical activity. Secondly, on the basis of the 2000, 2005, 2010 and 2015 *Surveys of Sporting Habits,* empirical analysis of factors associated with regular sports participation in Spain is carried out. The use of databases gathered at different times enables us to examine the evolution of sports participation, controlling for other factors, as well as to verify to which extent the relevance of sports participation-related variables has changed over the past few decades.

1. A Review of Spanish Economic Literature

At the international level, there exists an extensive economic literature on factors affecting sports participation, which has been subject to review by Cabane and Lechner (2015). Since the early 21st Century, there is a growing interest in analyzing sports participation in Spain from an economic perspective, by applying theoretical microeconomic models of individual decision and/or econometric approaches enabling to estimate the effect of the different variables considered on the probability or frequency of sports participation.

Proliferation of such literature has been made possible through availability of nationwide surveys on households gathering information about the physical or sporting activity of individuals. In this regard, the *Survey of Sporting Habits,* conducted every five years since 1975, is especially worth mentioning. From 1980 to 2010, it was carried out by the Center for Sociological Research (CIS, in its Spanish initials) with the patronage and collaboration of the High Council of Sport (CSD, in its Spanish initials). However, the last 2015 edition was conducted by the Ministry of Education, Culture and Sport (MECD), in collaboration with the CSD, and was subject to substantial design changes. This database is the most detailed source of information on the sporting habits of Spaniards aged 15 or more. The works by Professor García Ferrando (García Ferrando and Llopis Goig, 2011 and 2017) have considerably contributed to the development of the information provided by these surveys.

Nevertheless, there exist other surveys also enabling analysis of sports participation, such as the *Time Use Survey* and the *European Health Survey in Spain.* The primary objective of the *Time Use Survey,* conducted by the National Statistical Institute (INE, in its Spanish initials), is to find out the individual one-day time distribution between remunerated and non-remunerated activities, including sporting activities. This survey was first carried out in Spain in 2002-2003, and then again in 2009-2010, following certain changes in its questionnaire. The *European Health Survey* is also conducted in Spain by the INE every five years, the latest dating from 2014. The aim of this database is to gather information on state of health, use of healthcare services, and health determinants, which include physical activity.[2] However, some economic studies use their own specific surveys including information on additional variables, such as spending on sporting goods and services, or else on specific population groups, either defined by age or by place of residence. Such is the case of Lera-López and Rapún-Gárate (2005, 2007); Lera-López, Rapún-Gárate and Aguirre Zabaleta (2008); Lera-López, Garrues and Suárez (2017), and Lera-López and Suárez (2012).

Variables analyzed in empirical research vary according to available information and the goal pursued by authors. In some cases, sports participation is exclusively analyzed (Lera-López, Rapún-Gárate and Aguirre Zabaleta, 2008; Downward, Lera-López and Rasciute, 2011; Kokolakakis, Lera-López and Panagouleas, 2012; Muñiz, Rodríguez and Suárez, 2014). In other cases, different kinds of physical activity during leisure time are also considered, for instance, walking (García, Lera-López and Suárez, 2011). Muñiz, Rodríguez and Suárez (2011) even include the daily time spent on active and passive sporting activities, that is to say, on sports participation and any other physical activity, as well as on attendance to sporting events.[3]

Regarding methodology, probit or logit models (*e.g.,* Kokolakakis, Lera-López and Panagouleas, 2012) are usually applied to estimate probability of performing physical activity. When the study object is frequency of practice, ordered probit models (*e.g.,* Lera-López, Rapún-Gárate and Aguirre Zabaleta, 2008), ordinary least squares or similar (*e.g.,* García, Lera-López and Suárez, 2011),[4] or count-data models (Muñiz, Rodríguez and Suárez, 2014) are basically used, depending on the characteristics of the study variable.

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[2] The *National Health Survey,* which is conducted every five years and alternates with the *European Health Survey in Spain,* also includes questions on physical activity. This survey has been used in some medical studies, such as, for instance, Alonso-Blanco *et al.* (2012).

[3] Other studies published in medical journals provide definitions including all kinds of physical activity, whether performed during leisure time or within the framework of other daily activities (transportation, work, etc.), either jointly (Casado-Pérez *et al.,* 2015) or separately (*e.g.,* Alonso-Blanco *et al.,* 2012).

[4] García, Lera-López and Suárez (2011) estimate a system of leisure and sport relative demand equations by applying Seemingly Unrelated Regression Estimation (SURE), whose main difference with respect to Ordinary Least Squares is that of enabling correlation between the error terms of equations comprising the system.

Explanatory variables included may be classified, according to Cabane and Lechner (2015), into five groups: individual characteristics; weather conditions; characteristics of the place of residence; family, colleagues, and neighbors-related variables; and last, economic habits and incentives.

The individual characteristics group includes age, gender, marital status, family variables, socioeconomic variables such as education level, employment situation or income, and medical condition-related variables. Broadly speaking, conclusions on the effect of these factors on the sporting habits of Spaniards are similar to and consistent with findings obtained in other countries. All studies including gender as explanatory variable conclude that men show higher probability of practicing sport, as well as higher frequency than women. In fact, some authors conduct a different analysis for each gender, as they consider that variables associated with physical activity might have different effects or relevance for men and women (such is the case of García, Lera-López and Suárez, 2011; Muñiz, Rodríguez and Suárez, 2011 and 2014). As for age, young people tend to practice sport to a greater extent than middle-aged population. Occasionally, findings show that sports participation increases again in old age.[5] Education level, when included, usually has positive effects, whereas in the case of family characteristics such as marital status, family size, and number of children, findings are not unanimous. Family obligations tend to reduce probability of practicing sport, though they are not significant in some studies (Lera-López, Rapún-Gárate and Aguirre Zabaleta, 2008), and mixed results are also obtained regarding their impact on frequency of practice. As for economic situation, most studies conclude that a higher economic level (either due to an upper-range occupational category, higher income level, or higher socioeconomic level) is usually associated with a more extensive sports participation. Finally, some studies include health condition-related variables, but results are inconclusive.

Regarding weather conditions, García, Lera-López and Suárez (2011) and Muñiz Rodríguez, and Suárez (2014) include variables relative to the year quarter in which information is collected; in both cases, sports participation increases in the third quarter. Relevance of these variables may be due to climate, especially in the case of outdoor sports, but also to differences in the amount of leisure time available, since most people enjoy holidays in the summer months.

The third group of variables possibly associated with sport includes environment characteristics. Empirical studies usually find differences in sporting habits which depend on the size of the municipality or Autonomous

[5] In the case of García, Lera-López and Suárez (2011), age increases relative demand of daily time spent on physical activity.

Community of residence. On the contrary, availability of nearby sports facilities was not significant in the two consulted studies including this variable (Lera-López, Rapún-Gárate and Aguirre Zabaleta, 2008; Downward, Lera-López and Rasciute, 2011).

Social interaction might encourage sports participation when people surrounding an individual (family, friends, fellow students or workers, neighbors, etc.) practice sport. Among the works published and reviewed, only that of Downward, Lera-López and Rasciute (2011) considers the effects of the sporting activity of parents on children habits, finding the impact of this variable on probability and frequency of sports participation to be positive.

With respect to the fourth category of explanatory variables, we have found no literature examining the impact of economic habits or incentives on the sports participation of Spanish population.

Finally, some works analyze the relation between active and passive sport (attendance to sporting events, watching television sport programs, listening to radio sport programs, reading the sport press), either by including additional explanatory variables in the sports participation equation (Lera-López, Rapún-Gárate and Aguirre Zabaleta, 2008; Downward, Lera-López and Rasciute, 2011), or else through joint analysis of both activities (Lera-López, and Suárez, 2012). In some cases, opinions on the relevance of sport or variables relative to the kind of sport practiced are also included when analyzing frequency of practice (Downward, Lera-López and Rasciute, 2011). Other variables included refer to leisure activities other than sport, or to different kinds of physical activity (Lera-López, Rapún-Gárate and Aguirre Zabaleta, 2008; Downward, Lera-López and Rasciute, 2011).

2. Empirical Analysis of Factors Associated with Sports Participation in Spain

The purpose of this subsection is to analyze variables associated with regular sports participation in Spain, in order to verify possible relevant changes in their degree of impact over the past few years, as well as to confirm the upward trend observed in the descriptive analysis included in Section II. To that effect, available data from the last four *Surveys of Sporting Habits* (2000, 2005, 2010 and 2015) have been used.

Provided that the population scope is not identical in all surveys, in order to render comparisons compatible, analysis has been restricted to population aged between 15 and 74 and resident in Spain, excluding Ceuta and Melilla. Regarding variables used for the study, we have encountered the problem of changes in the questionnaire over time, especially in the 2015 survey, following a substantial reform. To enable comparison of estimates from different surveys, the variable examined has been similarly defined for all 4 periods, and the same set of explanatory variables has been considered.

Such standardization criteria lead to define a binary dependent variable that takes the value one if an individual practices sport at least once a week, and zero otherwise. Explanatory variables include personal characteristics as well as socioeconomic and geographic variables considered in all four surveys, which may be similarly defined in all cases: gender, education level, age (included in quadratic form), employment situation, sports participation of parents, and Autonomous Community of residence. Our goal of examining comparable estimates entails the exclusion of other variables, such as size of the municipality or household characteristics, which might be associated with individual sports participation but were not included in all questionnaires, or, when included, the information gathered did not allow for analogous definition in all cases. However, preliminary tests lead to conclude that inclusion of such variables, when available in some surveys, does not substantially affect conclusions on the influence of all other factors considered.

Given the binary nature of the dependent variable, probit models are used as estimation method. In such models, probability of the dependent variable taking value one or zero is defined as follows:

$$\Pr(Y_i=1) = \Phi(\beta' X_i) \qquad [1]$$

$$\Pr(Y_i=0) = 1-\Phi(\beta' X_i) \qquad [2]$$

In these equations, Y is the dependent variable, X is the explanatory variables vector, β is the vector of parameters to be estimated, Φ is the cumulative distribution function of the standard normal distribution, and subscript i refers to the individual. The probit model is estimated through the maximum likelihood method.[6]

Since the equations are not linear, in this model, estimated coefficients are not subject to direct interpretation, though their sign indicates whether the relationship is increasing or decreasing. For this reason, we estimate the marginal effect of each explanatory variable on the variable analyzed for each individual on the basis of coefficients.

[6] For further information on the probit model, see, for instance, Cameron and Trivedi (2005).

Empirical analysis is divided into two parts. On the one hand, all four databases are jointly considered to estimate a single model including year variables besides the explanatory variables discussed. This estimate enables us to ascertain possible changes in sports participation over time, controlling for personal, family, and place of residence characteristics. On the other hand, separate estimates are made for each survey year, in order to verify possible variations in the effect of variables considered over time.

Regarding the first empirical model discussed, Table 8 shows average values for the marginal effects of binary variables identifying each different survey year, taking the year 2000 as reference category. Findings suggest that, having all other variables remained constant, regular sports participation increased on average in 7 percentage points in 2010 with respect to the reference year, and in 18.5 percentage points in 2015, which reveals an upward trend in the sports participation of Spanish population, a result also obtained by Palacios-Ceña *et al.* (2012) for the 2000-2010 period.[7]

TABLE 8

WEEKLY SPORTS PARTICIPATION PROBABILITY PROBIT:AVERAGE MARGINAL EFFECTS OF YEAR VARIABLES

	Pooled data 2000-2015
2005	0.010 (0.008)
2010	0.071*** (0.008)
2015	0.185*** (0.008)
Nº. of observations	29,991

Notes: Other explanatory variables include: gender, age and its square, education level, employed, retired, unemployed, student, sports participation of parents, and Autonomous Community of residence. Information on standard errors provided in parentheses. *** p<0,01, ** p<0,05, * p<0,1

Source: Own elaboration.

The second part of our empirical analysis is intended to verify possible changes in the relevance of factors associated with sports participation; to that end, separate estimates are made for each year. Table 9 provides information on average marginal effects of the different variables considered for each year.

[7] Palacios-Ceña *et al.* (2012) also make use of the *Surveys of Sporting Habits* from years 2000, 2005, 2010; however, they apply logit models, and their dependent variable is not regular practice but practice of one or more sports, whether on a weekly basis or not.

At large, findings are consistent with those obtained in previous works on the subject in Spain. Men show higher probability of practicing sport in all four periods examined. However, the degree of impact of this variable fluctuates from year to year, showing a decrease in 2015, when male probability of sports participation was only 8 percentage points higher than female probability. The marginal effect of age is negative, but very small. The most relevant difference regarding the effect of this variable is that, in year 2000, sports participation probability fell to 72 years of age (a value very close to the age limit of the sample analyzed, which is 74). On the contrary, in the following periods the impact of age becomes positive in the last years of life, which seems to suggest that the elderly are changing their physical activity patterns.

TABLE 9

WEEKLY SPORTS PARTICIPATION PROBABILITY PROBIT: AVERAGE MARGINAL EFFECTS

	2000	*2005*	*2010*	*2015*
Male	0.136*** (0.013)	0.109*** (0.011)	0.158*** (0.011)	0.082*** (0.010)
Age	-0.005*** (0.001)	-0.004*** (0.001)	-0.005*** (0.001)	-0.005*** (0.000)
Primary education	0.071** (0.029)	0.088*** (0.028)	0.118*** (0.035)	0.182*** (0.034)
Secondary education	0.128*** (0.033)	0.198*** (0.030)	0.202*** (0.037)	0.259*** (0.036)
Professional education	0.123*** (0.033)	0.169*** (0.031)	0.203*** (0.037)	0.308*** (0.036)
University education	0.195*** (0.032)	0.244*** (0.030)	0.298*** (0.037)	0.377*** (0.035)
Employed	-0.003 (0.022)	0.011 (0.018)	0.006 (0.021)	0.084*** (0.019)
Retired	-0.081*** (0.030)	-0.027 (0.024)	-0.035 (0.025)	-0.007 (0.024)
Unemployed	-0.069** (0.030)	-0.010 (0.024)	-0.040* (0.023)	0.016 (0.021)
Student	0.056* (0.030)	0.103*** (0.027)	-0.002 (0.031)	0.146*** (0.029)
Sport by parents	0.136*** (0.014)	0.113*** (0.011)	0.145*** (0.012)	0.140*** (0.012)
Aragon	0.021 (0.032)	0.028 (0.029)	0.028 (0.028)	-0.062** (0.026)
Asturias	0.185*** (0.048)	0.055 (0.034)	0.009 (0.029)	-0.047* (0.026)

TABLE 9 *(continued)*

WEEKLY SPORTS PARTICIPATION PROBABILITY PROBIT:AVERAGE MARGINAL EFFECTS

	2000	*2005*	*2010*	*2015*
Balearic Islands	0.079** (0.032)	0.042 (0.029)	0.057** (0.028)	0.038 (0.027)
Canary Islands	0.038 (0.045)	0.031 (0.023)	0.031 (0.027)	-0.003 (0.027)
Cantabria	0.043 (0.032)	0.001 (0.030)	-0.030 (0.029)	-0.012 (0.026)
Castilla-León	0.009 (0.032)	0.011 (0.028)	0.034 (0.028)	-0.024 (0.025)
Castilla-La Mancha	0.070** (0.028)	0.006 (0.026)	-0.022 (0.028)	-0.066*** (0.026)
Catalonia	0.039 (0.028)	0.062*** (0.020)	0.018 (0.024)	0.013 (0.021)
Valencian Community	0.076*** (0.026)	0.018 (0.020)	0.030 (0.026)	0.008 (0.022)
Extremadura	0.002 (0.054)	0.002 (0.030)	-0.046 (0.029)	-0.029 (0.027)
Galicia	0.037 (0.028)	0.019 (0.025)	-0.041 (0.028)	-0.070*** (0.024)
Madrid	0.093*** (0.029)	0.038* (0.021)	0.017 (0.025)	-0.006 (0.021)
Murcia	0.059* (0.032)	-0.001 (0.032)	0.011 (0.028)	-0.034 (0.025)
Navarre	0.176*** (0.066)	0.035 (0.029)	0.039 (0.029)	0.046* (0.026)
Basque Country	0.087** (0.038)	0.041 (0.026)	0.011 (0.028)	-0.022 (0.025)
La Rioja	0.044 (0.033)	0.059** (0.030)	0.047 (0.029)	-0.016 (0.026)
Nº. of observations	4,976	7,866	7,717	9,432

Notes: Information on standard errors provided in parentheses. *** p<0.01. ** p<0.05. * p<0.1.

Source: Own elaboration.

Education has positive effects on sports participation in all cases: the higher the educational level, the higher the probability of regular practice. In this case, a clearly growing trend over time is indeed observed, the marginal effect of any educational level having approximately doubled in 2015 with respect to year 2000. As for employment situation, employed individuals do not show a sports participation probability significantly different to that of people devoted to household tasks (which is the reference category). In almost all analyzed years (except for 2010), students show higher probability of sports participation than individuals included in the reference group.

Another variable showing a significant positive effect is the sports participation of parents. In all cases, if the father or the mother practice or had practiced sport, the probability of children weekly practicing sport increases between 12 and 14.5 percentage points. Last, differences depending on the Autonomous Community of residence have been observed, although no clear and stable pattern is to be found between periods.

In summary, empirical analysis of the sporting habits of Spanish population reveals that, even controlling for differences in personal and family characteristics, regular sports participation probability is increasing; moreover, analysis reveals changes in the existing degree of association between probability and certain personal characteristics, such as age and education, for instance.

IV. PUBLIC POLICIES PROMOTING SPORTS PARTICIPATION IN SPAIN

In Spain, the development of sports participation promotion policies results from a decentralized structure based on participation and collaboration between three types of public administration (PA): the national authority or central administration, basically through the High Council of Sport (CSD); regional authorities (Autonomous Communities); and local authorities. This situation, which is peculiar within the European context, implies shared responsibility between authority levels, as provided by the 2013 Sport Act (*BOE*-A-2013-6732).

Thus, the CSD is responsible for authorizing the organization of international competitions in Spain, as well as for managing the participation of Spanish national teams in all international competitions. This entity is also in charge with fighting against doping, financing sporting federations, among other organizations, and defining quality standards of official sports training at the national level. Other responsibilities are however assumed in coordination with regional authorities, as is the case of school and college sport, and construction and improvement of sporting facilities.

On account of their broad territorial competences, legislative and economic power to foster sports participation mostly rests with Autonomous Communities (CC.AA., in its Spanish initials) in Spain (Lera-López and

Lizalde-Gil, 2013). CC.AA. are responsible for promoting and regulating sporting activity at all levels, in collaboration with the private sector (regional federations, sports clubs, etc.), especially regarding provision of sports services and sporting facilities construction and maintenance.

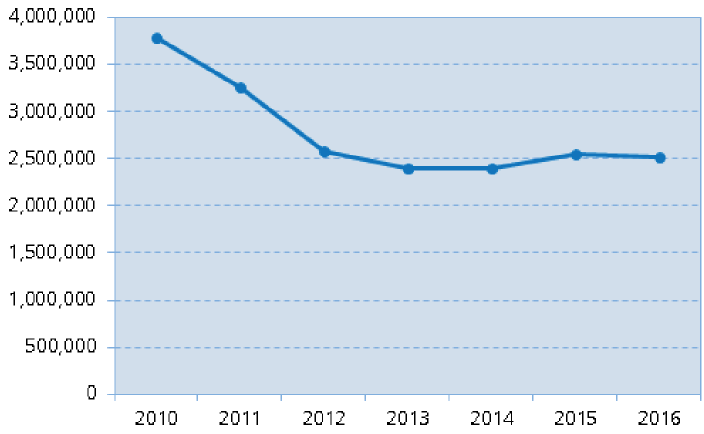
Finally, local administrations (including provincial Councils) also have a number of general competences in the area of sporting activities. Thus, by law, municipalities with more than 20,000 inhabitants (5,000 in the case of Catalonia) have an obligation to provide sports services to its citizens. Moreover, in some CC.AA. smaller municipalities associate to jointly manage sporting resources.

Analysis of the evolution of public expenditure on sport might help showing the importance of sport promotion in Spain. Therefore, Figure 1 shows the evolution of public expenditure on sport between 2010 and 2016.

As can be observed in Figure 1, during the first years of the recent economic crisis, particularly until 2013, public expenditure on sport was significantly reduced in Spain, especially in years 2011 and 2012. The historic low for the period analyzed was reached in 2013, followed by a slight growth, and then by stabilization in 2015 and 2016, but well below 2010 figures. Thus, whereas public expenditure on sport amounted to 3,786 million euros in

FIGURE 1

EVOLUTION OF PUBLIC EXPENDITURE ON SPORT IN SPAIN, 2010-2016 (in thousands of euros)



Sources: Collected by authors based on the *Yearbook of Sports Statistics,* MECD (multiple years).

2010, representing 0.30% of Spanish Gross Domestic Product (GDP), in 2016 figures drop to 2,522 million euros and 0.23% of Spanish GDP. Such decrease represents a 33% drop in the public budget for sport.

Now, if we analyze such expenditure evolution by type of PA, we find, as shown in Table 10, that the leading PA in terms of expenditure is local administration, followed by regional administration, whose importance is higher than that of central administration. This situation is intrinsically linked with distribution of sport competences between all three administrations, and clearly illustrates that local administration is the primary provider of sports services to citizens in Spain, as well as responsible for the maintenance of most public sporting facilities.

TABLE 10

EVOLUTION OF PUBLIC EXPENDITURE ON SPORT BY PA IN SPAIN (in thousands of euros)

Type of PA	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Central State Administration	170,230	151,972	171,339	152,123	127,994	138,791	143,587
Regional Administration	558,684	579,246	362,341	336,558	308,993	299,232	303,420
Local Administration	3,057,293	2,520,762	2,046,966	1,902,621	1,963,878	2,115,192	2,075,014
Total	3,786,207	3,251,980	2,580,646	2,391,302	2,400,865	2,553,215	2,522,021

Source: Collected by authors based on the *Yearbook of Sports Statistics,* MECD (multiple years).

Analysis of the evolution of per capita public spending on sport (euros per inhabitant) enables us not only to observe the relative importance of each PA, but also to consider which PA has experienced the greatest cut in funds allocated to sport as a result of the economic crisis. Table 11 and Figure 2 show that regional administration has borne most of the costs associated with the crisis in budgetary terms. Furthermore, it can be observed that central administration expenditure remains stable over time. In percentage terms, when comparing the situation in year 2010 with that existing in 2016, last year for which there is statistical information available, contribution of local administration to Spanish total public expenditure slightly increased from 84.7% of total expenditure in 2010 to 87.3% in 2016. As illustrated by Figure 2, such greater importance of local administration stands out in a context of sharp fall in expenditure affecting local administration itself.

TABLE 11

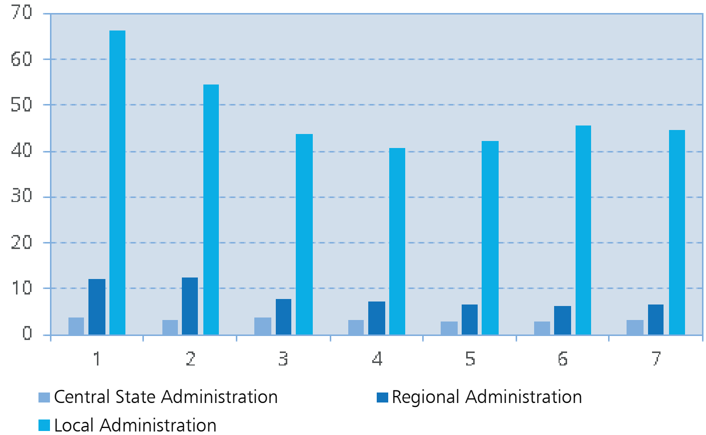
EVOLUTION OF PUBLIC EXPENDITURE ON SPORT BY PA IN SPAIN
(in euros per inhabitant)

Type of PA	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*
Central State Administration	3.7	3.3	3.7	3.3	2.8	3.0	3.1
Regional Administration	12.0	12.6	7.7	7.2	6.6	6.4	44.7
Local Administration	66.5	54.6	43.7	40.7	42.2	45.5	44.7
Total	78.5	67.2	51.4	47.9	48.8	51.9	51.2

Sources: Collected by authors based on the *Yearbook of Sports Statistics,* MECD (multiple years).

FIGURE 2

EVOLUTION OF PUBLIC EXPENDITURE ON SPORT BY PA, 2010-2016 PERIOD
(in euros per inhabitant)



Sources: Collected by authors based on the *Yearbook of Sports Statistics,* MECD (multiple years).

Let us now briefly consider the evolution of regional public expenditure, in order to verify if there exist significant differences between CC.AA. in Spain. Table 12 shows the evolution of expenditure on sport by Autonomous Community, revealing two relevant facts. First, it should be noted that the economic crisis that erupted in year 2008 had a very negative effect on the expenditure incurred by all CC.AA. Thus, for instance, whereas expenditure on sport represented 0.47% of their total public expenditure in 2006, that percentage will fall to 0.19% in the 2018 budget as a result of the crisis.

TABLE 12

CC.AA. PUBLIC EXPENDITURE ON SPORT
(in euros per inhabitant)

Autonomous Community	*2006*	*2008*	*2012*	*2017*	*2018*
Andalusia	3.09	18.88	6.61	4.78	5.13
Aragon	16.38	14.87	7.18(*)	--	8.65
Asturias	15.37	26.15	24.81(*)	11.57	11.66(**)
Canary Islands	5.29	18.76	6.00	3.59	5.01
Cantabria	7.78	36.87	25.10	14.63	15.21
Castilla-León	7.12	14.00	9.89(*)	--	6.32
Castilla-La Mancha	15.33	33.38	25.88(*)	8.03	4.29
Catalonia	5.60	12.62	10.18	8.17	8.14(**)
Madrid	5.56	21.59	7.33	5.34	5.49
Valencian Community	5.58	7.81	2.44	4.52	5.58
Extremadura	11.53	22.42	20.37	15.84	18.24
Galicia	5.59	15.13	7.65	7.06	8.10
Balearic Islands	3.01	13.53	12.22	21.76	26.02
Navarre	19.74	53.09	44.33	21.58	28.63
La Rioja	15.57	30.10	27.24	18.95	21.26
Murcia	9.01	11.19	6.36	4.62	4.47
Basque Country	3.30	28.61	6.16	3.73	4.06
Total	6.81	18.45	8.42	7.00	7.45

** Data from 2011 budget. ** Extended budget.*

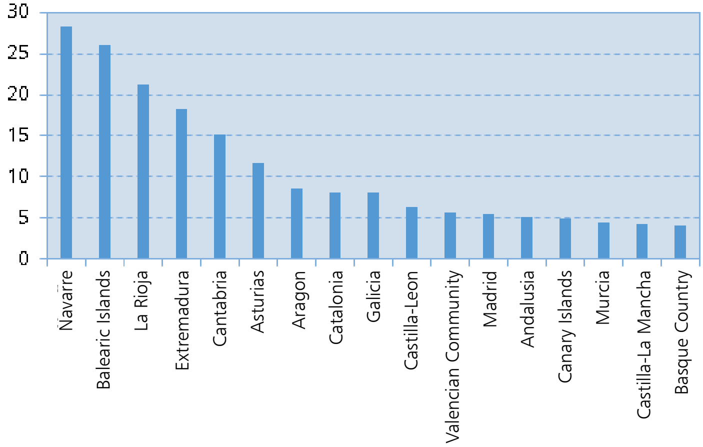
Sources: Collected by authors based on information from *Deportistas* magazine (multiple years).

Secondly, a large disparity in the amount of expenditure on sport incurred by different CC.AA. is observed. As shown in Figure 3, there exist major differences between CC.AA. in year 2018, ranging from the 28.36 euros spent by inhabitant in Navarre to the 4.06 euros budgeted in the Basque country.

Finally, when analyzing public expenditure on sport by local administrations, two major agents stand out, namely, provincial councils and municipalities. The former have played a very significant role in many CC.AA., their importance having exceeded that of CC.AA. themselves as far as public expenditure is concerned. Thus, in 2006, average per capita spending of provincial councils reached a value of 12.52 euros, whereas CC.AA. spent 9.12 euros, showing significant differences between them (Muñoz and Criado, 2007).

FIGURE 3

PUBLIC EXPENDITURE ON SPORT PER INHABITANT BY CC.AA., IN YEAR 2018 (in euros per inhabitant)



Source: Collected by authors based on Muñoz (2018).

Such spending differences between provincial councils and CC.AA. have been narrowing in recent years, for two reasons. Firstly, the increase in spending experienced by CC.AA.; thus, for instance, per capita expenditure on sport by provincial councils was 17.36 euros in 2008, whereas expenditure by CC.AA. amounted to 17.93 euros (Muñoz and Soria Fernández, 2008a). A second factor explaining this narrowing of differences in expenditure on sport lies in the severe spending restrictions experienced by provincial councils as a result of the economic crisis; thus, when comparing the expenditure peak reached in year 2008 with the situation in 2017, a 42% drop in expenditure on sport is observed, having decreased from the aforementioned 17.36 euros per inhabitant to 5.69 euros in 2017 (*Deportistas*, 2017). Furthermore, whereas CC.AA. stabilized or slightly increased their spending on sport in 2016 and 2017, provincial councils continued to follow a trend of spending contraction.

As aforementioned, municipalities account for most public expenditure on sport in Spain. Juncal and Muñoz (2006) analyzed the 2006 expenditure of municipalities of more than 150,000 inhabitants, as well as that of provincial capitals whose population is below that figure. Information gathered reveals an average per capita spending of 41.03 euros that year, which mounted up to 62.35 euros in 2008 (Muñoz and Soria Hernández, 2008b), and then significantly decreased in the following years in a context of economic crisis, reaching a low of 38.28 euros in 2016, though spending mounted again up to 42.81 euros in 2018 (*Deportistas*, 2018). Two interesting aspects of such evolution are noteworthy. First, from the peak reached in 2008 to present day, a decrease of 31.34% in expenditure on sport is observed. Secondly, the most recent data suggest a sustained growth in the expenditure on sport by municipalities that stands in contrast to the unabated contraction shown by provincial councils. As a result of this double conflicting trend, expenditure by local administrations seems to be stabilized after the economic crisis, as shown in Tables 10 and 11.

V. CONCLUSIONS

Physical activity is a major determinant of the state of health, which positively affects social welfare and helps constraining health expenditure. It is perhaps for these reasons that studies on the sporting habits of people have aroused a growing interest in sport economics, both at the national and the international level. The purpose of this article was to provide a brief overview of the current situation in Spain, as well as to contribute to the economic literature on the subject with a simple econometric analysis enabling to compare factors associated with sports participation in recent years.

Available data on Spain show a growing participation in sports over the last decades, both in general terms and from the specific perspective of regular practice (at least once a week). This upward trend is observed in all age ranges. Furthermore, a decrease in gender differences regarding sports participation has also been verified. On the other hand, changes in the type of sporting facilities used have led to sustained increase in the use of private and household facilities. Variations in the kind of sport practiced have also been observed, even though swimming, football and gymnastics were still among the most popular sporting activities in the years examined.

Economic literature on participation in sports is not abundant in Spain, and quite heterogeneous regarding variables studied and databases used. However, most studies reveal the relevance of personal, family, socioeconomic, and environment characteristics for sports participation and frequency of practice. Empirical analyses suggest that male and young individuals show higher probability of sports participation, as well as a positive effect of education level and economic situation on such practice.

Besides a review of the existing studies on the subject, the present article also includes an econometric analysis enabling to compare over time the degree of association between sports participation and variables relative to personal and family characteristics, and to place of residence. Data provided by the

Surveys of Sporting Habits from years 2000, 2005, 2010 and 2015 have been used for comparative analysis. Noteworthy findings include a growing positive impact of education level, and age-related changes in behavior from 2005 on, namely, the increased probability of older people regularly practicing sport.

Changes detected in sports participation-related decisions might be at least partly determined by public policies promoting sport. In Spain, competences in this field are shared between the High Council of Sport, Autonomous Communities, and local administrations. Although Autonomous Communities are primarily responsible for promoting and regulating sporting activities, expenditure by local administrations is well above, a fact indicating that municipalities are the main providers of sports services to citizens. On the other hand, a great disparity in spending between CC.AA. is observed. Last, public expenditure on sport decreased in the period of economic recession, though such decrease did not have an impact on sports participation, which continued to increase in 2015.

Finally, it should be noted that there exist certain loopholes in economic literature regarding this matter in Spain, which would be advisable to address in future research. First, it would be useful to have panel data available, in order to conduct a dynamic analysis of sports participation. Secondly, we have been unable to find works examining the importance of economic habits and incentives in the sports participation of Spanish population. Another line of research that could be more thoroughly developed is the analysis of physical activity performed in different facets of everyday life (leisure time, work, transportation), intended to verify if there exist complementarity or substitutability between the different spheres. Last, it would be interesting to examine in greater depth the effects of sport on health, welfare, and labor market.

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THE OUTCOMES RELATED TO SPORT AND PHYSICAL ACTIVITY: A BETTER UNDERSTANDING OF HEALTH, SOCIAL, LABOUR AND ACADEMIC IMPACTS

Cristina MUÑIZ

Paul DOWNWARD

Abstract

Sport and physical activity are recognized as central to the delivery of both economic and non-economic outcomes in society. In terms of economic outcomes, they contribute on a macro level to Gross Domestic Product (GDP) and also to the level of employment. Sport and physical activity also has microeconomic outcomes as well through the labour market. In addition to direct economic outcomes, sport also has impacts on health and education as well as the development of social capital and integration. Whilst these are important outcomes in themselves, they also indirectly influence labour market outcomes. This chapter consequently provides insight into the role of sport with respect to these outcomes. Gaps in the literature and methodological weaknesses are also identified. Finally, implications for the Spanish context are presented which could be informative for policy-makers in fostering an array of desirable outcomes by means of engagement in sports.

Keywords: sport, physical activity, health, social inclusion, labour market, education.

JEL classification: I12, I20, I31, J20, Z20.

I. INTRODUCTION

Though many beneficial outcomes have been identified in research stemming from individuals participating in spsort and physical activity, this is concomitant with participation rates in these activities declining. While there are disparities across countries, there is conspicuous evidence of the decline and a recognised challenge to reverse this (European Commission, 2018). It is important to recognise that this is not emphasised because participation is good for its own sake but, from a policy point of view, because engagement in sport and physical activity is argued to have beneficial externalities to society in terms of improving health and well-being, social capital and cohesion, and the labour market outcomes of citizens. After having defined sport and physical activity and presented the theoretical foundations of sports participation and the associated outcomes, this chapter will review the evidence connected with these impacts to help to inform policy discussion generally and, specifically, for the Spanish context. Currently, most literature focuses on isolated outcomes although Downward, Hallmann, and Rasciute (2018) suggest that there are connections between sport, social capital, well-being and health. This is to say that a holistic approach analysing the impacts on diverse outcomes will be of strategic value for numerous policy stakeholders in tailoring and coordinating their strategies. Thus, the outcomes that are reviewed include health-related outcomes discerning the associated economic costs, the debate on optimal exercise dose and intensity, and well-being and happiness. Subsequently, the chapter will explore the social dimension of sports with a special focus on the most vulnerable groups of the population. Then, the outcomes associated with the labour market are discussed in terms of employability and earnings probabilities and also the impacts on absenteeism and presenteeism. The literature recognises that as well as there being direct effects of sports participation on labour market outcomes, mediation through health and education is possible. These educational outcomes are then also examined. Methodological weaknesses in literature are identified and implications for the Spanish context are outlined. Finally, overall conclusions are drawn.

II. SPORT AND PHYSICAL ACTIVITY

Prior to analysing the impacts of sport and physical activity, it is important to better understand these concepts. To begin with it is important to note that physical activity and sports are often identified as distinct concepts and they are analysed within separate literatures. The difference in meaning is however, subtle. For example, The World Health Organization (WHO) (2017) describes physical activity "as any bodily movement produced by skeletal muscles that requires energy expenditure" (n.p.).[1] This is a broad concept that includes different domains and consists of activities performed when individuals take part in recreational pursuits, travel, household chores and also working. It can be argued that sport is nested within this definition as, on the other hand, the Council of Europe (CoE) (2001) in the *European Sports Charter* defines sports as "all forms of physical activity which, through casual or organised participation, aim at expressing or improving physical fitness and mental well-being, forming social relationships or obtaining results in competition at all levels" (2001: p. 3).[2] Such a definition was influenced by earlier arguments by Rodgers (1977) who suggested that four core elements should be conceptually found in sports, with the first two being essential. Thus, sports should involve physical activity, be practiced for recreational purposes, involve an element of competition and have a framework of institutional organization. It is clear however that physical activities like gardening or commuter cycling could, in principle, equally improve physical fitness and help with the other aspirations identified by the CoE for sport. Thus, gardening can be for recreation and moreover, commuter cycling could be identified by the participant as a form of leisure. As a consequence, from a conceptual point of view it is difficult to make a distinction between sport and physical activity *per se,* though clearly activities like manual labour include the latter and are not the former. Consequently, a different way to pragmatically define sport and physical activity is to argue that they are what is generally accepted to be the case by, for example, the media and sports agencies and other agencies. This argument has been used to define sport, for example, by Gratton and Taylor (2000), though is not without debate (Hallmann and Giel, 2018). The arbitrariness of definition is, for example, illustrated in England in which the *Active People Survey* that used to measure sports participation for the sport policy agency "Sport England" has been redeveloped into the *Active Lives Survey* in which physical activities not traditionally identified as sport are included. Consequently, in this chapter the two terms are treated as being synonymous.

III. THEORETICAL FRAMEWORK OF SPORTS PARTICIPATION AND ASSOCIATED OUTCOMES

Downward (2007) draws a clear distinction between neoclassical and heterodox perspectives as the core theoretical approaches to sports participation. Nonetheless, Becker's neoclassical theory of household production (Becker,

[1] See http://www.who.int/topics/physical_activity/en/

[2] The European Sports Charter was initially adopted by the Committee of Ministers on 24 September 1992 at the 480th meeting of the Ministers' Deputies and subsequently revised at their 752nd meeting on 16 May 2001. See https://rm.coe.int/16804c9dbb

1965), arising out of the premise that households maximize their utility by means of combining time and market goods to produce commodities, is increasingly recognized as central to a better understanding of the demand for sports. Downward and Riordan (2007) extend that time-allocation model and some subsequent developments (Becker, 1974; Stigler and Becker, 1977) to analyse sports consumption arguing that individuals allocate resources to the purpose of enhancing desirable social characteristics and consumption skills. Humphreys and Ruseski (2011) also extend Becker's seminal analysis subsequently as presented in the so-called Cawley's SLOTH model.[3]

In terms of specifically health-related outcomes, Grossman's (1972) extension of the time allocation model has been important. In this way, Humphreys, McLeod and Ruseski (2014) assume that utility is derived from a health commodity produced by health inputs including physical activity, and also the mediating role of education, which increases efficiency in health production. Moreover, the framework also underpins analysis of the effects of sports participation on academic performance (Pfeifer and Cornelißen, 2010) and in the implications for labour outcomes (Barron, Ewing and Waddell, 2000). Whilst extensively exploited, the neoclassical perspective has been criticized by the supporters of the heterodox approach that stress a major role for psychological and social characteristics in shaping individual's behaviour (Janssen *et al.,* 2017). Furthermore, behavioural economists challenge the assumption of rationality underpinning the neoclassical approach. They argue that this is evidenced in some health-related behaviour to the extent that unhealthy individuals are unable to conduct an intertemporal cost – benefit analysis of, for example, physical activity and consequently they abstain from investing in health (Shuval *et al.,* 2015)

IV. THE POTENTIAL IMPACTS OF PHYSICAL ACTIVITY AND SPORT

1. Health Outcomes

1.1. Physical Inactivity: NCDs and Health Risk Factors

The effects of sports and physical activity on health are long-established deriving from literatures drawing upon economics, physical activity and epidemiology. They explore both subjective and objective indicators of health

[3] See Cawley (2004) for further details of the SLOTH model: S represents time spent sleeping, L time at leisure, O time devoted to occupation (paid work), T time in transportation, and H time spent in home production (unpaid work).

with a majority of the literature focused on the domain of recreational physical activity (see Cabane and Lechner, 2015; Warburton, Nicol and Bredin, 2006). In terms of the impact on self-assessed health, exercise has been demonstrated to bring with it substantial beneficial effects and that the health outcomes arising are also mediators to augment labour earnings (Lechner, 2009). Apart from recreational physical activity, Rasciute and Downward (2010) explore the impact of active travel and overall their findings indicate beneficial effects for self-assessed health and subjective well-being. However, disparities between genders are also reported as Sari and Lechner (2015) suggest no significant effect of regular leisure-time physical activity on subjective health for females.

More generally, seven lifestyles including physical activity (the so-called "Alameda 7")[4] have been identified as major contributors to better health outcomes (Belloc and Breslow, 1972). This is despite the huge consensus that urbanization, industrialization, and the dependence on motorized vehicles are leading to a shifting in health patterns. As a consequence, contemporary societies are characterized by progressively less healthy behaviours that have become major drivers of Non-Communicable Diseases (NCDs) (McMurray and Smith, 2013). More specifically, physical inactivity is identified as the fourth leading risk factor for global mortality with physical activity being associated with a reduction in all-cause mortality (Pedersen and Saltin, 2015).[5]

An empirical economics literature has therefore focused on exploring the effects of physical activity on an array of NCDs and, for example, positive impacts on diabetes, high blood pressure (BP), arthritis, asthma, heart disease and self-reported health have been identified (Humphreys, McLeod and Ruseski, 2014). In line with this, Sarma *et al.* (2015) explore the impact of both recreational and also work-related physical activity on diabetes, high BP and heart disease. Health-related outcomes including overweight and obesity are also examined. While physical activity for recreational purposes lowers the probability of obesity, there is no effect on other health outcomes although physical activity at work reduces the risk of obesity and NCDs. The latter finding is therefore indicative that physical activity also plays a substantial role in the prevention of overweight and obesity. Thus, Cawley, Frisvold and Meyerhoefer (2013) report that physical activity classes reduce both the likelihood of obesity and Body Mass Index (BMI), especially in boys. Dhar and Robinson (2016) note that physical activity participation reduces the likelihood that overweight and childhood obesity persist later in life, and moreover suggesting that participation is more helpful

[4] Exercising, eating breakfast, maintaining desirable weight, not snacking between meals, never smoking cigarettes, moderate or no alcohol consumption, and regular 7-8-hour sleep.

[5] These causes of premature death include type 2 diabetes, cardiovascular disease, metabolic syndrome, hypertension, breast and colon cancer, dementia and mental health disorders.

than the frequency of physical activity in tackling obesity. For adults, Sarma *et al.* (2014) report that physical activity is negatively associated with BMI, finding a stronger impact on females and stressing the role played by work-related physical activity in addition to the recreational domain.

1.2. The Economic Costs Associated with Health Issues

As a substantial economic burden is attributed to physical inactivity, physical activity remains a potentially effective means of curbing rising costs for healthcare systems (see Breuer, 2014) and moreover part of the solution could involve rewarding healthy behaviours monetarily (Cawley, 2015). More specifically, the values of the cost implications are large with a global cost of 67.5 billion of dollars attributed to physical inactivity worldwide through direct health care costs as well as productivity losses (Ding *et al.,* 2016). With respect to specific countries, Kang and Xiang (2017) identify that regular physical activity leads to a noticeably lower utilization of inpatient care, emergency rooms, home health care, and prescription medications for adults in the U.S. Sari (2009) explored the social cost imposed by the overuse of the public health system stemming from physical inactivity in Canada. The results show that low levels of physical activity accounts for 2.37 million family physician visits and 1.42 million hospital stays. Finally, in terms of obesity, Effertz *et al.* (2016) estimate that obesity accounted for 29.39 billion of euros with additional indirect costs amounting to 33.65 billion of euros in Germany. However, some negative effects have also been noted as injuries arising from physical activity and sports could potentially increase economic costs, although these detrimental impacts have gained less interest from research (Marshall and Guskiewicz, 2003).

1.3. Dose and Intensity of Physical Activity

Following the WHO's guidelines,[6] most research has focused on analysing the potential beneficial effects of moderate and vigorous physical activity for adults. This is despite there being no consensus on the optimal dose required to produce significant impacts on health (Rhodes *et al.,* 2017). Some empirical studies recommend going beyond the threshold for physical activity suggesting that 150 minutes of moderate activity weekly is not sufficient to derive substantial health benefits (Sari and Lechner, 2015) and that moreover high levels of moderate physical activity also offset the risk of death associated with sitting time (Ekelund *et al.,* 2016). However, detrimental effects on health arising

[6] See http://www.who.int/dietphysicalactivity/factsheet_adults/en/

from excessive exercising also are noted (Räisänen *et al.,* 2016). On the other hand, recent findings suggest that light physical activity is also related to all causes of mortality (Loprinzi, 2017). Moreover, Downward and Dawson (2016) challenge the purposes of policies that seek to promote more intense physical activity suggesting that less intense activity have potential greater impacts on social well-being.

1.4. Well-being, Life Satisfaction and Happiness

Therefore, another important branch of the health-related outcomes literature has focused on well-being, suggesting that physical activity leads to a better quality of life (Das and Horton, 2012). Well-being could be then described as a composite measure more closely aligned with quality of life and happiness, and in relation to health, it would psychological elements. However, as this latter condition usually clusters a myriad of mental illnesses, this dimension is also obviously distinct from the genuine notion of well-being (Wicker and Frick, 2015) although the strong interconnection between health and well-being is underlined by institutions like WHO when describing health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 2006: p.1).[7]

In terms of economic literature, Rasciute and Downward (2010) argue that physical activity has an overall largely beneficial effect on well-being but that more research is required on the effects of specific activities, as for example cycling is reported to have some detrimental effect on well-being despite positive health effects. Subsequently, these authors also identify that happiness is amplified by engagement in sports with substantial impacts, in particular, for team sports suggesting a link between social interaction and the outcome of happiness (Downward and Rasciute, 2011). Dolan, Kavetsos and Vlaev (2014) corroborate the association between physical activity and life satisfaction and moreover argue that the magnitude of the benefits is greater for males. In addition to the disparities between genders, there are also discrepancies in accordance with age. Thus, Pawlowski, Downward and Rasciute (2011) identify a larger positive effect on well-being as individuals age although this effect declines from 70 years onwards. However, Ruseski *et al.* (2014) suggest a U-shaped association.

In terms of frequency and intensity, while a higher frequency is associated with an improved level of happiness (Kavetsos, 2011a), Wicker and Frick (2015)

[7] See http://www.who.int/governance/eb/who_constitution_en.pdf

suggest that more vigorous physical activity has detrimental effects on well-being. More specifically, Maxcy, Wicker, and Prinz (2018) explore long-distance triathlons and they note that although satisfaction with the performance of the race positively affects happiness, mental suffering during both training and the race reduces the level of happiness. For disabled individuals however, higher levels of life satisfaction arise for intense levels of sports participation (Pagan, 2018). There is also evidence in support of outdoor activities arguing that these activities result in less tension and anger, and also bring the opportunity for more vitality and engagement for individuals (Thompson Coon *et al.,* 2011). Finally, as compared to membership in other leisure activities, Balish, Conacher and Dithurbide (2016) suggest that membership in a sports organization exhibits a stronger association with happiness.

Although research usually focuses on analysing the association of sports with health or well-being in isolation, some recent studies have also considered that there are interrelations between these outcomes. Furthermore, Downward and Dawson (2016) suggest a trade-off between health and well-being goals that should be accounted for by policymakers. Downward, Hallmann and Rasciute (2018) analyse the simultaneous relationship between sport, subjective health and well-being and the findings suggest a multiplier effect of sports on health and well-being with subsequent physical and mental health benefits.

1.5. Limitations in Health-Related Outcomes Literature

While a large literature exists, different shortcomings have also been identified. An important gap is that recreational physical activity has been primarily explored. This is despite the fact that total physical activity accounting for the different domains of recreation, transportation, household chores and/or occupation would have a potential impact on health. Consequently, recent research has started to explore other domains suggesting for example that bicycling for travel is associated with a reduced risk of a large spectrum of health conditions, while walking was only associated with a lower risk of cardiovascular disease (Celis-Morales *et al.,* 2017). This latter finding is in line with Sarkar, Webster and Gallacher (2018) who report a negative association between the walkability of cities and the risk of high blood pressure and hypertension. On the other hand, in terms of occupational domain, there is a pressing demand to reduce workplace sitting time (Cabanas-Sánchez *et al.,* 2018) although a "physical activity paradox" has been also identified with detrimental health effects stemming from high level of occupational physical activity (Coenen *et al.,* 2018).

Another limitation is that despite the extensive analysis of the effects on subjective well-being, most studies focus on physical health impacts while less research target the objective mental dimension. This is in spite of the fact that the prevention of mental illness has been included in the Sustainable Development Goals (WHO, 2017). Consequently, an avenue of work is developing showing concern with the association between mental health and physical activity, and more specifically in the importance of "green exercise" in improving mental health (Mackay and Neill, 2010). Moreover, in many studies self-reported measures of physical activity are used. Studies reveal however disparities in the impacts arising according to objective (*e.g.,* accelerometers) or subjective measures of physical activity that suggest more analysis on this (Anokye *et al.,* 2012).

2. Social Outcomes

Policy attention to the social impact of sports has increased considerably with the social dimension of sports comprising a broad set of aspects like social inclusion, education, volunteering, violence and intolerance. The "Declaration of the European Council on the specific characteristics of sports and its social function" (European Council, 2000), and subsequently the "Communication on Developing the European Dimension of Sport" (European Commission, 2011) underline the important role of sports in contemporary societies.[8, 9] More recently, sports has also been associated to the Sustainable Development Goals (Lindsey and Darby, 2018).

Sports have been identified as a source of social capital through different channels. Thus, there is evidence that social interactions emerge from sports participation (Downward and Riordan, 2007), and that these social interactions are essential to generate relational goods that subsequently augment the happiness of individuals (Becchetti, Pelloni and Rossetti, 2008).[10] Furthermore, social interactions bring with them the opportunity to learn "life skills" (Holt *et al.,* 2009) as sports specifically enhance communication skills, reduce the prevalence of antisocial behaviour and promote other social skills. In particular, specific strengths are attributed to team sports in shaping communitarian identities by promoting a sense of belonging (Andersen, Ottesen and Thing, 2018) and contributing also to integration into the workplace (Jakobsen *et al.,* 2017). Finally, physical activity also promotes trust (Di Bartolomeo and Papa, 2017) which is also recognized as a mediator to better health outcomes

8 See http://www.europarl.europa.eu/summits/nice2_en.htm#an4

9 See https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0012:FIN:EN:PDF

10 The concept of relational goods is related to the quantity and quality of relational experience through interpersonal relationships whereby individuals perform activities without any visible reward apart from the activity *per se* (Bartolini, 2014).

(Audet *et al.,* 2017). More specifically, trust and social integration are more prevalent in voluntary sports clubs than in commercial fitness centres (Ulseth, 2004). However, some detrimental effects are also identified and importantly Downward, Pawlowski and Rasciute (2014) report that association with sport reduces trust and evidence also suggests that it could promote criminal behaviour (Caruso, 2011; Faulkner *et al.,* 2007). Moreover, violent and antisocial behaviours have been associated with specific sports including physical strength sports and wrestling (Endresen and Olweus, 2005).

2.1.Vulnerable Groups

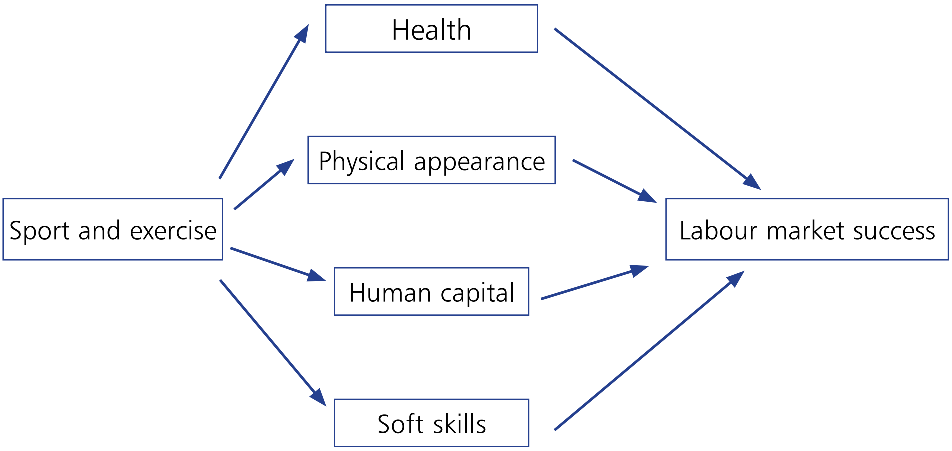
Of immense importance are the effects that can emerge from sports in relation to particularly vulnerable groups. Thus, sport has been demonstrated to be a powerful tool to mitigate the problems faced by marginalized groups including the poorest individuals, immigrants and refugees, or individuals with disabilities (Pack, Kelly and Arvinen-Barrow, 2017; Vandermeerschen, Van Regenmortel and Scheerder, 2017; Waardenburg *et al.,* 2018). In terms of age, sport also contributes to overcoming younger people's vulnerability by means of supportive effects of sports clubs (Haudenhuyse *et al.,* 2014) and Schüttoff *et al.* (2018) report more specific positive effects in relation to helping friends, volunteering and civic engagement. Though most studies focus on developed countries, Pawlowski *et al.* (2018) also found positive impacts on social capital for Peruvian children taking part in a sports group. Finally, physical activity plays also a substantial role for the elderly under circumstances of vulnerability including loneliness (Devereux-Fitzgerald *et al.,* 2016).

3. Labour Market Outcomes

There is a literature that analyses the economic consequences of physical activity in terms of the labour market directly and outcomes that are relevant to this. These outcomes are of interest as they bring with them the opportunity to enhance economic productivity which will subsequently strengthen the competitiveness of the economy and ultimately will increase social wellbeing as well (Lechner, 2015). Figure 1 illustrates the association of sports and physical activity with labour market outcomes through various potential channels which has been explored above. Thus, health and the physical appearance that would partly be related to obesity are mediators in professional success that is also driven by the role of social ("soft") skills. Finally, the significance of human capital will be addressed in the subsequent subsection.

FIGURE 1

SPORTS AND LABOUR MARKET: CHANNELS OF ASSOCIATION



Source: Lechner (2015).

In terms of the probability of being recruited, Kavetsos (2011b) reports that physically active individuals, in particular males, are more likely to be employed across Europe. Cabane (2013) argues that individuals doing sports regularly are also more likely to be employed and that this is underpinned by sports leading to a better mood than is helpful in the search for employment. Further, physical activity may act as a signal by applicants seeking employment of a potential better health status that subsequently could lead to gains in productivity. Taking part in sports also could imply other skills such as discipline, competitiveness, leadership, perseverance and social skills including teamwork (Pfeifer and Corneliβen, 2010) which foster work performance (Brinkley, McDermott and Munir, 2017). Therefore, these skills are of interest for companies when they recruit applicants for a job and consequently helpful signals in gaining access to a position (Rooth, 2011). More specifically, social skills are of great relevance for the employees as the labour market increasingly demands and rewards social skills (Deming, 2017). Moreover, as physical activity is related to obesity outcomes, physical activity could be a means of preventing job discrimination as obese individuals are more likely than their non-obese peers to be unemployed or more segregated in self-employment (Garcia and Quintana-Domeque, 2006).

In terms of earnings, there is evidence that earnings are higher for workers who are more physically active (Lechner, 2009; Kosteas, 2012) and more specifically, the increases in earnings are estimated to be between 4% and 17%

(Lechner, 2015). In line with this, Lechner and Sari (2015) also explore the effects on earnings although they report that substantial impacts only are found for high level of sports participation. Moreover, Barron, Ewing and Waddell (2000) note that wages are higher for individuals who engaged in high school sports rather than in other extracurricular activities. Cabane and Clark (2015) found an association between sports, specifically performed during the childhood, with subsequent better labour-market outcomes with this being relevant as there is little evidence of long-term benefits of physical activity. However, and despite the overall positive association of physical activity with labour outcomes, the results are typically more robust for males than females. Thus, Lechner and Downward (2017) report that for males in particular, sports participation is negatively related to unemployment, as well as higher youth employment rates and earlier retirement rates for older employees. Discrepancies are found in terms of the type of sport with team sports contributing more to employability although the effects here also vary by gender. Finally, specific outdoor sports (horse riding, hunting, golf, etc.) exhibit a positive link to earnings. Consequently, more research is required for a better understanding of the channels of association of physical activity with labour outcomes (Cuffe, Waddell and Bignell, 2017).

3.1. Absenteeism and Presenteeism

Several unhealthy behavioural patterns including physical inactivity exacerbate health problems and subsequently lead to potential increases in costs for companies. Thus, in terms of firms, recruitment and training costs could emerge because of new recruitments arising from absenteeism and sick leave induced by physical inactivity. Tolonen, Rahkonen and Lahti (2017) suggest that vigorously active workers had fewer sick leaves per year and subsequently the direct cost associated with these absences is 404 euros less for the vigorously active worker than the cost of an inactive employee. On the other hand, the beneficial role of being physically active has been recognized in terms of presenteeism (Guertler *et al.,* 2015) although it is also argued that there is limited evidence on the impacts of physical activity on the presenteeism that would require future research (Brown *et al.,* 2011).

4. Academic Performance

Although Bailey (2006) argues that many of the benefits that emerge from physical activity in schools do not arise from participation *per se,* there is a growing body of evidence suggesting that both school-based and extracurricular physical activity has the potential to reinforce human capital through an enrichment of cognitive skills, and subsequently improving academic performance (Fricke, Lechner and Steinmayr, 2018). This is in line with the previous subsection as human capital is one of the means of achieving better labour outcomes in accordance with Lechner (2015). Thus, Pfeifer and Cornelißen (2010) explore the impact of participation in sports during childhood and adolescence on both secondary school and professional degrees, and overall the findings suggest a positive effect on educational attainment although they also note that participation in competitions could undermine the beneficial effects by arguing that they are high time-consuming activities. However, Cuffe, Waddell and Bignell (2017) argue that the longer an athlete's season, the higher the academic performance. Moreover, these authors note that athletic participation in high school reduces school absenteeism and that more specifically, strong evidence is reported for black and Hispanic students suggesting that sports may be especially beneficial in reducing racial discrimination from truancy. Felfe, Lechner and Steinmayr (2016) found positive effects on academic performance focus on children sports clubs' participation. Importantly, this participation leads to a crowding-out effect of television consumption, but in contrast sports clubs do not have a substitutive effect on other sports activities. Moreover, the effects of other extracurricular activities, such as playing music, have been also examined suggesting that while music is a more powerful tool than sports in boosting the academic performance of children, those participating in both sports and music activities achieve better outcomes than from involvement in a sole activity (Cabane, Hille and Lechner, 2016). However, Ransom and Ransom (2018) while supporting the role of sports in the educational system as a social or cultural activity, argue that sport has a lower human capital value as they show no evidence of substantial impacts on educational outcomes.

Despite the overall beneficial effects, physical activities have been often relegated in the curricula, not on the grounds that they are not important, but on the rationale that detrimental effects on the time devoted to other academic subjects, and that the latter should be prioritized in a crowded school curriculum (Bailey, 2017). This is despite physical activity potentially resulting in enhanced academic performance without conflicting with other disciplines (Cawley, Frisvold and Meyerhoefer, 2013; Cuffe, Waddell and Bignell, 2017). More specifically, there is evidence that physical activity has beneficial cognitive effects on science, mathematics, reading and composite scores (Fedewa and Ahn, 2011; Mullender-Wijnsma *et al.,* 2016). However, some controversial results are also found suggesting that while moderate to vigorous physical activity is only linked to better performance in writing and arithmetic, a greater sedentary time is strongly associated with a higher achievement in a large portfolio of academic subjects (Maher *et al.,* 2016).

Finally, there is also evidence of further beneficial effects as sports participation has been demonstrated to be beneficial for students who are lagging behind (Cappelen *et al.,* 2017) and stimulates educational and occupational aspirations. Stevenson (2010) reports that specifically for females, an increase in sports participation leads to an increase in university attendance and subsequently an increase in participation in the labour market.

However, there are disparities in the beneficial impacts according to the intensity and the type of physical activity performed, with more beneficial effects being consistently reported for team sports (Gorry, 2016). Moreover, gender differences are also found which is indicative of further research required about the association of physical activity and academic skills between genders (Fox *et al.,* 2010; Pfeifer and Cornelißen, 2010). Finally, as it applies also to other outcomes, discrepancies in the academic impacts are reported to the extent that self-reported or objective measures of physical activity are used (Marques *et al.,* 2018).

Political implications could be inferred from the above and associated to labour outcomes too. This is because if participation in sports brings with it a long-term accumulation of human capital, a paucity of public initiatives promoting sport could result subsequently in a workforce with weaker cognitive and non-cognitive skills (Leeds, 2015). However, there is also some evidence of negative effects as Eide and Ronan (2001) suggest that sports participation has a detrimental effect on educational performance for white males and by contrast a positive effect for both white females and black males. Finally, there are also shortcomings in this literature that has focused primarily on the role of sports activities for high school students or adolescents with less analysis of children. In addition, less emphasis has been placed on the analysis of the role of extra-curricular activities (Felfe, Lechner and Steinmayr, 2016).

5. Methodological Weakness in the Analysis of Impacts

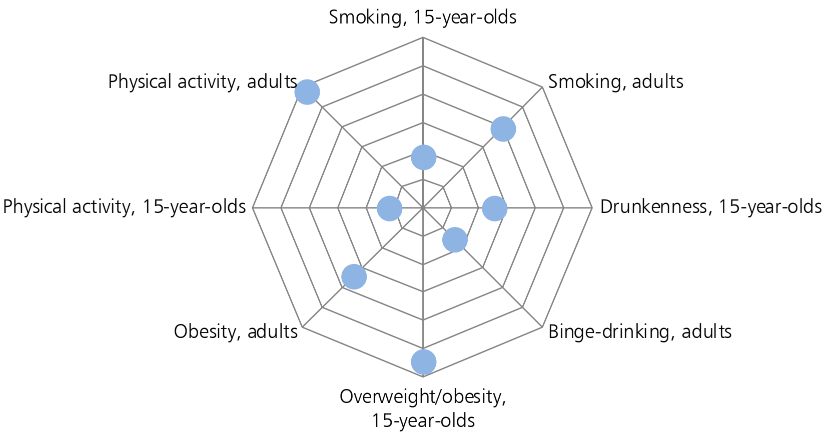
Methodological weaknesses have also been identified in the analysis of the different sports-related outcomes. These methodological weaknesses are the consequence of the fact that many studies primarily explore the associations that arise between physical activity and potential outcomes rather than taking potential causal effects into account. Thus, Ruseski *et al.* (2014) note that establishing the causality relationship is challenging due to the unobserved heterogeneity affecting both sport and the health-related outcomes. This also applies to physical activity relationship with other outcomes and thus, in terms of labour outcomes, Lechner (2015) suggests that some previous findings are questionable and that the pathways of association between physical activity and the outcomes derived from are not yet properly understood. In terms of educational outcomes, in many studies there is no clear understanding of the direction of the association between sports and educational attainment and more appropriate methodologies like an instrumental variable approach would be required in order to have more robust results (Eide and Ronan, 2001).

VII. THE IMPLICATIONS FOR SPAIN

This section presents the primary implications in the Spanish context in relation to the various outcomes previously examined. Firstly, the Spanish rates of physical inactivity for adults are relatively higher across Europe and this could partly explain some alarming circumstances, for example in terms of obesity as is illustrated in Figure 2:[11]

FIGURE 2

SMOKING, OBESITY, DRINKING AND PHYSICAL ACTIVITY IN SPAIN



Note: The closer the dot is to the centre the better the country performs compared to other EU countries.
Source: OECD (2017).

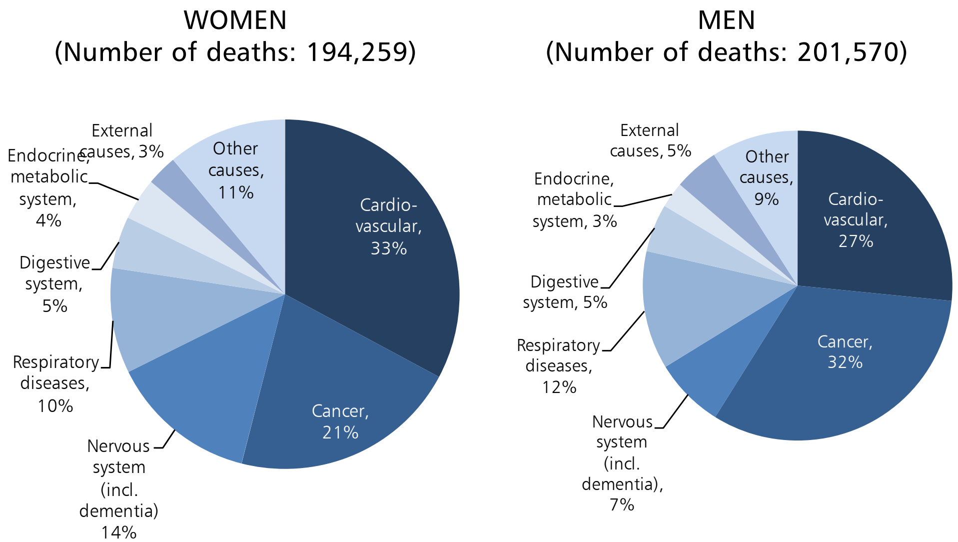
For adults, empirical evidence suggests that performing vigorous physical activity lowers the risk of total and abdominal obesity for adults (López-Sobaler *et al.,* 2016). Whilst Figure 2 shows that Spain has better performance in terms of physical activity for young people, the rates of obesity are extremely high for the youth. The prevalence of childhood obesity has multiplied by a

[11] See https://www.oecd-ilibrary.org/docserver/9789264283565-en.pdf?expires=1541445320&id=id&accname=guest&checksum=8B53759D4A3047B810EAC447CDA95A2D

factor of four in recent decades (Ministerio de Sanidad, Servicios Sociales e Igualdad, 2016) and national evidence corroborates the role of physical activity in preventing obesity suggesting that physical activity and diet accounts for disparities in adolescent's body fat (García-Pastor *et al.,* 2016). However, more research would be required to clarify the specific role of physical activity in young people according to Figure 2. Moreover, there has been a proliferation in NCDs in recent decades (Gómez-Huelgas *et al.,* 2011) with cardiovascular diseases being more prevalent in women, while cancer is more prevalent in men as illustrated in Figure 3:

FIGURE 3

CAUSES OF DEATH BY GENDER IN SPAIN



Sources: OECD (2017).

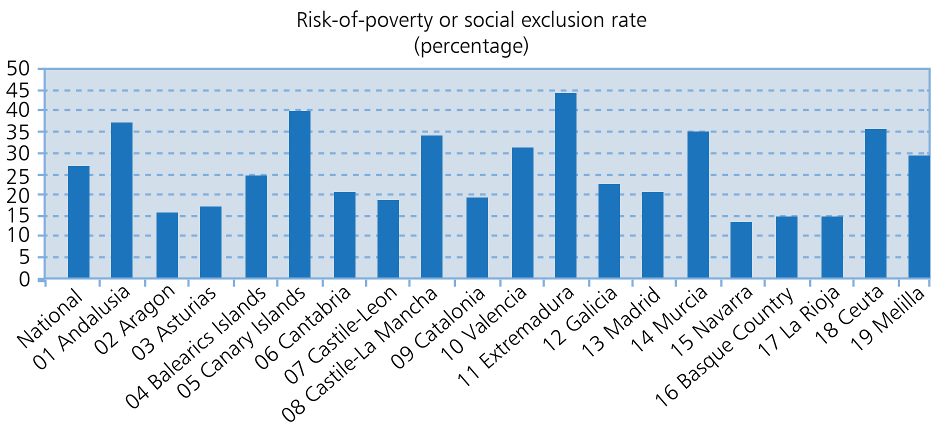
In line with international evidence, there is a higher prevalence of these conditions in the inactive population and more specifically, physical activity could contribute to reduce the risk of diabetes, depression and anxiety in more than 60%, and lower the risk of hypertension and high cholesterol particularly for males (Fernández-Navarro, Aragonés and Ley, 2018). This study also reports the importance of physical activity in lowering the prescription of medicines. Moreover, physical activity could attenuate excess long-term mortality from all causes and cardiovascular diseases associated with poor physical and mental health for people aged 60 and over (Higueras-Fresnillo *et al.,* 2018). Finally, Cabanas-Sánchez *et al.* (2018) suggest that every hour sitting a day increases the probability of dying from cardiovascular conditions by 6.4%. This is also of relevance in relation to the associated economic costs as physical inactivity accounts for 990 million euros per year specifically related to main NCDs (Aragonés, Fernández Navarro and Ley, 2016). In terms of well-being, sport is also identified as a driver of happiness (Durán *et al.*, 2017) and greater levels of life satisfaction for older adults taking part in physical activity have been reported (Barriopedro, Eraña and Mallol, 2001)

Mirroring international institutions, national agencies have recognised the role of sports activities to overcome social exclusion (Consejo Superior de Deportes, 2011).[12] This is relevant as Spain is the third-leading EU country in terms of the growth of the risk of poverty or social exclusion in recent decades, although there are disparities between the regions as illustrated in Figure 4.[13,14]

A recent national report also recognizes the substantial contribution of physical activity in enhancing the productivity of employees (Instituto Nacional de Seguridad, Salud y Bienestar en el Trabajo, 2017)[15], and empirically Puig-

FIGURE 4

SOCIAL EXCLUSION RATE IN THE SPANISH AUTONOMOUS COMMUNITIES



Source: INE, National Statistics Institute (2018).

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[12] See https://sede.educacion.gob.es/publiventa/descarga.action?f_codigo_agc=14863_19

[13] *Encuesta de Condiciones de Vida 2017* (INE, 2018). See http://www.ine.es/jaxiT3/Tabla.htm?t=9963&L=0

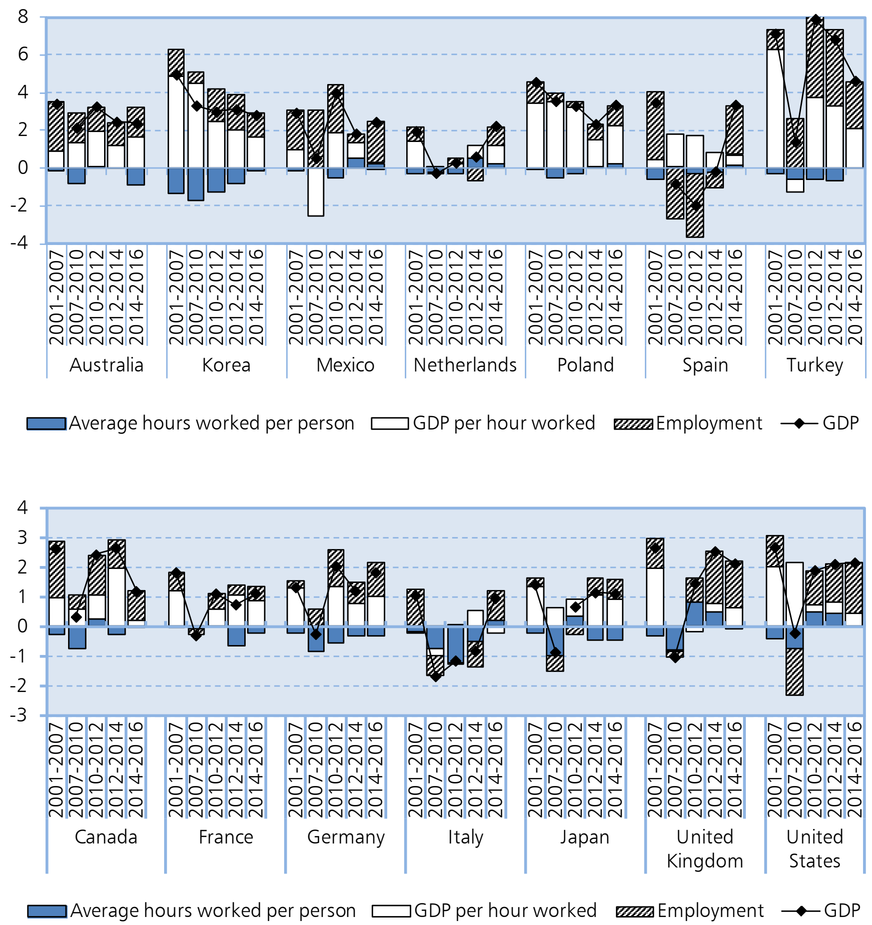
[14] See http://ec.europa.eu/eurostat/news/themes-in-the-spotlight/poverty-day-2017

[15] "Beneficios del fomento de la actividad física y la práctica deportiva, en términos de mejora de la salud, el bienestar y la productividad empresarial - Benefits of promoting physical activity and sport in terms of improved health, well-being and business productivity."

Ribera *et al.* (2015) suggest that workplace programs promoting physical activity and less time sitting result in productivity improvements for university workers. This is relevant because, as shown in the Figure 5, the growth rate of Spanish labour productivity is relatively lower and has dropped drastically in recent decades.[16]

FIGURE 5

GROWTH IN GDP, LABOUR PRODUCTIVITY, AVERAGE HOURS WORKED AND EMPLOYMENT (SPECIFIC COUNTRIES, PERCENTAGE)



Source: OECD (2018).

[16] *"GDP per hour worked"* is the average percentage change at annual rate in national labour productivity.

Physical activity could also reduce costs for Spanish companies as annual losses in relation to inactivity approximately amount to 2,500 million euros (Aragonés, Fernández Navarro and Ley, 2016). Finally, because physical activity influences obesity which is a potential mediator of occupational outcomes, physical activity could contribute to more egalitarian labour outcomes between genders as women with morbid obesity are stigmatized in the workplace (Vallejo-Torres, Morris and López-Valcarcel, 2018).

Physical activity and sports would be also essential bringing with them the opportunity to strengthen human capital as Spain is poorly performing in terms of human capital across Europe (World Economic Forum, 2017).[17] Ruiz *et al.* (2010) report several beneficial outcomes arguing that participation in physical activity does not imply less time devoted to other academic subjects but has a crowding-out effect on watching television and playing video games.[18] Whilst participation in "formal" sports is also associated with higher grades at university (Muñoz-Bullón, Sánchez-Bueno and Vos-Saz, 2017), students in non-compulsory secondary education appreciate more the physical activity impact on satisfaction, fun and enjoyment than the potential cognitive improvements (Jubera, Arazuri and Isidori, 2017) with this being reminiscent of the research by Downward, Hallmann and Rasciute (2018). These findings are relevant as while Spain has improved its scores in both mathematics and reading subjects, the level has decreased in science subject (OECD, 2017). Figure 6 shows that overall Spain obtains good academic scores with in excess of 70% of the students surpassing the minimum level of proficiency, but also that the performance is below that other European countries including Finland, Germany, Norway, Ireland, Denmark, Poland, Switzerland, the Netherlands, Slovenia and Estonia, and being also inferior to the outcomes of Japan, Canada and Korea:[19]

Disparities are also reported according to the intensity of the physical activity with the best academic performance being associated with moderate physical activity while the worst grades are for excessive levels of physical activity (Cladellas *et al.,* 2015). Ardoy *et al.* (2014) also identify the role of sports intensity in academic outcomes by suggesting that increasing the number and intensity of weekly physical education sessions in schools has positive effects on cognitive outcomes and subsequently school performance.[20] Consequently, the

[17] See http://www3.weforum.org/docs/WEF_Global_Human_Capital_Report_2017.pdf

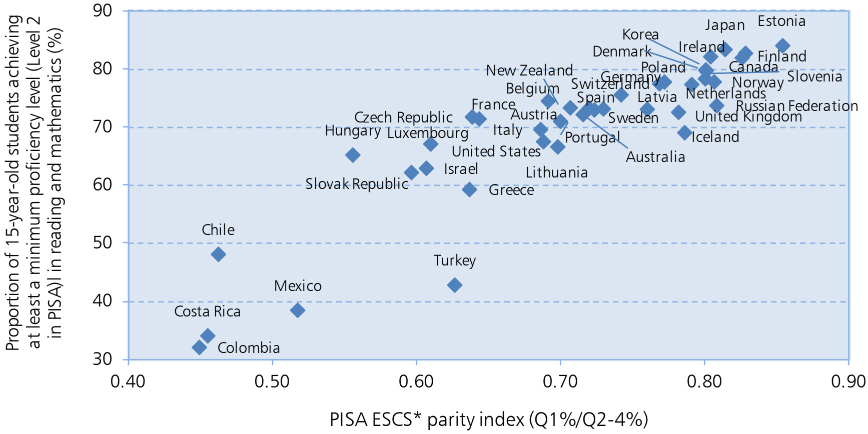
[18] These findings are relevant as 48.4% of Spanish children and adolescents spend more than two hours per day in front of the screen and this percentage amounts to 84% on weekends (Mielgo-Ayuso *et al.,* 2017).

[19] This figure shows the aspects of excellence and equity in academic performance for 15-year-old-students across OECD countries.

[20] Enhancements would be required as fewer hours of physical education are provided in the Spanish educational system as opposed to other EU countries. In particular, while there are 53 hours and 35 hours in primary and in secondary school respectively on average a year, for example in France and Austria the number of hours is in excess of 100 hours a year (European Commission /EACEA/Eurydice, 2013). See https://eacea.ec.europa.eu/national-policies/eurydice/content/physical-education-and-sport-school-europe_en

FIGURE 6

STUDENT ACHIEVEMENT IN PISA 2015 AND THE SOCIO-ECONOMIC PARITY INDEX



* ESCS refers to the PISA index of Economic, Social and Cultural Status. The parity is calculated as Q1%/Q2-4% where Q = quartile of ESCS. A value closer to 1 on the PISA ESCS parity index (x-axis) indicates greater equity. A value closer to 100% in the "proportion of 15-year-old students achieving at least a minimum proficiency level in reading and mathematics" (y-axis) indicates a better performance in the PISA assessment. For further details, see https://www.oecd-ilibrary.org/docserver/9789264266490-en.pdf?expires=1541777861&id=id&accname=guest&checksum=0F940BC03E409C4BE34391652FFFD3F0

Source: OECD (2017).

"Plan Integral para la Actividad Física y el Deporte en el ámbito del Deporte en Edad Escolar" aims to promote school-related physical education.[21] Moreover, as international evidence shows that physical activity leads to less school absenteeism this would be of interest as the school dropout rate amounts to 19% being considerably higher than the EU average.[22]

VIII. CONCLUSIONS

This chapter has revisited the primary findings in previous research focused on the impact of physical activity and sports on a variety of outcomes. International evidence demonstrates the significance of sports, not as an end per se but as a sizeable means to deliver multiple beneficial impacts arising

[21] "Comprehensive Plan for Physical Activity and Sport in the context of School-aged Sport". See https://www.csd.gob.es/es/plan-integral-para-la-actividad-fisica-y-el-deporte-en-el-ambito-del-deporte-en-edad-escolar-0

[22] See http://ec.europa.eu/social/BlobServlet?docId=17224&langId=en

from the engagement. Some limitations have been also identified in order to suggest fruitful avenues for further research. More specifically, the present paper has been structured as follows: after an introductory section elucidating the distinctions between physical activity and sport and presenting the theoretical framework, firstly health-related outcomes have been reviewed. The findings overall suggest that physical activity is central in terms of subjective and objective health outcomes including lower prevalence of NCDs and augmenting well-being although a lack of consensus on the optimal dose is also noted. Physical activity also plays a crucial role on health risk factors including obesity. As a consequence, physical activity has the potential to lessen health-related economic costs and ultimately alleviate the burden on healthcare systems. Secondly, the social dimension of physical activity and sports is explored indicating that these activities are a source of social capital and that are central in the integration of communities in vulnerability contexts. Finally, the outcomes in terms of the impacts on labour market and educational outcomes are examined. Sport enhances the probabilities of employability and increases labour earnings with health and human capital being mediators in labour outcomes. More specifically, physical activity contributes to better academic outcomes in specific academic disciplines as well as being a driver of other beneficial educational effects. However, methodological weaknesses are identified suggesting that new research is required, in particular about the fact that many studies are not able to disentangle the causality of the effects which would undermine the validity of their results.

National evidence also demonstrates significant findings in the Spanish context. In particular, these findings are relevant as an analysis of the current status of the multiple outcomes show that in terms of health, there are high rates of obesity and a rise in premature mortality attributable to NCDs. Spain also has poor ratings with respect to other countries in terms of social exclusion risk, labour productivity and human capital. The status of these outcomes in Spain and the crucial role that sports have demonstrated in shaping them should be informative for policy-makers in promoting sports as a means to deliver an array of desirable outcomes in society. Though the multiple outcomes have been primarily analysed in isolation, the potential synergies between them, with some impacts being mediators of others, suggest that a holistic approach would be relevant by addressing the overall positive impacts arising from sports engagement facilitating a more cohesive policy through the interaction of several strategies.

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THE ECONOMIC IMPORTANCE OF THE SPORTS SECTOR AND THE ECONOMIC IMPACT OF SPORTING EVENTS

Júlia BOSCH

Carles MURILLO

Josep Maria RAYA

Abstract[1]

In this chapter, the issue of measuring the economic importance of sport is addressed from two points of view, which are related but different in terms of conception and methodological approach: first, weighting of sport considered as economic sector; secondly, quantification of the economic impact of sporting events. The conceptual framework, empirical evidence, and main methodological problems are detailed in both cases. Finally, the closing section includes key recommendations for future studies adopting either approach.

Keywords: sport, economic weight of sport, sports industry, impact of sporting events.

JEL classification: C67, C82, Z20, Z21.

[1] Article translated from the Spanish by Ciro Arbós.

I. INTRODUCTION

Sport is an activity sector whose importance may be considered from different points of view. One of them is certainly the economic perspective. But sport also plays other significant roles, for instance, of social, cultural, or relational nature. Moreover, sports practice helps to preserve and improve people's health, and, on the other hand, sport is a basic source of entertainment and occupies a considerable amount of our leisure time. All of this provides a picture of the interest aroused by sport in many individuals, and, consequently, in a growing number of sports companies and entities.

In this chapter, the issue of measuring the economic importance of sport is addressed from two points of view, which are related but different in terms of conception and methodological approach: first, weighting of sport considered as economic sector; secondly, quantification of the economic impact of sporting events. A different section of this chapter is devoted to each study field, which is preceded by a review of usual sport definitions and some terminological clarifications, that may help in the reading and interpretation of findings elicited from a selection of recent empirical evidences pertaining to the aforementioned study fields. The chapter concludes with some practical recommendations for future efforts to measure the economic weight of the sports sector and the economic impact of sporting events.

II. THE SOCIAL AND ECONOMIC CONCEPT OF SPORT

Physical activity, physical exercise, and sport are related elements, but also different, usually organized and managed according to a sporting system in which both public and private economic agents interact. The World Health Organization[2] defines physical activity as "any bodily movement produced by skeletal muscles that requires energy expenditure," whereas physical exercise "is a subcategory of physical activity that is planned, structured, repetitive, and purposeful in the sense that the improvement or maintenance of one or more components of physical fitness is the objective." In this regard, physical activity includes exercise, as well as other activities involving bodily movement, whether performed as part of playing, working, active transportation, house chores, productive or recreational activities.

Explicit acknowledgement of sport at European scale was first made in year 1992 in the *European Sports Charter.*[3] Article 2 of the Charter includes

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[2] http://www.who.int/dietphysicalactivity/pa/

[3] European Sports Charter. Recommendation of the Committee of Ministers to member states, 24 September 1992.

a defining reference according to which "sport means all forms of physical activity which, through casual or organised participation, aim at expressing or improving physical fitness and mental well-being, forming social relationships or obtaining results in competition at all levels." It is therefore a broad conception of the term "sport", including both competition in any sporting discipline and the simple act of performing physical activity or exercise, that is, an activity implying a minimum of organization and planning, and the pursuit of a specific objective. It is noteworthy that, in this definition, reference is made to the aims pursued by people who practice sport: health maintenance or improvement, sporting performance, or even social relationships, thus closely relating sport to the idea of a relational good. This view of sport has prevailed over the years, as revealed, for instance, by the 2014-2020 multiannual framework, or the spread of sports related actions and calls (Fernández, 2017).

Social, cultural, educational, and economic functions of sport were first explicitly and distinctively acknowledged in Europe in the *Nice European Council Declaration* in December 2000. As defined in the Declaration, sport is a means with sufficient adaptive capacity to enable individuals to interact with each other and integrate into their usual environment, as well as to share and transmit values. In Annex 4 to the Declaration, sport for all, amateur sport, sports federations and its basic entities (clubs and sporting associations and federations), the economic dimension of sport (probably owing to the phenomenon of professional football players transfers), as well as public policies in the field of sport, are explicitly mentioned.

A few years later, in 2007, the European Commission divulged the results of its sport policy efforts in the form of a *White Paper on Sport.* This document is essential to understand the European position on the significance of sport in current society (its social and educative function, and its importance in the lives of European citizens, regardless of their social condition, age, gender, and state of health), the way sport should be regulated and organized (from the perspective of private non-profit entities, companies, and public bodies), and, finally, the need to measure the economic dimension of the phenomenon of sport (acknowledging, in short, the place of sports economy).

Certain specificities of sport that make it unique and require a particular approach have been recognized. According to the aforementioned White Paper, sport is specific inasmuch as certain rules apply to it that are not generalizable to other contexts. This statement basically refers to regulations applicable to competition sport (where, for instance, there are different rules for male and female competitions), and also to the need of adopting mechanisms to preserve uncertainty of outcomes and to render balanced competitions (meaning similar chances of success for all competitors). The second specificity refers to organizational structures and, more specifically, to the pyramidal structure existing in most competitions and to solidarity mechanisms between different levels of competitive sports. Once specificity has been recognized, it is nevertheless underscored that it must not be construed as to justify a general exemption from the application of Community law.

The *White Paper on Sport in Europe* goes even further, underlining the importance of sport for health improvement (leaving therefore open the possibility of health policies that take account of sport as a means to treat certain health problems among the population), education and training, enhanced processes of social inclusion of disadvantaged groups, the struggle for social integration and equal opportunities, as well as against racism, violence and doping. The social dimension of sport reaches beyond the borders of European Union member states; accordingly, the White Paper remarks the role that sport might play in the relations of EU countries with the rest of the world, especially for the sake of sustainable development.

In 2011, the European Commission published an interesting communication entitled "Developing the European Dimension in Sport," a document gathering the results of an extensive consultation of member states and private sports entities (non-profit organizations). The main conclusions of that document reinforce the key aspects recognized in the White Paper, while introducing as new elements the concern for gender equality in sport and the need to bring it naturally closer to individuals with any kind of disability or handicap.

From an organizational point of view, the *White Paper on Sport* warns about the importance of sport for the common market, the need to preserve free competition between the various agents operating in the sports system, and free movement of persons and capitals, and, furthermore, the need to protect minors and to struggle against corruption and the fixing of sporting outcomes. Another important section is devoted to media and, particularly, the television broadcasting rights market.

The economic dimension of sport is recognized in the *White Paper on Sport* from two complementary points of view. First, sport is recognized as a booming economic sector with capacity to contribute to local and regional development, economic growth and employment generation; interrelation with other sectors, like the aforementioned health and education sectors, or tourism industry, is also highlighted. On the other hand, a deficit of homogeneous statistical information for the measurement of the economic importance of sport is acknowledged. The 2011 European Commission Communication levels these issues with the Europe Strategy 2020 objectives regarding improvement of people's employability and mobility.

The concept of sport as an economic activity sector was definitively endorsed by the "Vilnius Definition of Sport,"[4] so called in recognition of the Lithuanian capital where the working group met, which furthermore fostered the development of satellite accounts in sport. Application of the basic principles of national accounting implies recognition of the sports sector and, consequently, of the need to consider the production and gathering of homogeneous data on EU countries as statistical objective. From the statistical perspective, both a restrictive and an extensive definition are considered, the latter including, besides input activities, that is, sports characteristic products, activities requiring sport as input to produce other goods and services, that is, derived products. A definition of sport by statistical approximation was also recognized in Vilnius, by including sporting activities code 931 in NACE-2009.

As highlighted in the cited references, emphasis in the different sport definitions is mostly put on sport practice, that is, on the so-called active sport. Though less emphatically, references are also made to sport as spectacle, and to the various mechanisms encouraging spectators to become interested, attend to stadiums, follow sports in the media, interact and, ultimately, enjoy watching competitions or events. The characteristic features of this experiential and relational activity render the sport product a unique, singular, and unrepeatable reality. Sport generates, both for those who practice it and those who follow it as spectators, personal relationships (with other practitioners and followers) producing a special kind of relational good, which is deemed part of individual social capital (Gui, 2000; Gui, and Sugden, 2005; Pena, Sánchez Santos, and Membiela, 2013; Zamagni, 2004). From the experiential point of view (Pine, and Gilmore, 1998), provided that individuals experience sporting products or services in a more emotional and sensitive way, new expectations of future repeated experiences are generated. In short, there is a growing number of people interested in the phenomenon of sport, which calls for a review of the traditional concept of passive sportsman/woman (attributed to spectators). The economic relevance of participating in a sporting event (as practitioner and/or spectator) seems to be beyond doubt, and will therefore be considered a significant element in the study of sport as economic sector and the measurement of the impact generated by sporting events.

III. MEASURING THE WEIGHT OF SPORT AS ECONOMIC SECTOR

1. Differences Between Economic Weight and Economic Impact

Measuring the relevance of the sports sector in economy implies a previous definition of what is exactly to be measured, whether its economic weight or

[4] *EU Working Group on Sport and Economics agreement.* Vilnius, Lithuania, 2007.

its economic impact, for both elements are similar but show differences. The weight of sport considered as economic sector may be conceived, according to the Vilnius definition, as the economic value of all activities directly or indirectly related to sporting activities. Thus, studies on economic weight focus on estimating the main economic aggregates of the sector (production, added value, intermediate consumption, occupation) from a supply-side perspective, or else the expenditure on sport of families, companies and institutions from a demand-side perspective.

The economic impact of sport is a broader concept referring to the expansion effects promoted by this sector in the global economic fabric (Bosch, García, and Murillo, 2018). It is therefore obvious that, in order to appraise impact, an economic model is required in which sector performance and its links with all other sectors are properly represented. Economic impact is usually estimated when appraising relevant and far-reaching sporting events. Findings are also usually expressed in terms of the same aggregates estimated for measuring the economic weight of the sector.

2. Conceptual and Methodological Framework

There are two approaches to measure the economic weight of sport, that is, to estimate its economic aggregates. The first one, after previous identification of producers and economic agents associated with the sports sector, consists in assessing individual production accounts and then aggregating them to obtain the total of the sector (bottom-up). The second approach consists in creating a satellite account enabling the fit of macroeconomic data from the sports sector with the information on general economic accounts (from top to bottom).

Methodologically, when adopting the first approach and from a supply-side perspective, the first task consists in delimiting and classifying the activities associated with this sector, as well as in identifying characteristic and related producers, according to the Vilnius definition of sport as economic sector.

When classifying sports producers, the first distinction to be made is that between private and public sectors. Among private producers, profit-seeking market agents must be distinguished from private non-profit (PNP) institutions. In turn, profit-seeking agents may be classified in legal persons (business societies), natural persons, and other eventual agents, such as sports-related media, sports private schools, or private universities offering sports-related courses or services. On the other hand, PNP organizations include sporting clubs and federations.

As for public producers, a variety of institutions provide sporting goods and services for citizens: government agencies and institutes, local and regional administrations, universities, and non-university sports education centers. It should be noted that some media operating in radio and television markets might also be public producers.

Activities selection is the first methodological stage for the estimation of sporting activities production accounts. The following four estimation stages would be: production, Gross Value Added (GVA), taxes, and Gross Domestic Product (GDP) estimation. From the profit and loss accounts (income and expenditure statements) of each producer, data corresponding to the accounting concepts included in Table 1 (Secretaria General de l'Esport, 2010) may be elicited.

Availability of these data may be direct (census) or the result of an estimate, which is made when a sample is required to approximate a census that cannot be directly observed. The "Income" column includes the total production of a producer from a microeconomic perspective, and is derived from the sum of expenditure items (a), (b), and (c) following the usual accounting criterion according to which operating surplus corresponds to the income and expenditure adjustment item. The "Income" item therefore includes the economic estimate of the total production of sports producers, whereas the "Added value" column shows its net contribution to production. The total amount is used to measure the relative weight of the sports sector over total GVA. To estimate the GVA of different sports producers, definitions and concepts of economic aggregates adopted for national accounting may be used. Production and GVA valuation of

TABLE 1

INCOME AND EXPENDITURE

	Wages (a)	*Surplus (b)*	*Added value (a)+(b)*	*Intermediate Consumption (c)*	*Income (a)+(b)+(c)*
Private sector	...	...	...	...	...
Producer 1	...	...	...	...	...
Producer 2	...	...	...	...	...
...	...	...	...	...	...
Private Sum	...	...	...	...	...
Public sector	...	...	...	...	...
Producer 3	...	...	...	...	...
Producer 4	...	...	...	...	...
...	...	...	...	...	...
Public Sum	...	...	...	...	...

all sports producers is based on this general methodological framework, though there may be certain methodological particularities, due to available databases, practical difficulties in access to information, and accounting estimation and approximation procedures.

Another aspect of the relevance of sport in economy is its contribution to occupation. Provided ideal data availability, it is possible to measure the amount of employment generated by sports producers, both private and public. A significant peculiarity of the sports sector lies in its capacity to attract volunteers performing support and promotion tasks; these jobs are not remunerated at market prices.

Estimates from a demand-side perspective involve measuring the final spending on sport by economic agents (consumption by families, companies, PNP organizations, and public administrations), gross capital formation, and exports. This perspective implies greater difficulties for isolating the part pertaining to the sports sector within the different macro-magnitudes; availability of a specific survey of families on sport habits and consumption, or of statistics on foreign trade in goods and balance of payments for services is therefore needed. In any case, without diminishing the importance of the demand-side perspective, measurement of the net contribution of sport as economic sector should be based on the value added by the sector to the productive process, that is to say, on the analysis of its output supply.

If, on the other hand, the satellite account approach is adopted, methodological approximation will be different, since it takes account of how the analyzed sector, that of sport in our case, fits with all other sectors considered in national accounts. It should be noted that satellite account systems are implemented for sectors that do not correspond to a specific, statistically defined economic activity. That is to say, a satellite account is, from a statistical perspective, a robust framework to measure the economic importance of a sector like that of sports in a national economy. A sport satellite account system identifies all sport-related activities included in a national account to enter them in a separate account (the satellite account), though preserving the structure and aggregated sums of national accounts. Without a satellite account, sport-related economic activities would go undetected among broader categories of national accounts, like, for instance, sports clothing within the general clothing category.

Satellite accounts are usually based on two different but complementary accounting elements: supply and use tables, and input-output tables. The former tables are easier to elaborate, but only input-output tables allow for estimation of indirect and induced effects, since they are more advanced and developed on the basis of supply and use tables, which may be combined to create symmetrical input-output tables. Thus, we will now focus on the steps to be followed in order to create a sport satellite account from an input-output table.

To clearly identify the place of sport in economy, the input-output table must be enlarged. Each sector including sporting activities is divided in two parts: the non-sport part, which remains unchanged, and the sport part, which is entered in its own row and column, and whose values are drawn from the original ones, so that totals remain invariable.

The first step consists in finding or calculating sport-related values for the main macro-magnitudes: employment, added value, production, intermediate consumption, final consumption, imports and exports. Elicitation of these data is the most complicated aspect when developing a sport satellite account, being advisable to proceed, as in the previous approach, on the basis of census information, indirect information, estimated and/or ad hoc elaborated data.

3. Empirical Evidence

We will now exemplify both methodological approaches through a selection of some recent findings relevant for the study of the sports sector from an economic point of view.[5] Among the studies consulted, those focusing on Andalusia (Analistas Económicos de Andalucía, 2015), Catalonia (Bosch, García and Murillo, 2015), and the province of Barcelona (Bosch, García and Murillo, 2017) are noteworthy.

The study on Andalusia is divided into three distinct parts: analysis of sporting goods and services supply; demand analysis, intended to estimate private expenditure on sport; and analysis of the impact of expenditure on sport on regional economy as a whole. From a supply-side perspective, the weight of sport GVA over the total amounted to 1.12% in Andalusia in 2014, and workers employed in the sector represented a 1.71% of total employment. From a demand-side perspective (private expenditure), the weight over GDP raised up to 3.1%, whereas, regarding impact, contribution of private expenditure on sport to Andalusian economy represented a 3.5% of regional production and a 1.9% of employment. This study is a good example of how different perspectives may produce different results, since, as the authors themselves point out, different

[5] A detailed review of the pioneering studies, both international and focused on Spain or any of its autonomous communities, may be consulted in Bosch *et al.* (2009: 4-6).

economic realities are measured from each different perspective, and different methods are adopted.

The studies on Catalonia and Barcelona are carried out from a supply-side perspective, and are updates to two previous studies (Secretaria General de l'Esport, 2010; Bosch *et al.,* 2009). The weight of the sports sector GVA over Catalonian GVA was 1.2% in 2013, and that of employment amounted to 2.5%, whereas findings for the province of Barcelona from that same year are 1.3% over GVA and 2.2% over occupation.

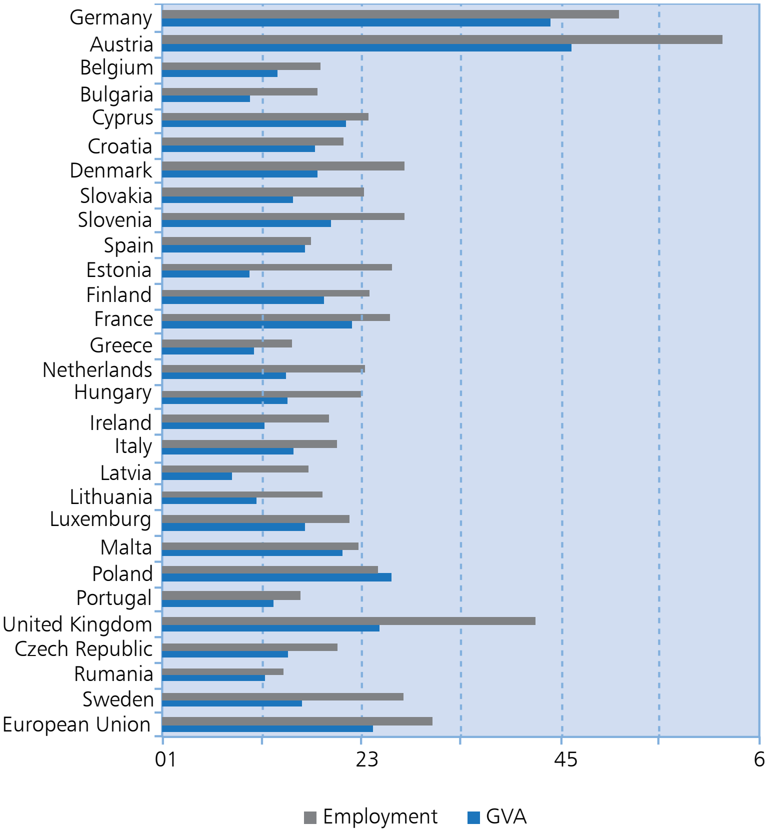
In any case, the optimal way to evaluate the weight of a sector like that of sport is to elaborate a satellite account (second approach) including all necessary accounting information. Examples of sport satellite accounts are to be found in various European countries, such as the United Kingdom (Semens, Brookfield and Bridgewater, 2015) or the Netherlands (Statistics Netherlands, 2012), among others, as well as for the whole EU in the studies by SpEA (2012) and Spea and Sheffield Hallam University (2018), promoted by the European Commission. These latter studies have filled a gap in the assessement of sport as economic sector, having quantified its weight in all European Union (EU) countries following the same methodology. A specific adaptation of member states national accounting is used, as well as data on intra-Community trade, to compose a multiregional input-output table for the sports sector based on the 27 input-output tables for sport from the 27 EU countries. This means that findings are consistent with national accounts on the one hand, and with intra-Community trade on the other hand.

Figure 1 shows 2012 data on the weight of sport in GVA and employment in EU countries (SpEA and Sheffield Hallam University, 2018).

Germany and Austria are the European countries where sport has greater importance in economy, their sport sectors representing close to 4% of GDP, and 4.6% and 5.5% of employment, respectively. On the contrary, Baltic countries, together with Bulgaria, show the lowest weight of sport, since its percentage over GDP is below 1%. Findings from Spain are 1.44% over GDP and 1.5% over employment, figures below EU average, which are 2.12% over GDP and 2.72% over employment. Be as it may, it should be noted that the relevance of sport in Spanish economy has been increasing from 2005 on, reference year for the preceding study, when the weight of sport as a percentage of GDP amounted to 0.9%, and to 1.33% with respect to total employment. That year, European average weight was 1.13% over GDP and 2.12% over employment.

FIGURE 1

IMPORTANCE OF SPORT IN ECONOMY (2012)



Source: SpEA and Sheffield Hallam University (2018).

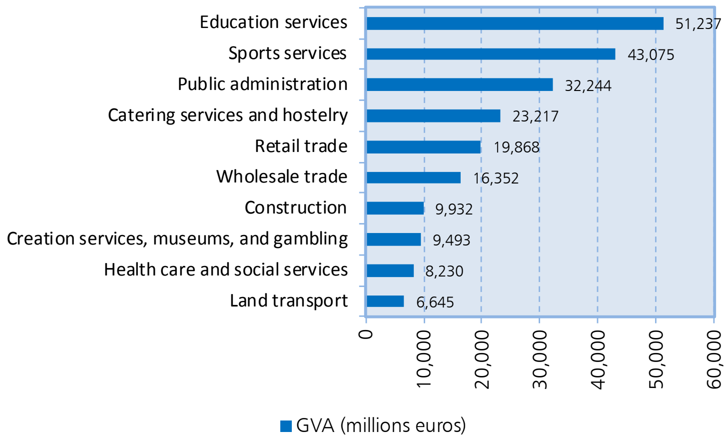
It is important to underline distribution of total sport GVA among the different sectors that compose it. For EU countries as a whole, and also for Spain (Figures 2 and 3), education services are the most relevant sport subsector, showing a weight of 0.4% as a percentage of total GDP in both cases. In the EU, the second most important sub-sector is that of sports services, whereas in Spain it ranks third, just below creation services, museums and gambling (SpEA, and Sheffield Hallam University, 2018).

4. Methodological Problems

Once the conceptual framework for study of the economic weight of sport has been defined, both on the basis of production analysis and satellite

FIGURE 2

SPORT GVA BY SECTORS (BROAD DEFINITION): EUROPEAN UNION

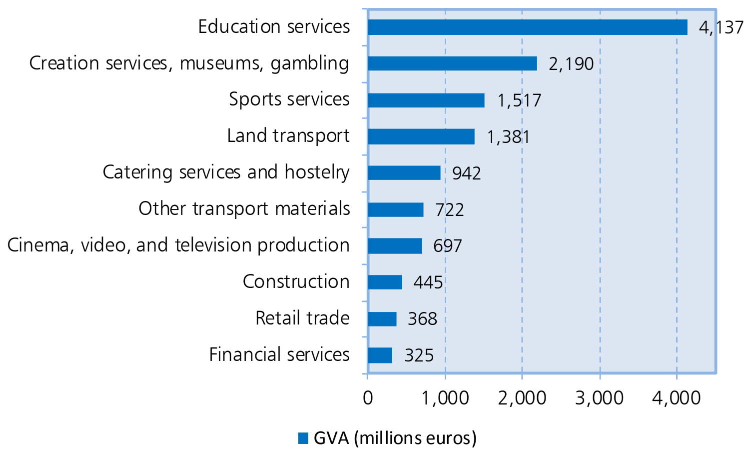


Source: Collected by authors based on SpEA and Sheffield Hallam University (2018).

account elaboration, many difficulties usually need to be overcome in order to render estimates operative. Non-exhaustive examples include: absence of data or incomplete data; productive sectors where it is difficult, if not impossible, to

FIGURE 3

SPORT GVA BY SECTORS (BROAD DEFINITION): SPAIN



Source: Collected by authors based on SpEA and Sheffield Hallam University (2018).

distinguish activities producing sporting goods and services; unavailability of census data and need to design surveys; difficulties in delimiting the territorial framework of some activities producing goods and services (imports and exports), etc.

This sort of problems is not at all exclusive of the sports sector, but common when analyzing the economic activity of any sector showing a multisectoral nature and thus not included in any standard category of national accounting. In such cases, the task of researchers consists in minimizing divergences between conceptual framework requirements and the inevitable limitations of available information. On a systematic work basis, difficulties need to be explicitly stated and solutions proposed in order to quantitatively determine margins of error, or, failing this, to qualitatively identify limitations affecting findings.

IV. MEASURING THE IMPACT OF SPORTING EVENTS

1. Typology of Sporting Events

Measuring the impact of a sporting event on a territory requires previous knowledge of the event characteristics and the context in which it is going to be held. Conditions surrounding the event affect the degree of economic and social impact on the area. Furthermore, each sporting event shows specificities that need to be identified and considered for an impact analysis. Events may be classified according to: frequency (regular, irregular, unique) (Gratton, Dobson and Shibli, 2000; Wilson, 2006); geographic scope (international, national, local); media attention (high or low); and activity generation (reduced or significant). Therefore, the impact of a sporting event and the kind of analysis technique used to measure it depend on the type of event and its environment.

2. Conceptual and Methodological Framework

The primary methods adopted to measure the impact of sporting events are: general balance models, the input-output method, and cost-benefit analysis (Barajas, Salgado and Sánchez, 2012).

Approximation based on general balance is a model using a set of equations relative to production, consumption, and foreign, private, and public trade. Four kinds of equations are employed in this method (Blake *et al.,* 2001): production equations; demand equations; income and expenditure equality equations; and supply-demand equations, guaranteeing market balance. These models are deemed appropriate for major events at national or international scale, entailing high media attention and high activity generation.

Input-output tables record intersectoral or intermediate transaction flows in a given region or country for a specific year, as well as the different final demand vectors and primary inputs. From this statistical information it is possible to develop an economic input-output model in which global variations in the economic activity of productive sectors are explained on the basis of final demand variations, and which shows a distinctive feature: sector interdependences allow to compute the cross effect of changes in the final demand of goods or services provided by a sector on the global activity index of all other sectors. Change due, for instance, to the celebration of a sporting event.

The key benefit of input-output analysis lies in its ability to measure the effect of productive interdependence between sectors, and to distinguish between indirect and direct impact. Direct impact measures the effect on the activity of a sector compelled in the first place to adjust production in order to satisfy the new levels of the final demand. Indirect impact measures, for its part, production levels adjustments in all sectors as a response to new inputs demands, that must be considered to adjust the production level of the sector on which the new final demand originally falls. Given that each input providing sector requires in turn inputs from all other sectors, indirect impact records sequential adjustment in all sectors, intended to mutually meet their input needs as a response to changes in final demand generated by a sporting event. This method is especially suitable for high-level, regularly celebrated, long duration events. Although input-output tables are also often used to predict the economic impact of short duration sporting events, Porter and Fletcher (2008) show that, for this kind of events, the model produces results far from reality and inflating the actual profits obtained. The model provides accurate results closer to reality when used to analyze events whose supply curve is perfectly elastic, a situation associated with a lasting final demand that is unusual in short duration sporting events.

Finally, cost-benefit analysis (CBA) is a tool intended to assess public policies and investment projects from a social needs perspective, thus enabling to establish priorities when it comes to decision-making (Baade and Matheson, 2002; De Rus, 2010; Policy, 2014; Raya and Moreno-Torres, 2013). CBA consists in quantifying in monetary terms the costs and benefits that a given action (in our case, a sporting event) entails for society as a whole, therefore allowing direct comparison between results and costs on the basis of the program net value. Its main disadvantage lies in the difficulties found to express all significant effects of an action, such as the celebration of a sporting event, in monetary terms.

In economy, a social benefit is anything that contributes to increasing the welfare of people, whereas a social cost is anything contributing to reduce it. Therefore, the cost or benefit of an event not only lies in monetary loss or profit, but in every element improving or reducing welfare, defined on the basis of individual preferences for a given income distribution. Accordingly, a cost-benefit economic assessment must adopt a social perspective, as aforementioned. Costs are estimated according to the cost opportunity concept, whereas benefits include consumer surplus (usually estimated from willingness to pay) and the event value as public good. In order to value non-market goods by creating a hypothetical market, the Contingency Valuation Method (CVM) is usually adopted, which consists in observing the reaction of an individual to hypothetical (contingent) change in prices or quantities of goods and services. It is therefore a complementary tool enabling to ascertain the spectator's willingness to pay for event attendance, or that of residents for the construction of a new sports facility. In practice, cost-benefit analysis is suitable for studying the economic impact of virtually any sort of sporting event. However, its results are better observed in the long run, being thus more effective for events periodically celebrated along a season. This method is also useful to assess public spending policies, and therefore suitable for events with public funding.

3. Empirical Evidence

Models based on an input-output framework are by far the most commonly used approaches, especially for major events (mega-events) such as Olympic Games or football World Championships. Two good examples of this meta-analysis in literature can be found in Matheson (2006), and Maening and Zimbalist (2012). For its part, the work by Porter and Fletcher (2008) is a remarkable example of the studies comparing ex-ante and ex-post analyses. Recently, focus has been shifted towards minor events, for instance: a minor baseball league (Agha and Rasher, 2016); a college hockey championship (Veltri, Miller and Harris, 2009); college football (Coates and Depken, 2011); or an all-American junior athletics championship (Taks *et al.,* 2011). In Spain, some examples are: Valencia Marathon (Maudos *et al.,* 2016); football clubs (Aza *et al.,* 2007); tennis Davis Cup (Rodríguez and Baños, 2013); Skating World Championship (Baños, Pujol and Rodríguez, 2012); a race of Moto GP World Championship (Martí and Puertas, 2012); or Figure Skating World Championship (Murillo *et al.,* 2016).

Studies addressing the impact of a sporting event by means of cost-benefit analyses are scarce in literature. Some remarkable examples are those focusing on winter Olympic Games, both in Canada and Utah (Shaffer, Greer and Mauboules, 2003; Baade, Baumann and Matheson, 2008); the Melbourne Formula 1 Grand Prix (Economists at large, 2013); Seville Women Tennis Championship (Ramírez Hurtado, Ordaz and Rueda, 2007); the all-American Junior Athletics Championship (Taks *et al.,* 2011); and Cáceres Paddle Tournament (Jiménez-Naranjo *et al.,* 2016). As for macroeconomic models, Andersson, Armbrecht and Lundberg (2008) compare all three methods on the basis of different empirical studies of sporting events. Brückner and Pappa (2015) use a macroeconomic model to show the effects of being a candidate country or actually hosting the Olympic Games. Last but not least, Fourie and Santana-Gallego (2011) adopt a gravity model to estimate the touristic impact of various mega-events, such as world cups or Olympic Games.

4. Methodological Problems

Broadly speaking, the impact analysis of an event requires obtaining information not always available for analysts or researchers. For instance, there may be problems to obtain disaggregated data from items corresponding to sport in input-output tables. Likewise, necessary information to carry out a cost-benefit analysis may be difficult to obtain. For either analysis, surveys providing a great amount of information on participants and spectators of a sporting event are usually conducted. The major drawback is that these are expensive and laborious methods, which, furthermore, are always subject to sampling errors.

Among the aforementioned methods, economic impact analysis based on input-output tables is the most criticized. Taks *et al.* (2011) underscore that many criticisms refer to the use of inadequate and inflated impact multipliers, as Matheson (2009) also points out, as well as to the fact of disregarding negative effects, as stated by Barget and Gouguet (2010). Thus, besides overestimating net benefits for towns hosting sporting events, social benefits and costs in terms of welfare for resident population are excluded from estimates (Crompton, 2006). Specifically, Matheson (2006) points out that, if substitution, crowding-out, and leakage effects are not considered when conducting impact studies, positive but unreal findings will be obtained. The substitution effect occurs when expenditure on the hosting town is not autonomous, that is, when the estimated amount would have been equally spent even if the event had not been celebrated. Such expenditure corresponds to local attendees, time-switchers (people who already intended to visit the town, and simply change dates to attend the event), or incidental attendees (people who were already visiting the hosting town and attend the event instead of choosing another activity in the area). For its part, the crowding-out effect refers to the potential spending displaced on account of an event: celebration of a sporting event may –for instance– deter tourists who were planning to visit but prefer to avoid crowds. Finally, leakages occur when direct revenue generation in town does not have an effect on local economy in terms of income, since local entrepreneurs and workers obtain no benefit. Crompton (2006) details the most common errors in the economic impact analysis of events.

V. CONCLUSIONS AND RECOMMENDATIONS

As aforementioned, sport has a significant social aspect, both due to the high media impact of major sports events and the involvement of citizens in sporting activities, which helps in establishing relationships, channels confrontation needs, stimulates creativity, and may contribute to improve the social climate and favor social integration. It is important to acknowledge the social relevance of sport, for it has economic implications insofar as sports sector activities foster goods and services production, income distribution and job creation.

In the present chapter, we have first defined sport as an economic sector, and subsequently presented the most common methods used to measure both the sector as a whole and the impact of major sporting events. We have also provided some examples of application of such methods, a reference that might be useful for researchers interested on the subject. Finally, we have set forth some of the problems that researchers might face when undertaking the task of assessing the economic weight of sport, or else of analyzing the economic impact of sporting events.

Accordingly, we now present key recommendations for carrying out a study of the kind described. In the case of studies on economic weight, the following considerations should be bore in mind:

- Address major sectors first, whose information is easier to elicit, and which usually include between 50% and 75% of the sport-related economic activity.

- Focus on key products first, such as tourism, health, education, sports betting, trade, infrastructures, public administration, etc.

- Use very detailed data on production and imports, as well as family consumption surveys, which are usually available in national statistics offices.

- Use information elicited from experts or indirect information.
- Handel available statistics on education to estimate the share of sport.
- Identify, for instance, 10 major companies in the sports sectors, and subsequently derive the share of sport on the basis of data from those companies.
- Proceed bearing in mind that, frequently, the share of sport in imports is equal to the share of sport in final consumption.
- Proceed bearing in mind that the weight of sport in GVA is approximately the same as the weight of sport in production.
- Take account of the following identity: *Production* + *Imports* = *Consumption* + *Exports.*

When conducting impact analysis of a sporting event, the following recommendations, among others, should be considered:

- Follow Crompton (2006): exclude local residents, time-switchers, and incidental attendees (in all cases, their spending would have occurred anyway); exclude crowding-out and leakage effects; consider income instead of sales; carefully interpret employment measurements (Have new jobs really been created, or it is the same workers doing extra hours? What kind of new employment has been generated? Are workers indeed from the hosting town?); and adequately define multipliers.

Mind the importance of monitoring the event effects over time (Kokolakakis, Lera-López and Ramchandani, 2018). To grasp the social and economic benefits generated by an event in a hosting town in the long term, extended monitoring over time is required. For instance, a study of the economic impact of a sporting event celebration should consider that tourism increase is one of the most important effects generated by the event. It is highly likely that it has attracted new tourists, or built customer loyalty among previously incidental tourists. But impact may only be thoroughly measured by monitoring tourism over time in the hosting town. And the same may be said of event effects on the sporting involvement of residents. A sporting habits time series is required to obtain the net impact of an event on changes in sporting habits of residents. Notwithstanding, Coalter (2007) illustrates the complexity of such an estimate.

Ideally, at least one ex-ante and one ex-post impact analysis of each event should be carried out (Scandizzo and Pierleoni, 2018).

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PUBLIC SECTOR AND PROFESSIONAL SPORT

Pablo CASTELLANOS-GARCÍA

José Manuel SÁNCHEZ-SANTOS

Abstract[1]

This paper deals with some of the most relevant aspects of the relationship between the public sector and professional sport. First, we basically focus on the assessment of arguments providing the rationale for public subsidies to professional sport both in terms of efficiency and equity. In the second part of this study, we focus on the analysis of the degree to which residents in a given urban environment consume the public goods generated by the local club, and on how such consumption might in turn affect the well-being of both fans and other residents. In order to provide empirical evidence on these issues, we use, on the one hand, data from two surveys carried out specifically for the case of RCD de La Coruña, and, on the other hand, results from the Centro de Investigaciones Sociológicas (*i.e.* Center for Sociological Research) barometer on the sporting habits of Spaniards.

Keywords: public subsidies, sport economics, externalities, public goods, professional sport.

JEL classification: L83, Z21, Z28.

[1] Article translated from the Spanish by Ciro Arbós.

I. INTRODUCTION

Professional sport has been gradually transformed into a spectacle whose production is governed by economic or business logic, having thus become established as an entertainment industry facing the same problems as any other industry, its own peculiarities notwithstanding (Neale, 1964). Such specificities include both the product supplied by this industry and the nature of competition between producing companies; some of them are worthy of consideration when addressing the relationship between the public sector and professional sport, and, particularly, the rationale for public intervention in the sector (Baade, 2003).

One of the reasons given to theoretically justify public intervention in economy is the existence of market failures. In the case of professional sport, these failures would be associated with externalities and public goods generated by sport, for instance, a local professional club, the construction of sporting facilities for professional use, or the organization of a major sporting event.

Although a sporting club may well be considered a firm whose output is the spectacle offered in a game, it should nevertheless be acknowledged that it does not only provide the entertainment enjoyed by those who pay for attendance (private good), but also a number of by-products associated with the sporting event entailing obvious positive externalities for the well-being of residents in the hometown of the club. Given that such by-products are available for consumption by all citizens, who may benefit from them at no cost, and that consumption is not subject to rivalry nor possible exclusion, we are evidently dealing with a kind of goods which may be characterized as public goods.

The public good features present in sport can be appraised by analyzing certain behavior– and attitude-related issues: following games broadcasted free-to-air by radio and TV; presence of sport in everyday conversations; reading club-related press articles; emotional involvement (interest) of fans with their favorite club; effects of wins and losses on the mood of people; participation in collective celebrations; effects on the image and prestige of the town; perceptions on how it affects quality of life, etc. Several authors have discussed the supposed benefits of having a hometown professional club for the community, suggesting that the value of indirect and intangible benefits is probably higher than that of tangible benefits brought by the club (Owen, 2006; Noll and Zimbalist, 1997).

In this regard, it should be stressed that, when a town has a local club with outstanding track record in a sport of certain economic and social relevance, that club usually plays an important role in the lives of citizens, even if most of them do not attend matches played by the team. Consider, for example, the contribution of a club and its sporting successes to improve the external projection of its hometown, or to the strengthening of community spirit and a sense of local-regional identity (civic pride). This positive consumption externalities produced through generation of pride in belonging to a community and being fan of its club, even if intangible, have undeniable value.

But beyond identification of externalities, the key issue to be solved is the magnitude of such benefits, for quantification of their value objectively involves serious difficulties and is subject to substantial uncertainties. Although it is difficult to give a precise answer to this question, it is an essential step in rigorously addressing the role of the public sector in professional sport, and, more specifically, in evaluating the rationale for public policies affecting the sports sector.

In the present study, we limit our analysis to public interventions consisting in the use of public resources to support professional sport. Such support takes different forms, but, in practice, it usually translates into direct or indirect financing of construction or remodeling of sporting facilities, sports clubs, organization of major sporting events, and other financial aids contributing to support professional clubs.

In this sense, a number of questions not free from controversy arise in both the academic and public policies management spheres. Noteworthy questions include whether public investment in professional sport fosters local economic development, or whether benefits from attending games obtained by supporters or other residents are sufficient to justify public subsidies (Siegfried and Zimbalist, 2000). In practice, one of the most commonly used arguments, basically by policy makers and business representatives, is contribution of professional clubs to the development of local economy. But, in fact, the empirical evidence available does not support this argument (Coates and Humphreys, 2008). However, even if accepting consensus on the insignificant effects on income and employment, local governments can find reason for investing public funds in professional sport by arguing that stadiums and professional clubs produce consumption externalities and public goods for local residents (Coates, 2007).

From the perspective of public policies management, the relevant question is whether a professional club generates enough benefits, both monetary (tangible) and non-monetary (intangible), as to justify public expenditure on the construction, refurbishment or remodeling of a stadium. Thus, identification of public good attributes in certain by-products associated with professional clubs and progress in quantification of their externalities are matters of undeniable interest for both club owners and elected representatives or local administration officials (positive externality, public good, social benefit, and intangible benefit are terms often used interchangeably in the sports sector). If the amount of such benefits for a given community is near to or exceeds the value of public aids, they would be somewhat justified, provided that they are necessary to ensure the viability and survival of a professional club.

Therefore, it is of interest to verify the extent to which residents in a given geographic area consume the public goods generated by a club, and how such goods might in turn affect the well-being of both fans and all other residents. In order to shed some light on these questions, we conduct a review of the scholarly literature addressing the externalities and public goods generated by professional sport (section II), the methodological challenges posed by quantification of such intangible benefits (section III), as well as other aspects to be considered in the framework of public subsidies to professional sport (section IV). Furthermore, in section V we provide empirical evidence on public goods consumption and its role in subjective well-being and quality of life for a specific sport variety (football), country (Spain), town (A Coruña), and club (RCD de La Coruña). Finally, key conclusions are summarized.

II. PUBLIC SUBSIDIES TO PROFESSIONAL SPORT: A REVIEW OF LITERATURE

An argument often used to justify public subsidies to professional sport is the economic impact generated by the construction of sporting facilities (stadiums), the organization of major sporting events, or the existence of professional clubs in a given town. Such impact would translate into tangible benefits related to labor market (employment creation) and income increase, and, ultimately, into increased tax collection. There exists abundant scholarly literature where such effects are examined (Baim, 1994; Rosentraub *et al.,* 1994; Baade, 1996; Zimmerman, 1997; Coates and Humphreys, 2003 and 2008; Rappaport and Wilkerson, 2001; Siegfried and Zimbalist, 2006; Agha, 2013). Evidence from practically all studies does not allow to conclude the existence of a significant economic impact of the aforementioned professional sport-related aspects on local economic development.

Authors like Rosentraub (2009) examine a somewhat different rationale for the allocation of public resources to the construction of sporting facilities for professional use. Specifically, this author highlights the role that such facilities might play in the revitalization of certain urban areas in some towns, a role greatly determined by the fact that these facilities offer a very specific entertainment service (which would not be otherwise available for local population).

More recently, Humphreys and Zhou (2015) developed a spatial model for production and services consumption enabling to analyze the impact of sporting facilities for professional use on urban development and local welfare in the presence of agglomeration effects. The authors formally model the main specific features of professional sports, and examine how public intervention, provided that it contributes to the viability of a professional club through the construction of a sporting facility, affects global welfare in a given town, as well as spatial distribution of such welfare.

The authors develop their line of argument on the basis of considering professional sport as one of the entertainment services with greater visibility and social impact in industrialized countries. To watch live top-level professional sports games (as is the case of the four major professional leagues in the United States) is reserved for a limited number of towns (almost exclusively for bigger towns). Moreover, attending professional sports events may be considered a good having a low degree of substitutability by other entertainment goods and services supplied by the market. This feature mainly owes to the fact that it is a so-called "experience good", satisfaction thus deriving from joint consumption with other fans. In fact, some towns base part of their civic identity on the existence of a local professional club participating in top-level competitions. In this context, to have a sporting facility for professional use nearby enables access to a kind of entertainment with special characteristics implying a great potential for the promotion of urban development in the town where such facilities are built.

In short, the Humphreys and Zhou model (2015) provides a framework for evaluating the role played by sporting infrastructures as urban development tools, and helps understand why local administrations continue to provide public funds for the construction of facilities in the United States, despite the lack of evidence of significant tangible effects on economy.

Although the aforementioned tangible effects are not such as to justify public subsidies to professional sport, another existing line of argument needs to be considered in order to appraise the possible economic rationality of such aids. That argument is based on the fact that clubs and the sporting facilities where teams play their games improve quality of life in a community (Siegfried and Zimbalist, 2000 and 2006). Conceptually, effects on quality of life can be assessed according to three types of benefit: consumer surplus, externalities, and public goods.

Consumer surplus is generated when consumers, in this case attendees to a live sporting event, are willing to pay a price higher than its actual market value for an entrance fee. Such difference between the willingness to pay and the price actually paid would result in a private benefit (it would improve consumer well-being) (Santo, 2007). From this point of view, the rationale for state aids is based on the fact that, due to the high fixed costs of construction and the impossibility for private companies to obtain the total of consumer surplus through perfect price discrimination, those companies might consider this kind of infrastructures as unprofitable, even if they are socially profitable (Layson, 2005). From this perspective, and in the absence of positive externalities, for a stadium to be socially profitable the discounted value of the sum of consumer surplus and revenue generated by the infrastructure must exceed the current value of facility costs (construction and maintenance costs).

Besides the benefits captured by consumer surplus, a professional club might generate externalities on consumption for local residents even if they do not attend games. In this regard, there is broad consensus on the existence of positive externalities (Siegfired and Zimbalist, 2000). For instance, residents might follow their team by reading press articles or watching matches on television without the need to attend live games. A local club provides a subject for conversation with colleagues, family, friends, neighbors, and even strangers; besides the satisfaction produced by such conversations, these favor social relationships and might play an important role as a social inclusion and cohesion factor (Boardman and Hargreaves-Heap, 1999). On the other hand, a great number of fans of a particular sport intensely follow the games played by their local team, and participate in collective celebrations of its sporting successes. Moreover, positive externalities in terms of civic pride, collective identity, the town's external image, and even quality of life, should be added.

Indeed, residents in some towns with professional clubs that achieve success in a given sport entailing widespread social impact share the view that such clubs grant a privileged status as a "first division" town. An enhanced image of the town is furthermore a form of free advertising and, more generally, affects subjective well-being (happiness) as perceived by individuals themselves (Rappaport and Wilkerson, 2001).

A professional club participating in the league of a highly popular sport enjoys media attention both at the national and the international level. This media repercussion is a factor contributing to identify a club with a town. In many cases, such identification leads to a positive association club-town which might help certain towns, especially middle-sized, enjoy an acknowledgement and distinction they would hardly achieve by other means. It is not without a reason that there is a limited number of clubs participating in a professional league, which in practice implies that there are more towns willing to have a hometown club than those having fulfilled that wish. In such a context, the fact of having a club while other towns are in lack of it is something to be proud of, since a hometown club is a distinctive entertainment option. In other words, a professional sport club may be considered a specific geographical and cultural feature at the local level, which offers an alternative leisure option contributing to make the town a more attractive place to live in (Siegfried and Zimbalist, 2006).

In this regard, the social anchor theory (SAT) provides a conceptual framework enabling to show how a professional club can be considered an institution rooted in a community, which links residents with the community and, ultimately, provides a mechanism generating social identity and capital (Clopton and Finch, 2011). According to this theory, in every community there are social institutions which function as a sort of anchor point for the establishment and development of social networks. These institutions contribute to the creation and development of social capital, since they provide a linkage for community members, and thus a sort of collective identity or singularity. It is in this sense that Alonso and O'Shea (2012) use that theory to illustrate how professional sport organizations are an example of social anchor, given their impact on community identity and the creation and development of social networks.

To some extent, all these by-products could be fitted within the psychic income paradigm developed by Crompton (2004). According to this author, psychic income includes various factors, such as community pride associated with growing visibility; civic pride of belonging to a community which has a club participating in a top-level competition; improvement of collective self-esteem; and emotional involvement of residents with the club. Several authors show that investment in top-level sport generates returns in terms of psychic income for local residents (Seifried and Clopton, 2013; Oja, Wear and Clopton, 2018).

Among externalities associated with professional clubs, the so-called demonstration effect should also be included. Authors like Mutter and Pawlowski (2014) have analyzed the impact of professional sport on frequency of sports practice. Their findings reveal positive externalities of professional sports in Germany. Earlier, Grix and Carmichael (2012) had already underscored that successes of both players and professional teams, besides enhancing the external image and strengthening national identity, also foster participation in mass sports. The positive impact of professional sport on active sporting participation contributes to improving aspects as relevant as productivity or the health of the population.

A common denominator of this kind of by-products associated with professional sport is the absence of consumption-related rivalry and possible exclusion, since all residents benefit from them (not only fans attending games at the stadium), that is, they are available for all members of a community with a professional club, who may enjoy them at no cost. In short, no value of the intangible benefits identified in this section is recorded in a market transaction, and there is no return for the club which generates them through the traditional revenue streams. Hence their classification as public goods, whose production by the private sector would be sub-optimal from a social perspective. Thus, monetary quantification of these positive externalities could provide an argument to be considered when justifying the use of public funds for the promotion of professional sport. Apparently, a cost-benefit analysis of this nature should take account of clubs generating negative externalities as well, such as traffic, noise, pollution, or violence of hooligans, which might even reduce the quality of life of those who are not consumers of the sporting product.

III. VALUATION OF INTANGIBLE BENEFITS ASSOCIATED WITH PROFESSIONAL SPORT: METHODOLOGICAL ASPECTS

In order to make progress in solving the problem of estimating the value of intangible benefits associated with professional sport, economists have basically used three different methods: demand curve analysis (consumer surplus), compensating differentials analysis (hedonic price method), and contingent valuation analysis (contingent valuation method).

The first method works on the assumption that stadiums and sporting facilities for professional use generate benefits in terms of consumer surplus, inasmuch as they provide unique (singular) forms of entertainment which would not be otherwise available for residents in a given geographical area. Quantification of these benefits in monetary terms would offer a first approximation to the social benefits deriving from this type of projects.

To that effect, a relevant issue is the sensitivity of consumer surplus estimates to assumptions on the absolute value of price and income elasticities of demand (Layson, 2005). On the one hand, the lower the price elasticity of demand, the higher the consumer surplus. On the other hand, the higher the income elasticity of demand, the higher the aggregate surplus and its uneven distribution among households. Therefore, if demand of attendance at live sporting events is inelastic (that is to say, if fans identify themselves with the club and are devoted supporters), the value of consumer surplus could be substantial.

As for empirical evidence available on this regard, Irani (1997) estimated consumer surplus associated with Major League Baseball (MLB) game attendance using data on ticket prices and attendance for the 1972-1991 period. Estimates of consumer surplus aggregate value fall between 2.2 and 54.1 million dollars per season. More recently, Alexander, Kern and Neill (2000) estimated consumer surplus for all four major professional sports in the United States, concluding that values obtained are too low to justify the public subsidies received by some major franchises.

In order to approximate the values that individuals place on public goods associated with professional sport, in the absence of markets where consumer preferences can be directly observed, some authors resort to the hedonic price method. For instance, Carlino and Coulson (2004) used this method to measure the social benefit generated by a National Football League (NFL) franchise. This approach is based on estimation of housing rental prices equations for a given geographical area, on the assumption that the presence of a club in a town implies a very specific form of entertainment which can be exclusively enjoyed by town residents. The possibility of enjoying this leisure activity leads to increased demand for residential housing, which in turn would result in higher rental prices. Within the framework of compensating differentials theory, the ascertainment of people's willingness to pay higher rents to live in a town offering such entertainment services could be interpreted as a signal that residents perceive professional clubs as valuable assets positively affecting local quality of life.

Carlino and Coulson (2004) found evidence supporting the hypothesis that the presence of a professional club in a town affects willingness to pay higher rents. However, Coates, Humphreys and Zimbalist (2006) argue that their analysis shows methodological problems reducing reliability of results. More recently, Agha and Coates (2015) found that the presence of clubs participating in minor baseball leagues is associated with a 20% to 30% rent increase in middle sized towns. Broadly speaking, hedonic price models have not generated enough consensus on the existence and magnitude of public benefits associated with stadium construction and the presence of professional clubs in metropolitan areas.

As aforementioned, positive externalities or public gods produced by professional sport may be entirely consumed by any individual, who, not having to pay a personal price for use, does not send out market signals regarding valuation of such goods. In such a context, it is therefore necessary to design a mechanism enabling to correctly reveal individual preferences for those public goods. This situation opens the way for approaches based on direct expression of preferences, such as the contingent valuation method (CVM).

Literature on the value of public goods generated by professional sport using the CVM has considerably increased over the past two decades. In the United States, works by authors such as Johnson and Whitehead (2000), Johnson, Groothuis, and Whitehead (2001), Johnson, Mondello and Whitehead (2007), Santo (2007), Coates and Gearhart (2008), Rosentraub, Swindell and Tzvetkova (2008), Feen and Crooker (2009), and Harter (2015) are worth mentioning. In the European context, studies are fewer and relatively recent (Castellanos, García and Sánchez-Santos, 2011 and 2014; Wicker et al., 2012; Wicker, Whitehead, Johnson and Manson, 2016; De Boer, Koning and Mierau, 2018).

The CVM is an approach based on sampling techniques, whose findings are elicited from answers given by individuals when openly asked in a survey about their valuation of a given good (Mitchell and Carson, 1990), which in our case would be the presence of a professional club in a town. More specifically, a key element of CVM is designing the questionnaire used to ascertain respondents' willingness to pay (WTP) for maintaining or attracting a professional team to their town of residence. In fact, the survey is intended as a tool to estimate the inverse demand function and use that function for calculation of aggregate WTP in a given community.

A key benefit of this approach is that it enables estimation of both use values (for those attending games) and non-use values (for those who do not attend games), the latter precisely measuring citizens' WTP for consumption of public goods resulting from having a hometown club.

Therefore, the CVM enables estimation of the monetary value of public goods generated by the existence of a local professional club in a given town. Arithmetically, to estimate the aggregate value of external benefits generated by a football club, average individual WTP is multiplied by the number of inhabitants of the reference area (city or metropolitan area, as the case may be). If aggregate WTP is considered as the annual benefit stream produced by the club, the current value of income from annual WTP may be interpreted as the value of benefits generated by the club.

IV. PUBLIC SUBSIDIESS TO PROFESSIONAL SPORT: SOME ADDITIONAL CONSIDERATIONS

The sum of consumer surplus from sporting events attendance and public benefits estimated through the CVM could give values justifying public subsidies from the perspective of efficiency (Coates, 2007). But even in this case, the use of this type of estimate as the sole criterion implies ignoring facets as important as, for instance, distribution aspects or the effects on competition.

Public financing of professional sport entails a problem of income distribution (Zimmerman, 1997; Swindell and Rosentraub, 1998). In fact, regardless of the form they adopt, state aids ultimately imply income transfers from taxpayers to sport fans, club owners, and players.

Part of the benefits from subsidies provided by public administrations for the construction and remodeling of stadiums are collected as a higher value of consumer surplus for sports fans using such infrastructures. Thus, since fans enjoy that surplus thanks to subsidies, a group obviously benefitting from them are spectators attending sporting events.

If stadium attendees benefitting from consumer surplus are not the same taxpayers covering subsidies, redistribution from taxpayers to fans of the sport concerned occurs. Accordingly, it would be useful to know how consumer surplus is distributed among households with different levels of income. Thus, income levels and financial position of fans, as compared with average of the reference population, are relevant data to determine to which extent this type of subsidies may be supported for equity reasons.

In practice, there is the widespread popular belief that attending sports events is a hobby proper to the "working class"; accordingly, it is not uncommon to come across media or policy makers invoking the idea that this kind of subsidies contributes to an income distribution which is favorable for the lower-middle class, being therefore justified. However, the empirical evidence available often points in the opposite direction. For instance, the study by Wilson and Siegfried (2018), focusing on professional sport in Australia, shows that those buying tickets for sports events have higher annual income and are wealthier than the rest of citizens. Since, in addition, government taxes covering most public financing of professional sport are generally regressive, the net effect of public subsidies for sporting facilities probably tends to income and wealth redistribution from residents with lower and middle income to those with higher income. Siegfried and Peterson (2000) come to similar results for the case of the United States.

According to these findings, public financing of professional sport could make sense from the perspective of correction of market failures, but not for equity reasons.

On the other hand, state aids to professional sport are also sharply challenged from a competition point of view, as has become recently apparent in the context of European professional football. Considering that this sport is a private business, the use of taxpayers' money to finance professional football clubs can distort competition. In this regard, by way of example, it should be noted that the European Commission has ruled that public aids (amounting to 68.8 million euros) granted by different Spanish public administrations to seven professional football clubs (Barcelona, Real Madrid, Valencia, Athletic Bilbao, Osasuna, Elche, and Hércules) gave them an unfair advantage over all other clubs, which constitutes an infringement of EU regulations on state aids, having therefore ordered to repay the aid (European Commission, 2016).

Considering that available evidence does not allow to identify effects of sufficient magnitude as to justify the amount of state aids received by some professional clubs; that neither do such aids seem to be justified for equity reasons; and that they might distort competition, it remains unclear why aids continue to exist in practice, and even to increase, both in the United States and Europe.

At first glance, it could be thought that policy makers act against the public interest, either because they behave irrationally or because they are subject to various pressures (social, electoral, etc.). However, some authors offer other plausible explanations for the behavior of public administrations. For instance, Siegfried and Zimbalist (2000) argue that, if there exists a relatively reduced group of individuals enjoying high visibility, and each group member benefits from a substantial amount of consumer surplus, that group might come to form a sufficient social base to strongly support demand for public aids for a club, even if aggregate consumer surplus generated by that club is objectively insufficient to justify such aid.

For their part, Zimbalist and Long (2006) develop a model enabling to explain the observed increase in subsidies for professional sport in the United States in the 1950s. The model is based on two elements: income growth in urban areas and exemption from competition law enjoyed by professional leagues. Due to increase in income and population, a growing number of cities are in a position to be home to a professional club and benefit from the positive social effects it would produce. On the other hand, professional leagues exert their monopoly by restraining the number of participating clubs, which would be higher if open market entry were allowed. Limited supply and increased demand for clubs leads to competition between towns for a club, which puts upward pressure on subsidies granted by local governments to acquire a club or to prevent an existing club to move to a different town. In principle, such an argument cannot be directly extrapolated to the European context, for there is no closed league system. However, a similar logic could apply to a certain extent in Europe, since public subsidies might represent a decisive support for a club aspiring to relevant sporting successes, and specifically, to remain in the top division of the professional sport in question.

V. PUBLIC GOODS GENERATED BY PROFESSIONAL FOOTBALL: EMPIRICAL EVIDENCE FROM SPAIN

Most studies on economic impact and valuation of public goods generated by professional sport refer to the US context. Results from these research works are a useful reference, but they do not simply apply as a whole to the European context; specific studies enabling contextualization by focusing on a particular sport, country, club and town are therefore required. In this empirical section, in order to illustrate certain issues related to identification and valuation of externalities generated by professional sport, we focus on the case of Spain, on professional football, specifically on the RC Deportivo de La Coruña (henceforth Deportivo), and on the city of A Coruña.

Spain may be considered as part of the European model for professional sport, whose prime distinctive feature is the absence of closed leagues, participation in leagues being based on a system of promotions and relegations. In the case of Spain, football is furthermore the prevailing professional sport, and that of greatest social impact. According to the economic report of the Liga de Fútbol Profesional (LFP) for season 2016-2017, total revenue of LaLiga (which includes the 42 clubs participating in first and second divisions) amounted to 3,662.3 million euros, representing a 15.6% increase over the preceding season. LaLiga operating results (EBITDA) raised up to 785.3 million euros, a growth that virtually triples that of national economy. According to data provided by KMPG Sports (2015) and LFP, the economic weight of football has increased from 0.69% of GDP in the 2011-2012 season to 1.02% in the 2017-2018 season. These figures make of football the most powerful and a most established entertainment industry.

Regarding interest aroused by professional football in Spain, according to the June 2014 *Barometer* of the Centro de Investigaciones Sociológicas (*i.e.* Center for Sociological Research), 22.4% of the population said to be most interested in football, and it was second choice for 20.6%. Regardless of their interest in football, it is moreover significant for our analysis that 67.4% of respondents felt close to or was fond of a professional football club. As for stadium attendance, available data from the last complete season (2017-2018) show that there were 10,342,948 spectators in first division games, to which 4,001,861 having attended second division games should be added. A recent study conducted by Kantar Media –provider of official TV audience measurements in Spain– and LFP itself reveals a noteworthy additional finding, namely, that almost 3.3 million occasionally visit catering establishments to have a drink or a bite while they follow Laliga games on television. All of this is most revealing of the role played by this sport as a leisure option in Spanish society.

In Spain, relationships between the public sector and professional sport have traditionally been a source of controversy. Debate intensifies in times of economic crisis, when public administrations are subject to tight budgetary constraints.

Public contributions received by professional clubs may adopt various forms: direct subsidies, sponsorships, advantageous tax treatment, knock-down rental prices for exclusive use and enjoyment of facilities, and even property speculation operations. Historically, a significant part of state aids was channeled into financing construction of new stadiums and/or remodeling of the existing ones. Not without a reason half of the stadiums of clubs playing in the first division of the Spanish league in the current 2018-2019 season are publicly-owned. In the case of publicly-owned stadiums, use and enjoyment is commonly regulated by agreements establishing long-term concessions and rental prices almost always well below market prices. Clubs owning their stadium have profited from land-use reclassification processes, their old stadiums having been reclassified for residential use.

In such a context, value analysis of the alleged positive externalities associated with professional football becomes particularly relevant. In order to provide empirical evidence on the justification of the amount of aids granted on the basis of intangible effects associated with the existence of a professional football club in a given town, the Real Club Deportivo de La Coruña (henceforth Deportivo) constitutes an appropriate case, to which the Contingent Valuation Method (CVM) will be applied.

A Coruña is a middle-sized town (244,099 inhabitants in year 2017) which, as aforementioned, could be classified in the segment of towns in a position to obtain greater benefits in terms of improvement of its external image as a result of having a professional club that participates in elite competition, especially considering the significance of football in Spain. Furthermore, Deportivo is the public limited sports company with the largest number of owners in Spain, having approximately 25,000 shareholders, which makes it the Spanish club with greater distribution of property: no shareholder reaches the 3% ceiling of social capital provided for in its constitution. This property model is indicative of the close link existing between Deportivo and the town, an aspect to be considered when interpreting data on positive externalities generated by the club for the reference population, as well as when identifying who ultimately benefits from the public aids that the club might receive.

For application of the CVM, results from two surveys conducted on January 2003 and September 2012 are taken as reference. Both surveys consisted in personal interviews, and their scope was the city of A Coruña and its metropolitan area (see data sheet of surveys in annex). The questionnaire is divided into different sections, and enables to approximate consumption by respondents of the sporting show offered by the club, as well as the degree to which they enjoy the public good aspects generated by the club.

In year 2003, when the first survey was conducted, A Coruña was home to a football club having scored important sporting successes. Throughout twelve seasons, from the 1992-1993 to the 2003-2004 season, the club won the Spanish league on one occasion, finished in second place in four seasons, and in third place in four other seasons; moreover, it participated in the UEFA Champions League for five consecutive years, having once reached the semi-finals, and also won twice the Copa del Rey.

The same survey was conducted again in 2012 (including some additional questions). The context was then quite different from that existing when the preceding survey was carried out: the club had been relegated to the second division in 2011, to be promoted again in June 2012 to the first division, in which it participated when the survey was conducted. In those circumstances, the risk of relegation was a credible threat implying disappearance as a professional club, inasmuch as its economic viability depended upon remaining in the top division of Spanish football. Not without a reason, the club found itself in a process of insolvency proceeding.

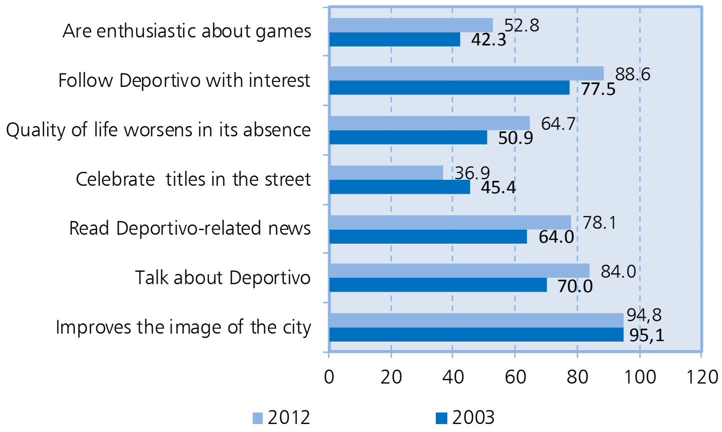
Findings from these surveys were used as a basis for two articles by Castellanos, García and Sánchez-Santos (2011 and 2014). In the first study, CVM was applied to estimate the willingness to pay (WTP) for preventing the disappearance of Deportivo. The second article focused on analyzing how factors such as general economic conditions and the plausibility of disappearance affected WTP.

In the present study, we elaborate on the treatment of findings from both surveys and, in accordance with the purposes stated in the section devoted to literature review, we use the information to appraise the extent to which public goods associated with the existence of a club like Deportivo are consumed, as well as the extent to which that consumption affects variables such as happiness, perceptions on quality of life, and civic pride. Information provided by both surveys furthermore enables us to offer some considerations on who benefits from consumer surplus.

Figure 1 includes information on some of the aspects previously characterized as public goods associated with Deportivo.

FIGURE 1

CONSUMPTION OF PUBLIC GOODS GENERATED BY THE DEPORTIVO (percentage of respondents)

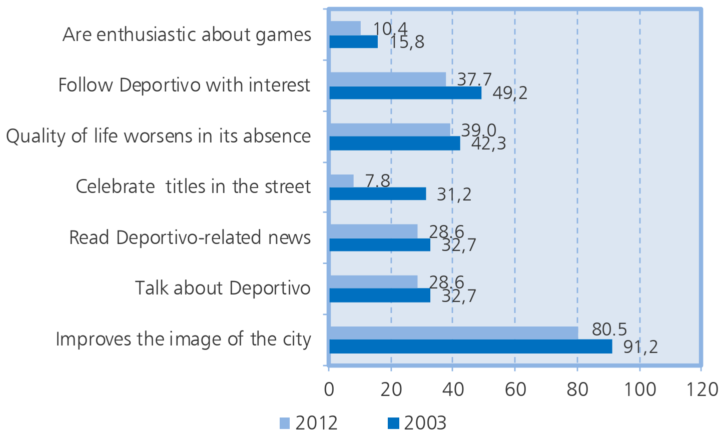


Source: Authors' own compilation based on data provided by surveys.

Information from Figure 1 may be complemented with that shown in Figure 2, which includes the same items, but data are from respondents who do not attend games nor watch them on television. As can be seen, in spite of being a very narrow definition of non-users, percentages are quite significant even for this group.

FIGURE 2

PEOPLE WHO DID NOT GO TO THE STADIUM NOR WATCH GAMES IN TV (percentage of respondents)



Source: Authors' own compilation based on data provided by surveys.

A further noteworthy aspect refers to the socio-demographic profile of consumers of this type of goods, which provides somewhat relevant information on how these externalities on consumption are distributed among the various population layers. Table 1 includes information differentiated by employment situation of respondents. Data reveal a broad impact on all groups, though retired workers and students seem to benefit from those effects to a greater extent.

TABLE 1

ATTITUDES AND PERCEPTIONS OF CITIZENS BY OCCUPATION
Percentage for each group of respondents

	Unemployed		*Retired*		*Students*		*Employed*	
Type of PA	*2003*	*2012*	*2003*	*2012*	*2003*	*2012*	*2003*	*2012*
Follow Deportivo with interest	84.1	85.5	80.9	91.7	82.5	95.0	76.8	85.5
Are enthusiastic about results	41.3	44.2	51.8	62.4	46.5	61.7	36.1	48.9
Read Deportivo-related news	64.6	73.9	60.7	81.2	69.8	81.7	57.3	80.6
Talk about Deportivo	60.0	84.8	64.8	85.6	73.9	93.3	55.3	82.8
Celebrate sporting successes	64.5	48.6	20.8	21.5	47.9	68.3	54.5	37.8
Impact on quality of life	50.8	60.1	65.5	70.2	47.8	68.3	45.0	60.0
Improves the image of the city	93.8	92.0	95.7	98.3	97.5	96.7	95.5	96.7

Source: Authors' own compilation based on data provided by surveys.

Regarding quantitative estimation of the monetary value of public goods, we refer to Castellanos, García, and Sánchez-Santos (2011 and 2014), who estimate aggregate WTP and provide use and non-use values decomposition. These values are shown in Table 2.

WTP values are comparable to the value of the flow of annual benefits generated by the club. To estimate the value of the club, the current value of

TABLE 2

AGGREGATE DATA OF WTP FOR THE CASE OF RCD DE A CORUÑA
Values in euros

	Average WTP	*Aggregate WTP*	*Use value*	*Non-use (passive)*
2003	14.48	4,350,704	660,872	3,689,832
2012	10.18	3,058,713	1,141,512	1,917,201

Sources: Castellanos, García and Sánchez-Santos (2011 y 2014).

such flows should be calculated, applying an appropriate discount rate. One of the most remarkable aspects resulting from these data is that value for non-users (that is, those who do not attend games at the stadium), which approximates the value of public goods generated by the club, represents a high percentage over total value. This latter value may be compared to the amount of public subsidization of stadium construction or remodeling, or else to the total value of direct and indirect public subsidies for the club.

Specifically, this comparison is relevant to determine whether a given subsidy leads to an improvement of overall welfare, or, on the contrary, constitutes an inefficient public intervention. In this regard, for example, the municipal government of A Coruña recently (11/22/2017) awarded the project to reform the roofs of Riazor stadium (where Deportivo plays its home games) for 7.2 million euros. A Coruña County Council contributed one million euros to finance the total cost of the works. The justification by local authorities focused on the significance of such reform for the town and the thousands of people who attend games weekly at the stadium, as well as on the stadium itself, which could thus continue to be an iconic image of the city. To that end, the comparison of aggregate WTP values for non-users included in Table 2, which are obtained by applying the CVM with the 2012 data (expressed in 2018 euros and properly updated), could serve as an argument providing the rationale for the granting of the subsidy.

On the other hand, in order to obtain empirical evidence on the role played by professional football in the subjective well-being of citizens, we have estimated three equations in which dependent variables are happiness (individual self-perceived subjective well-being), perceptions on how quality of life would be if the club did not exist, and civic pride (Table 3)[2] .

Model I column shows the estimated results of a regression model in which the dependent variable is happiness. Data for this variable were obtained from answers to the survey question: “Broadly speaking, you consider yourself to be…”. Possible answers were: Very happy; Quite happy; Hardly happy; Not happy at all. Once this variable was dichotomized, a logit model was estimated in order to analyze the link between happiness and some of the variables approximating both private (stadium attendance) and public (television and synthetic variable of public goods consumption) consumption.

The synthetic indicator for public goods consumption has been defined taking account of all dimensions considered in the survey; initially, it would result

[2] In all three models, base categories are: male for gender, retired worker for occupation, and single for civil status.

TABLE 3

LOGIT MODELS (DATA FROM THE 2012 SURVEY ON RCD DE LA CORUÑA, N = 807)

MODEL	*(I)*	*(II)*	*(III)*
Independent variables		*Dependent variable*	
	Happiness	*Quality of life*	*Pride*
Gender	0.445 (0.383)	0.530*** (0.179)	-0.168 (0,201)
Age	-0.241*** (0.086)	-0.051 (0.036)	-0.049 (0,042)
Age^2	0.002** (0.001)	0.001 (0.000)	0.001 (0,000)
Children	0.044 (0.162)	-0.107 (0.085)	-0.063 (0,099)
Education	-0.105 (0.157)	-0.052 (0.075)	-0.137 0,087
Unemployed	-1.553** (0.706)	0.081 (0.375)	0.243 (0,433)
Student	15.334 (4972.483)	0.292 (0.569)	-0.115 (0,590)
Household chores	-0.149 (0.673)	0.454 (0.220)	0.092 (0,399)
Employed	-0.545 (0.655)	0.109 (0.743)	-0.008 (0,382)
Other occupational situations	-1.135 (0.837)	0.107 (0.663)	-0.031 (0,748)
Health	0.776*** (0.219)	-1.160 (0.122)	-0.101 (0,137)
Stadium attendance	0.169 (0.160)	0.027 (0.062)	0.137* (0,079)
TV	-0.125 (0.147)	0.172** (0.068)	0.251*** (0,077)
Sports practice	0.278 (0.419)	-0.239 (0.180)	0.081 (0,202)
Public goods	0.416** (0.202)	0.384*** (0.102)	0.513*** (0,108)
Widower/Widow	-0.816 (0.746)	0.281 (0.441)	-0,062 (0,527)
Separated/Divorced	-0.291 (0.697)	0.451 (0.437)	-0,379 (0,484)
Married/Couple	1.077** (0.499)	0.399* (0.241)	-0,278 (0,274)

TABLE 3 *(continued)*

LOGIT MODELS (DATA FROM THE 2012 SURVEY ON RCD DE LA CORUÑA, N = 807)

MODEL	*(I)*	*(II)*	*(III)*
Independent variables		*Dependent variable*	
	Happiness	*Quality of life*	*Pride*
Constant	6.052** (2.523)	-0.372 (1.060)	0.517 (1,202)
p-value for likelihood ratio test	0.000	0.000	0.000
p-value for Hosmer and Lemeshow test	0.286	0.777	0.180
Cox and Snell pseudo-R^2 value	0.082	0.089	0.146
Nagelkerke pseudo-R^2 value	0.236	0.122	0.214
Global % of correct classification	94.757	68.025	77.834
% of outliers	3.470	0.496	3.098

Notes: Standard errors in parentheses, ***p-value < 0.001; ** p-value < 0.05; * p-value < 0.10.

from the sum of dummy variables representing the fact of reading club-related news; conversations about it; interest in following its performance; perceptions on how quality of life would be if the club did not exist; participation in social networks by expressing opinions on professional football; and participation in celebrations of sporting successes. Thus, all individuals for whom the value of this variable is other than zero are in principle consumers of public goods. If this criterion is strictly applied, the bulk of the sample (95.8%) would include consumers of public goods. Accordingly, we could further specify by distinguishing two groups of consumers: on the one hand, individuals showing low or no consumption of public goods (values between 0 and 3), amounting to 35.3% of respondents, and, on the other hand, intensive consumers of public goods (values between 4 and 6), representing 64.7% of the sample. However, the application of a reliability test (Cronbach's alfa) ultimately led us to narrow the number of items included in the variable-indicator down to three: reading club-related news; talk about the club; and follow it with interest. Thus, the synthetic indicator ranges from 0 to 3 in the estimated models.

Model I is not intended to be an explanatory model of happiness, but it does have the potential to reveal some interesting evidence, inasmuch as information provided by the survey enables us to control for some of the variables usually included in explanatory models of revealed subjective well-being (age, gender, income, health, employment situation, civil status, education level). In this regard, it is necessary to clarify that, given the limitations traditionally affecting data on the income variable in this kind of surveys (high non-response rates), and their correlation with other variables, such as education level and employment, all models have been estimated without explicitly including the household income variable as regressor, so as not to lose too great a number of observations.

According to the findings elicited for Model I, age, civil status (married), health, and unemployment situation are the statistically significant control variables. The sign of coefficients is as expected and consistent with results from studies on happiness determinants. Regarding the variables we are really interested in, consumption of public goods reveals itself as a significant variable, whereas stadium attendance and watching games on television do not seem to be associated with individual happiness.

The estimates for models in which the dependent variable is the perception of respondents on how quality of life would be affected if football itself or the club they support did not exist (Model II), or else whether the club they identify with contributes to increased pride (Model III), point in the same direction. In the case of these two variables, the most notable aspect for the purposes of our study is that the coefficients of variables measuring consumption of public goods and watching games on TV are positive and significant; the significance of stadium attendance in the explanatory model for civic pride is also noteworthy.

In this regard, despite limitations specific to the nature of the variables and estimation techniques used in this study, our findings suggest the existence of a positive relationship between consumption of public goods associated with Deportivo and happiness, perceptions on quality of life, and civic pride indicators. These results are consistent with the hypothesis of the relevance of intangible effects associated with the presence of a professional club in a certain urban environment.

For the purpose of supplementing the evidence obtained for the case of a given club and town, we estimated a model (Table 4) based on data provided by the June 2014 Center for Sociological Research (CIS, in its Spanish initials) Barometer, in which the dependent variable is individual happiness and the sports consumption-related independent variables refer to professional football in Spain. In this case, the dependent variable ranges from 0 to 10, and allows applying Ordinary Least Squares (OLS); furthermore, we used some additional control variables enabling us to extend the model.

TABLE 4

OLS MODEL (DATA FROM THE 2014 CIS BAROMETER, N = 1.569)

Independent variables	*Dependent variable*
Gender	-0.287*** (0.104)
Age	-0.082*** (0.018)
Age^2	0.001*** (0.000)
Education	0.024 0.057
Unemployed	-0.092 (0.184)
Student	0.441 (0.326)
Household chores	0.094 (0.208)
Employed	0.464*** (0.176)
Other occupational situations	0.577 (0.877)
Household income	0.112*** (0.031)
Health	0.486*** (0.054)
Stadium attendance	-0.034 (0.062)
TV	0.074** (0.031)
Sports practice	0.113 (0.100)
Public goods	0.045 (0.054)
Widower/Widow	-0.512** (0.227)
Separated	-0.536* (0.283)
Divorced	0.055 (0.248)
Married	0.393*** (0.123)

TABLE 4 *(continued)*

OLS MODEL (DATA FROM THE 2014 CIS BAROMETER, N = 1.569)

Independent variables	*Dependent variable*
Constant	6.165*** (0.498)
R^2	0.156

Notes: Standard errors in parentheses. ***p-value < 0.001; ** p-value < 0.05; * p-value < 0.10.

Again, the significant variables are those usually included in studies addressing happiness determinants (age, civil status, health, employment situation, income, religion, and gender), and show the expected sign. As for variables specifically included for the purpose of our study, consumption of public goods associated with professional sport does not seem to be significantly related to individual happiness, whereas watching games on television, an activity sharing some public good features, is indeed a significant variable.

Overall, the existence of an unequivocal causal link between professional football and subjective well-being indicators does not definitively follow from these empirical estimates. On the other hand, while not directly comparable, differences revealed by estimates for the case of Deportivo, and for that of professional sport in general, suggest that results might be greatly conditioned by the specific framework for analysis (country-sport-club-town).

Finally, in line with what was pointed out in the section devoted to reviewing literature, it should be noted that, in order to verify who benefits from consumer surplus, it would be appropriate to compare the income levels of those who attend Deportivo games with the levels of those who do not. In this regard, and despite limitations resulting from how the question on availability of income is phrased (only four intervals are considered), some considerations of interest may be arrived at. According to the data from the last survey (2012), the percentage of attendees belonging to families whose yearly income exceeds 30,000 euros is 25.18%, whereas the percentage of families over the total number of respondents exceeding that income level is 19.5% (the data from the 2003 survey reveal even greater differences). Furthermore, available information indicates that the average income levels of those attending games at the stadium are lower than the levels of those who do not attend games; thus, it appears that there are no indications that the working classes especially benefit from consumer surplus. These findings are consistent with the evidence obtained by other authors for different contexts (Siegfried and Peterson, 2000; Wilson and Siegfried, 2018).

VI. CONCLUSIONS

The relationships between the public sector and professional sport have traditionally been a source of controversy. In particular, there is a great deal of debate focusing on the rationale for public subsidies from the perspective of both efficiency and equity.

One of the reasons theoretically justifying public intervention in the professional sports sector (either regarding the existence of a club in a given town, the construction of sporting facilities for professional use, or the organization of a major sports event) is the existence of market failures resulting from externalities and public goods associated with sport. The key is therefore to appraise the magnitude of benefits derived from the consumption of public goods generated by professional sport, as well as to examine how such benefits are distributed among individuals with different levels of wealth and income.

The contingent valuation method enables to measure the extent to which people consume public goods generated by sports such as football, and to quantitatively approximate the monetary value of public goods generated by a professional football club. The application of this method allows for a qualitative and quantitative approximation of the value of certain goods lacking a market, as well as for obtaining valuable information that may be used to evaluate the rationale for public policies directly affecting the supply of public goods associated with the presence of a football club in a town.

Generally speaking, the available empirical evidence is not conclusive as to whether such effects are of sufficient magnitude for justifying public subsidies granted to professional sport. In any case, for that evidence to provide relevant information for decision-making by policymakers, specific studies are required, since findings from this kind of analyses are conditioned by factors such as the type of sport, the size of the town, club-town identification, or the sporting successes of the club.

The results obtained in the present study for the specific case of Deportivo and the city of A Coruña lead to establish that residents both in the city itself and the metropolitan area greatly consume the public goods generated by the club. Specifically, they appreciate its contribution to encouraging civic pride and improving the external image of the city and quality of life, and acknowledge that it is a recurring topic of conversation and that they read related press news. Our findings furthermore reveal high active participation in tittle celebrations, as well as that a substantial proportion of the population is enthusiastic about team performance.

Moreover, the models estimated in the present study suggest a positive relationship between consumption of public goods associated with a professional club and happiness, quality of life, and civic pride indicators. This conclusion is consistent with the hypothesis that the presence of a professional club in a given urban environment generates relevant intangible benefits for the well-being of the reference population. Notwithstanding, these findings need to be interpreted cautiously, and, since we use cross-sectional data, a strict interpretation in terms of causality is not appropriate.

Concerning redistributive aspects peculiar to the granting of public subsidies to professional sport, there is no available evidence as to justify subsidies on the basis of equity. Ultimately, the redistributive impact of subsidies depends on how they are financed. Specifically, a key issue is whether taxes used to finance professional sport are progressive or regressive. In any case, it would be most reasonable for local governments to primarily levy taxes from those who benefit from the stadium and/or the existence of the club.

On the other hand, regardless of the specific results obtained from a cost-benefit analysis of a public subsidy for professional sport, if policymakers seek to improve the quality of life of as many citizens as possible at the lowest possible cost, they should also take account of the value and cost of alternative local public services (libraries, symphonic orchestras, public parks, etc.).

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ANNEX

DATA SHEET OF SURVEYS ON DEPORTIVO

Population	Adult residents in A Coruña and its metropolitan area.
Type of survey	In-home survey.
Sample size	800 respondents in total: 600 from the municipality of A Coruña and 200 from the metropolitan area.
Sampling procedure	Disproportionate stratification in both sub-populations, with proportionate stratification between municipalities and the metropolitan area. Disproportionate stratification by district and electoral section.
Sampling design	Multistage sampling: -Random selection of sections in each sub-population. - Random selection of starting points for each section. -Systematic selection of households in routes generated on the basis of previous starting points. -Random selection of individuals from each household.
Sampling error	For a 95.5% confidence level, sampling errors would be the following: Stratum 1 (Coruña): +/- 4.08 %. Stratum 2 (Other municipalities): +/- 7.06 %. Total (stratum 1 + stratum 2): +/- 3,54 %.
Survey dates	January 2003 and September 2012.

eSports: A NEW ERA FOR THE SPORTS INDUSTRY AND A NEW IMPULSE TO RESEARCH IN SPORTS (AND) ECONOMICS?

Yulia CHIKISH[1]

Miquel CARRERAS

Jaume GARCÍA

Abstract

In recent years, electronic sports (*eSports*) have showed explosive growth, both in market value and number of participants. This paper discusses three issues associated with *eSports:* the structure and the economic dimensions of the *eSports* industry; the relationship between *eSports* and traditional sports; and the current and future research devoted to *eSports.* We find that the roles of stakeholders in the *eSports* industry are not as clearly defined and stable as in traditional sports. To assure stable growth of *eSports*, governance institutions and financial structures will be required to continuously adapt to changing conditions in the industry. The paper supports previous evidence in the literature emphasizing the complementarity between *eSports* and traditional sports. Finally, the increasing availability of *eSports* data and institutional peculiarities of the industry provide vast research opportunities not only in the field of sport economics but also in economics in general.

Keywords: eSports, industry, audience, research.

JEL classification: D12, L83, Z20.

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I. INTRODUCTION

More than fifty years have passed since, in 1967, Ralph H. Baer invented the first video game console, "Brown Box", which name was referring to the color of the wooden box of the console. But we had to wait until the late seventies and early eighties of the last century to reach the golden age of the arcade games (coin-operated entertainment machines). The arcade games have been considered the forerunners of what has subsequently come to be known as *eSports* – electronic sports (Lee and Schoenstedt, 2011). The nineties gave a strong impulse to *eSports.* The development of PCs (personal computers) and the evolution of the Internet through local area networks (LAN) technology changed the initial competition model from human versus machine to human versus human. Thus, that decade established the foundations for the explosive growth of *eSports.* But, despite the progress and success *eSports* have in our society, the interest generated by this phenomenon in the academic world is still limited, especially in sports economics.

There is no consensus about whether *eSports* must be considered a sport. *eSports* have not yet been officially recognized as sport. It is generally agreed upon that *eSports* refer to an organized, computer-mediated and competitive gaming (Hamari and Sjöblom, 2017). Some academics consider that a wider definition of the sport concept allows considering *eSports* as sport (*e.g.,* Wagner, 2006; Jonasson and Thiborg, 2010).

However, *eSports* substantially differ from traditional sports in two aspects. First, there are the differences in athletes' physicality. Jenny *et al.* (2017) point out that *eSports* involve movements using small groups of muscles (fine motor skills), whereas traditional sports require the use of large groups of muscles (gross motor skills). They conclude that *eSports* do not require the level of physicality associated with common definitions of sports. Second, sport is organized and regulated by institutions. One of the five criteria defined by the GAISF (Global Association of International Sports Federations)[2] states: "sport should not rely on equipment that is provided by a single supplier". Karhulahti (2017) discusses that *eSports* rely on commercial products owned and governed by private organizations. Moreover, the existence of many such organizations that struggle to achieve a hegemonic role is the greatest difficulty that *eSports* face to achieve the institutional structure required to be officially recognized as a sport (Jenny *et al.,* 2017).

In addition to the considerations above, the widespread perception of the negative risks associated with the practice of *eSports* (addiction, violence, social

[2] GAISF is an association composed of autonomous and independent international sports federations and other international sport and event related organizations.

isolation, reinforcement of sexism or stationary lifestyle) is also an impediment to accepting that *eSports* incorporate principles associated with traditional sports (Jonasson and Thiborg, 2010). Studies by Wagner (2006), Kretschmann (2010), Trepte, Reinecke and Juechems (2012) and Granic, Lobel and Engels (2014) underline the potential of *eSports* to contribute to developing players' social and personal skills. This outlook offers more complete, as well as more complex, perspective on *eSports.*

eSports have emerged as a growing economic and business sector associated with leisure and competition, which presents indisputable features (*sportification*) associated with sport (Jonasson and Thiborg, 2010 and Heere, 2018). Moreover, this degree of association would explain the synergies that traditional sports are seeking for the creation and delivery of *eSports* products[3] or monetizing assets in the *eSports* sector[4] (Cunningham *et al.,* 2018). Therefore, approaches and tools applied to the sport management can be useful to understand the processes behind value creation and product delivery in the *eSports* industry. Seo (2013) proposes to consider *eSports* from an experiential perspective, along the lines of the experience economy model developed by Pine and Gilmore (1998) which implies understanding that practising *eSports* is more than just competing through computer games. It includes many other experiences and can even be a way of life, integrating real and virtual worlds (Martoncik, 2015 and Seo, 2016). This set of experiences is co-created through a value chain with multiple actors participating and consumers having a leading role in the final value that is ultimately obtained from the process (Seo and Jung, 2016).

From the operational marketing perspective, various empirical studies analyzed the differences and similarities between sports and *eSports* consumption (Lee and Schoenstedt, 2011 and Pizzo *et al.,* 2018). The results show differences in the importance level of some consumers' motivations. However, *eSports* and sports can be considered very similar from a consumption motivation perspective. This supports the idea that sports marketing approaches are useful to help *eSports* management (Pizzo *et al.,* 2018).

Like traditional sports, *eSports* generate data about individuals' and firms' (or institutions') behavior with similar characteristics to data generated by laboratory experiments. This information can be used to test hypothesis based on economic theories, not necessarily limited to sports economics (see, for example, Palacios-Huerta, 2014).

[3] A clear example is the recent creation of *LaLiga eSport* by *La Liga Nacional de Fútbol Profesional* (a national sport association responsible for the administration of the two professional football leagues in Spain).

[4] The creation of professional *eSport* teams by football or basketball clubs is an example of this interest (*e.g.,* Valencia CF eSports or Thunder X3 Baskonia).

The paper focuses on three issues: the characteristics and the future of the *eSports* industry, the profile of *eSports* participants, with special attention to the relationship between *eSports* and traditional sports, and, finally, review of the sports economics literature related to *eSports* and some insights about the directions for the future research in this field.

The paper is organized as follows. Section II presents analysis of the recent worldwide evolution of the *eSports* industry and its future expectations. Section III addresses a review of the differences in the profile of *eSports* versus traditional sports participants, paying attention to the degree of complementarity of both activities, including some marketing issues related to *eSports* participants. Sections IV and V offer the review of the current sports economics research related to *eSports* and the consideration of some potential areas for the future research. The final section concludes.

II. *eSports* INDUSTRY: STRUCTURE AND PERSPECTIVES

The development of the *eSports* industry is relatively recent, but it has some features which require special consideration, when compared to the traditional sports industry. They reflect its organization and the distinct role played by the different stakeholders, and also with the economic growth perspectives. Both aspects are considered in this section.

1. Stakeholders in the *eSports* Industry and the Economic Framework

The *eSports* industry involves different agents in order to supply its products and services. They can be classified as: Publishers (*e.g.,* on-line multiplayer games developers), Infrastructure Platforms Suppliers (*e.g.,* PC, consoles, interconnecting networks or servers), Teams/Players, Competitions Organizers, Broadcasters and Sponsors. Seo (2013) proposes to complete the chain value by incorporating final consumers. Unlike in sports, *eSports* agents can play a multiplicity of roles in the industry. Riot Games is the publisher of League of Legends, but it also manages League of Legends Championship Series - LCS. The Russian telecommunications group Mail.ru Group has recently acquired ESforce for approximately 100 million dollars. ESforce owns two elite *eSports* teams (Virtus Pro and SK), and manages Dota2 and CS:GO *eSports* tournaments, a stadium (Yota Arena) for the *eSports* competitions in Moscow with a capacity of more than 1,000 seats, a merchandising platform specialized in *eSports,* and several *eSports* content production centers, as well as fourteen web pages specialized in *eSports.* The revenues of ESforce in 2017 were estimated at about 19 million dollars. These examples illustrate that role of agents in the *eSports* industry is not as clear, as in the sport industry, rather, it can create complex economic and relational framework.

eSports achieved great popularity in a very short period time. The *eSports* industry has not yet been able to consolidate a framework able to regulate economic relations among the agents involved. Unlike sports, which are organized in championships with independently owned teams, a single publisher controls each *eSports* game. A publisher organizes its own championships or provides licenses to independent organizers. The championship organizer selects participating teams based on their performance and on some economic criteria (*entrance fee*). Audiovisual broadcasting rights are also usually owned by the organizer. Thus, the *eSports* industry framework significantly differs from that in traditional sports. The role of publishers and organizers becomes more central, putting teams more in the background.

In the sports industry, revenues from media rights and ticket sales are important financial sources for teams, as well as advertising and sponsorship revenues. In the case of *eSports*, teams make money by winning tournaments. Also, the substantial share of their revenues comes from sponsorship and advertising (brand investment). Thus, brand investment is an important financial support, but this financial structure is very sensitive to strategies and priorities of sponsorship brands. This implies that less stable revenue streams make *eSports* teams less independent compared to their regular sports counterparts, even more so in cases where promotion and relegation system is in place.

One of the most relevant questions for the *eSports* industry is how to build durable governance structures that would accommodate the feature specific to *eSports*. They should assure the independent role of each agent and provide stable and autonomous financial structure to reduce risks and attract the investments and efforts necessary for a sustainable growth. The recent proposals developed by the two of the most important publishers could meet these conditions. In 2018, Riot Games announced the transitions of the North American League of Legends Championship Series to franchise format replacing existing promotion and relegation system. This means adopting a new competition format, different from the one used up to now, and which will still be maintained in Europe until 2019. The new competition format establishes a revenue sharing system, guaranteeing minimum revenues for the teams. Blizzard Entertainment has also launched Overwatch League in 2018 using a franchise format. In this case, each franchise is tied to a major city and teams are assured a minimum amount of annual revenues plus additional amount from a revenue-sharing system based on the team's performance in the season.

Adopting structures from traditional sports (*e.g.,* NHL or NBA) can be a way to offer stability and clarify the role of the agents. But the continuous emergence of new games and formats in the *eSports* industry requires more flexible and adaptable structures than those in the traditional sports.

Other initiatives are creating global associations similar to those in traditional sports (*i.e.,* FIFA in the case of football). The World *eSports* Association (WESA) is an initiative by some *eSports* teams and organizers to create a discussion space for all stakeholders in the industry, aiming to create a framework that would support and amplify sustainable growth of the *eSports* industry. The official recognition of *eSports* as sport requires establishing institutions that define a specific regulatory framework. From this perspective, a more prominent role of public authorities can be helpful. The first initiative taken in Europe by the French government[5] could be a first step. However, *eSports* are developed in an on-line world and this can limit the application of government regulations.

2. The *eSports* Industry: Situation and Perspectives

There is no available official data on the *eSports* industry. This section relies on publicly available information produced by private organizations (associations and consulting companies), with the aim of summarizing recent evolution of the industry and its future perspectives.

Figure 1 shows the worldwide data on revenues and audience in the *eSports* industry, based on the information provided by Newzoo (2016, 2017, 2018). Industry revenues increased by 500 million in the period from 2014 to 2017, and they are estimated to increase by almost 1,000 million during the period 2017-2021, reaching 1650 million in 2021. The main markets in 2016 were United States (32%), South Korea (30%) and China (17%). Germany was in the fourth place worldwide, leading European markets (11%). Spain was in the tenth place with estimated revenues of 1 million dollar.

The expected cumulative annual average revenue growth is estimated at 24.2% in the following years.[6] These forecasts are in line with those provided by PwC in its last report (PwC, 2018).[7] In that report, *eSports* is placed as the sport

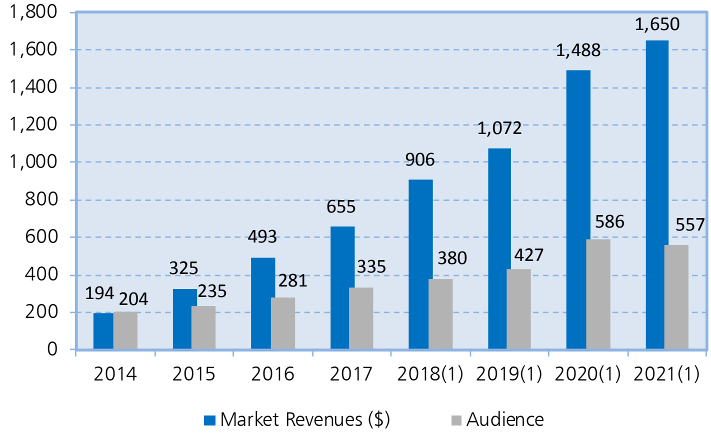
[5] Law n° 2016-1321, *'pour une République numérique'*, Decree N° 2017-871 about *'l'organisation des compétitions de jeux vidéo'* and Decree N°2017-872 about *'statut des joueurs professionnels salariés de jeux vidéo compétitifs'*.

[6] This rate is higher than the 10.3% cumulative annual growth estimated for worldwide videogames industry in the same period (Newzoo, 2018).

[7] PwC consulting produces an annual report on the sport industry since 2016. These reports collect the answers to a survey by professionals of the sport industry (470 professionals from 42 countries in the last report).

FIGURE 1

***eSports* WORLDWIDE: MARKET REVENUES AND AUDIENCE 2014-2021 (in millions)**



(1) Data are forecasts.
Sources: Newzoo (2016, 2017 and 2018).

segment with the highest growth expectation, replacing football,–the segment with the highest growth expectation in the previous report.

The audience grew by 130 million in the period from 2014 to 2017, and it is estimated to increase by 222 million during the period 2017 to 2021, reaching 557 million in 2021. The cumulative annual growth is expected to be 13.6%. It can be concluded that the *eSports* industry growth (recent and expected in following years) is mostly driven by growth in revenues rather than in audience. Therefore, a key element for the future of the industry is to be able to monetize the audience's interest in *eSports*.

The revenues of the *eSports* industry come from different sources: Marketing Support (sponsorship and advertising), Media Rights, Publishers Fees and Merchandising and Tickets. Table 1 summarizes the data provided by Newzoo reports on the estimated evolution of *eSports* revenues per stream.

Marketing support revenues are estimated to increase and remain the main source of the total revenues, 58.9% in 2018 (with a greater increase in advertising revenues). However, these revenues are not expected to have the greatest growth, and, therefore, they will lose weight over the total (its percentage is 60.8% in 2017). The highest growth is expected from media

TABLE 1

***eSports* REVENUES PER STREAM**
(in millions dollars)

	2017	*2018*
Brand Investment	421.6	533.2
Media Rights	92.5	160.7
Publishers Fees	115.8	116.3
Merchandising and Tickets	63.7	95.5
Total	693.6	905.7

Source: Newzoo (2017 and 2018).

rights (73.7%), and merchandising and tickets (49.9%) Publishers' fees are expected to be maintained at an approximately constant level. *eSports* are not considered to be very profitable business for publishers in the short-term, and they are considered to be a long-term investment (Newzoo, 2017). Therefore, the interest of the media for *eSports* events and the involvement of the fans will be an important factor for the industry growth.

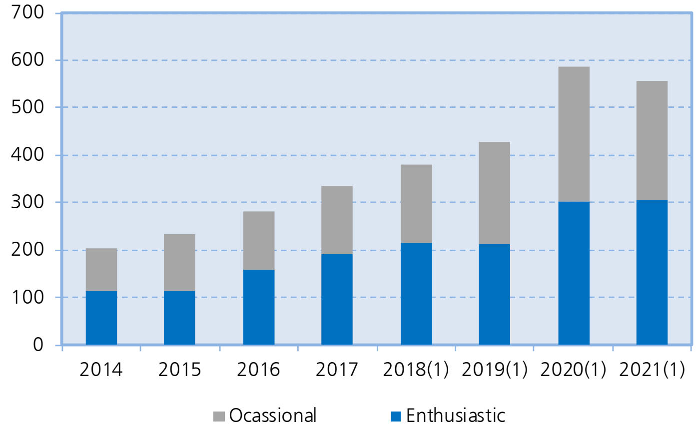
In fact, this interest could be explained by the observed change in the behavior of the younger generations. Industry reports suggest that a sizeable percentage of *eSports* followers are under the age of 35. For instance, PwC (2016) estimates this percentage at 68%. Being able to reach this age group is valuable for media, because it is becoming harder to reach younger generations (*i.e.,* millennials) through traditional media platforms (*i.e.,* TV). In fact, there is evidence that TV subscriptions in USA fell in 2017, while viewers continued to move to streaming and social platforms (Deloitte, 2018). Recently, two of the biggest streaming and social platforms (Youtube and Twitch) purchased exclusive rights to stream some of the most popular *eSports* tournaments.

The second largest growth rate for revenues comes from fans' spending in merchandising and tickets. Considering only the enthusiastic *eSports* audience (people who watch *eSports* more than once a month) and all revenue streams, Newzoo (2017) estimated that each *eSports* enthusiast, on average, spent 3.64 dollars per year in 2017. The annual average direct spending per fan on merchandising, tickets, or subscriptions was 0.33 dollars in 2017, which is below the average expenditure made by an enthusiastic fan of any of the most popular sports. For instance, according to UEFA data, a European football fan spent an average of 34.5 euros per match in 2017. Therefore, *eSports* has a space to increase this source of income in the future. This average annual spending is expected to grow up to 43% in the year 2020 (Newzoo, 2017).

In terms of audience, reports on the *eSports* industry usually differentiate enthusiastic audience and occasional audience (people who watch *eSports* less than once a month). Figure 2 shows estimated and forecasted data from Newzoo reports for both types of audience, where enthusiastic audience has had the higher growth ratio than occasionally audience in the recent years. Additionally, the enthusiastic audience has a pronounced presence in Asian-Pacific markets (51% of the total audience in 2017), but a lower share in European markets (18%) and North-American markets (11%). However, the figures for Spain are remarkable. According to AEVI (2018), and based on data from Newzoo, the percentage of enthusiastic audience was 47.3% with a total audience of 5.5 million in 2017. The trends are expected to change in the period 2017-2021, when occasional audience is predicted to grow by 70% and enthusiastic audience by 60%.

FIGURE 2

***eSports* AUDIENCE SIZE WORLDWIDE BY TYPE 2014-2021 (in millions)**



(1) Data are forecasts.
Sources: Newzoo (2016, 2017 and 2018)

This prognosis does not account for the total number of hours devoted to watch *eSports.* According to IHS Markit (2017), the annual growth of the worldwide number of hours is estimated at 9.8% in the period 2016-2021, which is lower than estimated increase of audience.

To summarize, the *eSports* industry forecasts are very optimistic about its future. However, the outcome will depend on two key aspects. First, establishing a framework that provides stability and allows attracting investments necessary for growth. Second, a more stable financial structure is required to translate the expected growth of the audience (fans' interest) into higher revenues, especially those coming from media rights and fans' spending.

III. *eSports* AUDIENCE: CHARACTERISTICS AND PARTICIPATION IN OTHER ACTIVITIES

At European level, there are no official statistics, defined as European statistics, in the field of physical activity and sports practice. Consequently, no official statistics for *eSports* exist. The available evidence comes from either industry reports (*e.g.,* Nielsen, 2017) or marketing studies, providing evidence on the motivations for participating in activities associated to *eSports* (Lee and Schoenstedt, 2011; Martoncik, 2015), including comparisons with participants in traditional sports (Pizzo *et al.,* 2018).

This section provides empirical evidence about the comparison of the profile of *eSports* participants and non-participants on several dimensions, and also about activities, motivations and opinions of those practising *eSports*, based on the information from a survey on physical activity and sports participation in Spain.

1. Comparison of the Profiles of *eSports* Participants and non Participants

García and Murillo (2018) characterize the profile of *eSports* participants using a sample of 11,018 individuals from the *Survey on Sporting Habits in Spain 2015* (EHD), produced by the Spanish Higher Sports Council. They use the information associated to the question about the interest in playing videogames related to sports as a proxy for *eSports* participation. They estimate a model consisting of two equations: whether an individual has interest in *eSports*, based on a 0-10 scale, where 0 means no interest, and an intensity equation for those who show some interest (scale greater than 0). This specification allows for different effects of the variables used to characterize the profile in the probability of being interested in *eSports* and in the intensity of this interest. Estimating the equations, the authors also look at men and women profiles separately. The results indicate that, apart from gender, variables like age, education, personal status (marital status plus composition of the household) and the size of the municipality, have a significant (and not equivalent) effect in both equations and for both males and females.

García and Murillo (2018) also provide empirical evidence about to whether practising *eSports* is a complementary or substitutive activity to practising traditional sports. All the approaches they used indicate that there is some complementarity between these two activities. The proportion of those interested in *eSports* is higher among those who are interested in any activity related to traditional sports (practice, live attendance, audience, information) than in the whole population. The correlation coefficients between the variables associated to the level of interest in these activities and the interest in *eSports* are positive and significant, as it is the correlation between the errors terms,

TABLE 2

DESCRIPTIVE STATISTICS OF SPORTS PRACTICE
(percentage)

	Non video gamers		*Video gamers*	
	Full sample	*<=25 years*	*Full sample*	*<=25 years*
Sports practice	44.53	74.20	72.19	85.44
Frequency				
Daily	35.15	37.15	38.10	46.73
At least once a week	50.14	54.23	49.41	45.58
At least once a month	9.18	6.07	8.82	6.06
At least once a quarter	2.95	1.16	1.96	1.04
At least one a year	2.58	1.39	1.72	0.59
Type of practice				
Individual	67.06	53.65	46.48	28.97
Team	10.80	14.17	18.60	28.77
Both	22.14	32.18	34.93	42.27
Organized competition	13.48	18.43	24.86	37.61
Type of sport*				
Football (soccer)	11.23	19.59	36.63	58.92
Cycling	33.50	38.58	45.27	48.22
Swimming	35.34	40.12	42.51	44.10
Trekking	31.57	29.41	32.22	27.94
Running, jogging	27.05	38.10	34.60	40.04
Chess	7.88	9.17	15.70	18.21
Gymnastics (soft)	31.52	31.68	25.31	20.74
Gymnastics (intense)	27.28	41.16	31.24	33.75
Body-building, weightlifting	14.88	21.25	26.72	31.36

* In the survey of the EHD, each individual practising sport at least once a year can choose more than one sport he/she practises more than once a year from a list of 41 sports. The sports reported in this table are among those with the higher proportions of participation with the exception of chess.
Source: Own elaboration.

when estimating a bivariate Probit model of being interested in traditional sports and *eSports*. Finally, adding a binary variable and a variable measuring the level of interest in any activity associated to *eSports* in the previous two-part model for the participation and the interest in *eSports* equations, in all cases these variables have a positive and significant effect in the probability of being interested in *eSports* and in the intensity of this interest.

Using the same data set, this paper extends the analysis by García and Murillo (2018) by looking at the relationship between the practice of sports and its frequency and whether there is an interest in playing sports video games, providing more evidence on the complementarity between these two activities. Additionally, the type of practice (individual and/or team), whether the individual participates in competitions or not, and the type of sport which is practised, are characterized in terms of playing or not sports video games. Table 2 reports the descriptive statistics.

The first piece of evidence, which reinforces the complementarity between *eSports* and traditional sports, is that the proportion of those practising sports is higher among those who are video gamers (72.19%) than among those who are not (44.53%). These results remains qualitatively the same when considering those who are 25 years old or younger (85.44% and 74.20%, respectively), which is the population segment to which most of the *eSports* fans belong. On the other hand, the differences in terms of the frequency of practice do not seem to be significant, it does not matter very much whether the whole population or the youngest segment is considered, but, if any, video gamers seem to practise sport more frequently than non video gamers. These results hold when estimating a two-part model where sports participation and the frequency are modelled separately by means of a Probit model and ordered model, respectively, and including the intensity of the interest in sports video games as an explanatory variable.

Table 3 reports the marginal effects of the intensity of the interest in sports video games on the probability of practising a sport and on the probabilities of the different frequencies, which appear in the survey, by gender. A unit increase in the intensity of *eSports* interest, on average, increases the probability of practising sports by 0.0137 and 0.0186 for males and females, respectively. On the other hand, the same increase in intensity has a positive effect on the probability of practising sports daily, but decreases all the probabilities corresponding to the other frequencies, for both males and females, although in the last case the effects are significant only at a 10% level.

From the evidence in Table 2, it can be observed that video gamers seem to practise team sports more frequently (71.04% of people 25 years or younger)

TABLE 3

MARGINAL EFFECTS OF THE INTENSITY OF INTEREST IN SPORTS VIDEOGAMES FOR THE MODELS OF SPORTS PRACTICE AND FREQUENCY

	Males	*Females*
Probit (practice = 1)	421.6	533.2
Ordered Probit (Fequency)	115.8	116.3
Daily	0.0036	0.0035*
At least once a week	-0.0013	-0.0017*
At least once a month	-0.0013	-0.0009*
At least once a quarter	-0.0004	-0.0004*
At least one a year	-0.0005	-0.0005*

* Significant at a 10% level but not at a 5% level.
Source: Own elaboration.

than non video gamers (46.35%), and they participate in competitions more frequently (37.61% and 18.43%, respectively). With respect to the type of sport, there are substantial differences between the two groups of individuals considered. The proportion of video gamers practising each sport included in Table 2 is higher than that for the other group, with the exception of both types of gymnastics and trekking, when considering the population of young people. It is also relevant that the proportion of those practising football is very large (above 50%) for those who are practising *eSports*, which emphasizes the abovementioned complementarity, even when considering football, the most popular sport in Spain.[8]

Table 4 provides another piece of evidence about the complementarity of traditional sports and *eSports*. In the case of sports video gamers, for 11.37% of them (15,10% among those who are 25 or younger) the first motivation to practise sport is because they like sport, whereas these percentages are 7.36% and 10,71%, respectively, for those who are not interested in *eSports*. Fun and entertainment is the main motivation among video gamers, irrespective of their age.[9] Similarly, the evidence about the main motivation for non practising sports is providing an additional piece of evidence about the complementarity

[8] It is interesting to point out the differences observed for these two groups with respect to the practice of chess, which is an activity which does not fit fully with the main elements of what a sport should be. Video gamers have a higher proportion of individuals playing chess.

[9] Although competition is not very much represented among the main motivations to practise sport, it is relevant to point out that this motivation is more present among video gamers, which is something indirectly related to one the key elements (professional competition) associated to the definition of *eSports*.

TABLE 4

DISTRIBUTION OF THE MAIN MOTIVATIONS FOR SPORTS PRACTICE OR NON PRACTICE (percentage)

	Non video gamers		*Video gamers*	
	Participants	*<=25 years*	*Participants*	*<=25 years*
Motivation participation				
Fun, entertainment	28.66	37.87	38.60	46.66
Fitness	34.24	33.31	29.01	22.72
Like sport	7.36	10.71	11.37	15.10
Competition	0.83	1.26	0.99	1.96
	Non Participants	*<=25 years*	*Non Participants*	*<=25 years*
Motivation non participation				
Lack of facilities	3.91	9.78	6.38	9.34
Age	15.20	0.69	4.38	0.61
Lack of time	43.33	57.80	60.10	61.52
Lack of interest	17.00	17.15	11.05	11.74

Source: Own elaboration.

between the two activities. Although it is not the most important among the main motivations, the lack of interest is the main motivation for, approximately, 11% of the video gamers. This percentage reaches around 17% for those who are not interested in *eSports*.

Apart from sports practice, the EHD includes some other activities related to sports participation: attendance, audience and information. Table 5 shows that the proportion of those attending sports events is higher among video gamers than among non video gamers, when considering the youngest group (59.41% and 52.55%, respectively), and, even more clearly, for the full sample. This is additional evidence about the complementary between *eSports* and sports activities, not only through practice. The evidence from audience associated to sports (watching television, listening to the radio or using internet) and from being informed about sports is reinforcing the previous findings, for both, the full sample and the youngest group. In the case of audience, the proportion is 15.6 percentage points higher for video gamers and 23.6 points in the case of information. These differences are more significant when the full sample is considered. On the other hand, in terms of audience of a particular sport, the difference for football is not as important, both in relative and absolute terms, as it is for other sports, and the differences are less pronounced when comparing the two groups for the whole sample. Finally, the proportions are higher for the video gamers, whenever internet, social media, mobile or tablets are involved, and also for the youngest group compared to the full sample.

TABLE 5

DESCRIPTIVE STATISTICS OF ACTIVITIES ASSOCIATED TO SPORTS (percentage)

	Non video gamers		*Video gamers*	
	Full sample	*<=25 years*	*Full sample*	*<=25 years*
Attendance	29.69	52.55	43.40	59.41
Audience*	74.83	75.84	89.10	91.54
Sport				
Football (soccer)	89.29	88.56	91.30	92.93
Basketball	42.27	30.81	51.49	51.46
Tennis	46.48	34.37	55.14	48.57
Athletics	20.63	15.59	25.18	18.58
Motorcycling	42.16	36.70	53.30	49.92
Cars	47.20	40.21	58.89	53.51
Media				
Television	99.33	99.04	99.00	98.63
Radio	15.59	12.37	23.58	22.96
Internet	8.88	17.54	26.57	35.40
Information*	55.83	49.43	73.78	73.03
Press (general information)	45.49	23.00	49.41	38.78
Press (sports)	30.46	20.66	49.12	47.03
Radio	32.44	13.67	35.18	21.84
Television	84.14	82.14	87.34	84.24
Internet	26.19	48.42	57.53	70.23
Social media	11.77	42.70	32.41	50.93
Mobile phone	14.68	35.08	38.45	53.04
Tablet	6.99	18.41	9.89	21.82

* Individuals can choose more than one sport, or more than one type of media, when indicating the event they have attended or the media they use to be informed about sports.
Source: Own elaboration.

2. Activities, Motivations and Marketing Aspects of *eSports* Participants

As mentioned above, most of the evidence about the profile of *eSports* participants comes from marketing surveys. In order to provide some evidence about specific marketing aspects associated to *eSports* audience in Spain, this

TABLE 6

DESCRIPTIVE STATISTICS OF ACTIVITIES ASSOCIATED TO *eSports* (Percentage), INTEREST (MEAN) AND EXPENDITURE IN SOME OTHER ACTIVITIES (Euros)

	Males	*Females*	*Total*
Activities related to *eSports**			
Audience	86.85	83.53	85.20
Only audience	32.67	42.57	37.60
Audience and attendance	10.36	5.62	8.00
Audience and competition	26.69	19.28	23.00
Audience, attendance and competition	17.13	16.06	16.60
Attendance	29.88	28.11	29.00
Only attendance	1.20	5.62	3.40
Attendance and competition	1.20	0.80	1.00
Competition	55.78	46.18	51.00
Only competition	10.76	10.04	10.40
Interest in some activities			
Video games	3.83	3.88	3.86
Traditional sports	3.98	3.50	3.74
*eSports***	3.60	3.54	3.57
Monthly expenditure on some activities			
Attendance live events (culture, sport, …)	23.24	25.78	24.50
Video games	20.25	17.05	18.66
Practice sports activities	13.54	10.11	11.83
Leisure activities	72.41	57.37	64.92
eSports	8.08	9.29	8.68

* Individuals can choose more than one activity. This is why the percentages of audience, attendance and competition add more than 100.
** Video games of professional competitions.
Source: Own elaboration.

paper uses the information from the "*eSports* survey Spain", carried out by Nielsen in September 2016. The sample is composed of 500 individuals who have practiced at least one activity associated to *eSports* including: watching (television, online), attending (live) events and competing.[10]

[10] A more complete analysis of this data set, including the estimation of some econometric models, can be found in the paper by J. García and C. Murillo, with title "eSports: perfil de los participantes (¿o deportistas?")", presented at the *VIII Congreso Iberoamericano de Economía del Deporte,* held in Ciudad Real (Spain) in June 2017. The paper is available on request.

Table 6 reports the proportion of *eSports* participants for each of the abovementioned activities. It is clear that, for both males and females, audience activities are the most frequent (above 80% in both cases), whereas live attendance is the less frequent. Both genders are more likely to watch *eSports* events (around 80%) rather than attend them (around 30%). At this aggregate level, there is a significant difference by gender in terms of competition activities, with a higher proportion for males. Males (46%) are more likely to participate in *eSports* competitions than females (36%). Females are more likely only watch *eSports* events (but not attend) and only attend (but not watch) than males, but there is no difference in the propensity to compete in *eSports* events for both genders.

Additional evidence supporting the complementarity between *eSports* and traditional sports is also provided in Table 6, when looking at the interest in some specific activities, measured as the mean value of an indicator of the degree of interest in a scale 1 to 5. Considering individuals included in the sample, those practicing an activity associated to *eSports*, have more interest in traditional sports than in *eSports*, defined as professional video games competitions. This is particularly evident for males, but not for females. In any case, even for females, the interest in traditional sports is not significantly different than that in *eSports*.

TABLE 7

MOTIVATIONS TO PRACTISE *eSports*

	Males	*Females*	*Total*
Top 5			
Fun, entertainment	80.48	79.12	79.80
Competitiveness	47.41	36.14	41.80
Event experience	24.30	22.89	23.60
Different experience of video games	22.31	22.49	22.40
To be a better player	27.49	15.26	21.40
Bottom 5			
To watch a team or a particular player	9.96	11.65	10.80
Drama	4.38	8.03	6.20
To participate in Fantasy eSports	5.58	6.02	5.80
To participate or watch cosplay	4.38	6.83	5.60
Betting	4.38	3.21	3.80

Note: Individuals can choose more than one motivation from a list of 22.
Source: Own elaboration.

On the other hand, when looking at the monthly average expenditure on some activities, *eSports* expenditures are clearly below the averages for other activities including video games and practice of traditional sports activities. This gives an idea of the extent of the potential growth in revenues in this industry, coming from the expenditure of *eSports* fans, as mentioned in the previous section.

Additionally, understanding the motivation of individuals for practicing *eSports* is relevant for defining marketing strategies designed for them. Table 7 reports the proportion of individuals whose motivation to be associated to *eSports* is one in the list in this table, which includes those motivations with the higher and the smaller proportions from a list of 22 in the questionnaire. Clearly, fun and entertainment and, to a lesser extent, competitiveness are those with the higher proportions (above 75% for fun and entertainment) for both males and, in particular, females, but males seem to be more motivated by the competition than females. On the other hand, betting is the motivation less representative for both genders.

Finally, in the abovementioned survey, individuals are asked for the brands/ products they recognize as more representative for advertising in *eSports*. In Table 8, the average of an indicator of how appropriate a brand is in a scale 1-5 is reported. From a list of 17 products, for both males and females, those products which are understood as more identified with *eSports* are the consoles for video games and, also, the technological products, which can be seen as very much associated to *eSports*, and energetic drinks. At the same time, liquors are clearly the products less identified with *eSports*, jointly with beer brands and outlets.

TABLE 8

INDICATOR OF HOW APPROPRIATE A BRAND IS FOR ADVERTISING *eSports* (mean)

	Males	*Females*	*Total*
Top 3			
Video games consoles	4.10	4.00	4.05
Technology	4.09	3.96	4.03
Energetic drinks	4.06	3.95	4.00
Bottom 3			
Outlets	3.29	3.29	3.29
Beer	3.25	3.32	3.29
Liquors	2.82	2.93	2.88

Source: Own elaboration.

IV. SPORTS ECONOMICS AND *eSports*: EXISTING RESEARCH

For an economist, sporting competitions represent human laboratory with controlled, repeated experiments under the same rules, and often with the same individuals. This setting creates a favorable environment for answering empirical questions, not only directly related to sport, but also questions related, for instance, to labor or behavioral economics. Similar to traditional sports, detailed data on *eSports* teams' performance and monetary incentives become more and more available with time, driving the research around *eSports*.

The popularity of *eSports* tournaments has been steadily increasing over the last decade. In 2017, about 4,000 tournaments took place around the globe with a total prize pool amounting to 120 million dollars.[11] Each tournament has clear structure, observable monetary prizes, and match outcomes. This enables a researcher to test empirically whether contests are efficient mechanisms for eliciting effort (Preston and Szymanski, 2003). The models proposed by Lazear and Rosen (1981) and Rosen (1986) predict that prizes must be highly skewed towards top ranking contestants to maximize effort level by every participant.

Using data on monetary prizes of *eSports* tournaments, Coates and Parshakov (2016) find that tournaments' reward schemes are designed so that the relationship between prize and player/team's tournament rank is convex. It means that each subsequent move up the tournament ranking brings sharper increase to team/player's rewards. Coates and Parshakov's results indicate that tournament organizers aim to maximize participants' effort by structuring reward schemes according to the Lazear and Rosen (1981) and Rosen (1986) predictions.

One of the well-researched questions in traditional sports literature addresses the importance of country-level factors in defining teams' or individual athletes' success. This literature suggests countries' economic conditions, human resources characteristics, political institutions, and geographical conditions in influence countries' sporting performance (see, for example, Bernard and Busse, 2004; Johnson and Ali, 2004; Noland and Stahler, 2016).

Parshakov and Zavertiaeva (2018) point out several important differences of *eSports* from traditional sports. First, *eSports* do not require outstanding physical form from athletes, nor do they require specific climate conditions or expensive infrastructure. Thus, costs of participation in *eSports* competitions are lower than in traditional sports, and competing in different games is possible for the same athlete. Second, due to the novelty of *eSports* competitions,

[11] According to the data from https://www.esportsearnings.com

governments have not yet intervened in the development of national teams. Taking both points into account, one can hypothesize that country-level fixed effects are small to non-existent in the *eSports* setting. Surprisingly, using data on money won by individual players each year, Parshakov and Zavertiaeva (2015) find that country-level fixed effects are substantial and similar to those in traditional sports.

To further explore the matter, Parshakov, and Zavertiaeva (2018) aggregate prize money won by gamers at the country-level and look at some particular country-level factors that may explain participants' success in *eSports* competitions. They use characteristics affecting national athletes/teams performance in traditional sports (GDP per capita, gross capital formation, population, life expectancy, dummies for post-Soviet countries and post-planned economies) along with factors specific to *eSports* – percentage of Internet users and high-technology export share in manufactured export – which proxy coverage and popularity of *eSports*, respectively.

The study employs two models – a selection model which determines whether a country won any prize money, and an outcome model which determines the amount of money won. The results show that GDP per capita does not affect the probability with which a country participates in *eSports* competitions, which conforms with low entry costs, but it also positively affects the amount of money won by participating countries. The coefficient on the country population variable is positive and statistically significant in the selection model but statistically indistinguishable from zero in the outcome model. This finding may indicate that *eSports* talents are not uniformly distributed across the world. Surprisingly, residents of post-Soviet and post-planned economies are more likely to participate in *eSports*. As for *eSports*-specific factors, a higher number of Internet users in the country increases participation in tournaments but does not affect the amount of money won. High-technology export share does not have significant effect in either model specification.

Another empirical question that could be studied in the context of *eSports* is the effect of team diversity on performance. The past few decades are characterized by a substantial increase in movement of people across borders. Therefore, workplaces around the globe have become increasingly diverse, which raises a question about whether diversity improves or worsens performance. The evidence from "regular sports" is mixed. Timmerman (2000) finds that age diversity and racial diversity is negatively associated with US basketball teams' performance, but unrelated to US baseball teams' performance. The author suggests that diversity should have more impact on basketball performance since it has more interaction between players during the game that baseball. However, replicating the study for Japanese baseball teams, Sakuda (2012) finds negative relationship between national diversity and team performance, but no significant results for age diversity. Kahane, Longley and Simmons (2013) find that NHL teams employing a higher proportion of European players performed better. However, the teams perform better when their European players come from the same country, rather than from many European countries. Using data from the Bundesliga, BenNer *et al.* (2017) find that football team performance and player performance are negatively affected by diversity among offensive players and positively by diversity among defensive players. These effects are strengthened by longer tenure of the two groups of players.

In addition to extensive data availability, studying effects of team diversity on the performance in the context of *eSports* has another advantage. The nature of *eSports* relies on communication in a computerized environment which closely resembles work environment in modern companies. Parshakov, Coates and Zavertiaeva (2018) consider effects of culture, language and skill diversity on teams' performance in *eSports* tournaments. Their results suggest that cultural diversity aids teams' performance, while language and experience diversity have an adverse effect. These findings imply that different kinds of diversity have different effects on team performance.

V. SPORTS ECONOMICS AND *eSports*: FUTURE RESEARCH DIRECTIONS

The existing studies about *eSports* are scarce, but the possibility to quantify performance of teams and individual players within teams shows great potential for increased understanding of the relationship between monetary incentives and effort provision. Moreover, there are some very specific features of *eSports* that deserve attention from researchers. First, *eSports* is a unique case where both promotion and relegation, and franchise league design were at place at different times. Second, a betting market is more embedded in *eSports* compared to "traditional sports". Finally, the previous feature, combined with the computerized nature of *eSports* competitions, affects incentives and practices of cheating. This section discusses institutional setting of these issues in more detail, to assess the relevance of these topics for future research.

1. Organization of Competition

Historically, most North American sports leagues are closed, which means that the same teams, called franchises, exist in the league year after year with occasional league expansion and relocation of existing teams, but without any team movement between leagues at different levels. An alternative system of league organization, used outside of North America, is an open model based on promotion and relegation. A team's performance over the whole season defines whether it will be promoted to a higher division or relegated to a lower one. The difference in league structure implies that teams might make different strategic decisions under different systems of league organization. The model developed by Szymanski, and Valletti (2010) predicts that teams operating under the promotion and relegation system have more incentives to invest in effort, but less incentives to promote competitive balance.

The *eSports* setting provides a unique environment to test these predictions. The League of Legends Championship Series (LCS) consists of two leagues with an identical number of teams, as well as tournament and prize structures. Twenty teams compete in two separate tournaments in Europe (EU LCS) and North America (NA LCS), with ten teams per continent. Each season is divided into two splits, spring and summer, and concludes with a play-off tournament between the top six teams from each region. Both leagues had a promotion and relegation system, where the bottom team in each league competed with the top teams from the Challenger Series for spots in the next LCS split. In 2017, the North American league officially announced that it would switch to the closed franchise model starting in the 2018 season.[12] The European league decided to follow, starting in the 2019 season.[13] These transitions from promotion and relegation to closed leagues will provide researchers with an opportunity to study outcomes in the same leagues under two different systems of league organization.

2. Betting in *eSports*

The *eSports* betting market is enormous and rapidly growing. One of the latest reports by Grove (2017a) estimates the amount of money wagered on major *eSports* events in 2015 at 5.5 billion dollars and projects it to grow to almost 13 billion dollars by 2020. By comparison, the estimate of money wagered on National Football League and college football games through the 2015 season amounts to $95 billion with about 93 billion dollars (or 98%) of betting through illegal channels.[14] The market might expand even faster after the U.S. Supreme Court decision on May 14, 2018[15] to overturn the 1992 federal

[12] https://www.lolesports.com/enUS/articles/evolution-of-the-na-lcs

[13] https://eu.lolesports.com/en/future-of-the-eulcs

[14] https://www.forbes.com/sites/darrenheitner/2015/09/09/93-billion-will-be-illegally-wagered-on-n-and-college-football/ad8c61a78810

[15] https://www.jdsupra.com/legalnews/the-supreme-court-may-14-2018-12047/

law that effectively banned commercial sports betting in most U.S. states. Now, states are allowed to establish their own sports-betting laws, so the volume of *eSports* betting is expected to explode even more.[16]

eSports betting is similar to traditional sports betting. Holden, Rodenberg and Kaburakis (2017b) lists three main categories of *eSports* wagering: eSportsbook wagering, fantasy *eSports*, and betting using in-game items. The first two categories are very similar to popular forms of traditional sports betting, while the last one is specific to *eSports*. eSportsbook wagering just means that people place bets on the outcomes of *eSports* events, for example, the LoL World Championship, instead of traditional sporting events, such as NHL or NBA games. Fantasy *eSports* allows participants to create their own virtual team of *eSports* players participating in a specific event, or a series of events, usually given a predetermined team salary cap. The virtual team receives points based on the performance of the real-life players. The virtual team that accumulates the highest scores wins the fantasy competition. eSportsbook wagering and fantasy *eSports* constitute the main components of "the cash" gambling market.

One of the peculiarities of the *eSports* wagering market is that participants can bet not only cash, but also some virtual items called skins. Skins allow changing appearance (but not functionality) of a player's in-game avatar, weapons, or equipment. Grove (2016b) compares their function to that of a casino chip. Players can deposit skins at a betting website and gamble using their deposited skins. They can not only place bets on any *eSports* outcomes, but also play traditional casino games such as blackjack and roulette, or a group of players can pool their skins and choose the winner by the means of lottery. Winners are paid in additional skins which they can use in a game, trade for other skins, or exchange for cash on third-party sites.

Out of 5.5 billion dollars total *eSports* wagering market in 2016, cash betting constituted only 649 million dollars or about 12% (Grove, 2016a); skin gambling accounted for the rest 88%. eSportsbook betting represents the main part of the cash gambling market – around 92%, with fantasy *eSports* amounting to 3% and head-to-head competitions to 5%. Head-to-head competitions imply that players bet on the outcomes of matches they participate in. According to Holden, Rodenberg and Kaburakis (2017b), there are four games that receive 92% of all current cash bets: League of Legends (38%), Counter Strike: Global Offensive (29%), Dota 2 (18%) and Starcraft 2 (7%).

The market for skin gambling is distributed across several dominant products (Grove, 2016b). eSportsbook betting is the largest segment, amounting to

[16] https://www.engadget.com/2018/05/31/esports-betting-gambling-legal-supreme-court-sportsbooks/

about 45% of all skins bets. The second most popular type of skin betting is jackpot-style games (26%), essentially lotteries, where players receive tickets based on the value of their deposited skins. Roulette-style and coin-flip games constitute 14% and 6% of all skins bets, respectively. The rest is a mixture of many smaller games such as blackjack, mystery boxes, slot machines, raffles, etc.

Despite the fact that skin betting accounts for about 88% of the *eSports* total wagering market, it primarily occurs within the player community of one game – Counter-Strike: Global Offensive (Grove, 2016b). The game was developed by Valve Corporation, which also owns the Steam marketplace, a digital distribution platform that provides technology allowing third-parties to enable trading, buying and selling skins. Even though Valve itself condemns gambling practices, and Steam does not have a system for turning skins into real world currency,[17] gambling with virtual items is acceptable under US laws and third-party websites create fluidity between virtual items and real currency, making skin betting ethically and legally questionable. The main controversy lies in the lack of age screening procedures that propels unregulated underage gambling.

In 2016 two lawsuits were led against Valve[18] resulting in cease and desist orders to websites using Steam accounts for commercial purposes (Holden, Kaburakis and Rodenberg, 2017a). In March 2018, to further combat the misuse of Steam accounts, Valve imposed a seven-day ban on trading new items.[19] Now, after acquiring a new skin (via trading or buying from the marketplace), players will have to wait seven days before being able to trade it again. The ban is supposed to impede the use for skins for gambling purposes, since the websites enabling gambling highly rely on the ability to trade each item very frequently.

With the market rapidly growing, there is a scarcity of research addressing *eSports* and gambling. The existing literature is mostly focused on legal and regulatory issues, especially on legal ramifications of classifying *eSports* as sport in U.S. (Owens, 2016; Holden, Kaburakis and Rodenberg, 2017a). Macey and Hamari (2018a) investigate the relationship between *eSports* spectating and gambling. Using data from international online survey they find that consumption of *eSports* has small to moderate association with gambling via the Internet, but not with offline gambling.

[17] http://www.digitalspy.com/gaming/news/a801327/valve-publicly-condemns-csgo-betting-sites/

[18] McLeod, *et. al* v. Valve Corporation and Reed v. Valve corporation.

[19] http://blog.counter-strike.net/index.php/2018/03/20308/

Further, Macey and Hamari (2018b) analyze participation rates and demographic characteristics of *eSports* spectators who gamble. The results indicate that individuals involved in *eSports*-related gambling activities are mostly young males, often underage. Participation rates were estimated at 67%, with rates of problematic and potentially problematic gambling at 50.34%. Even though the results of Macey and Hamari (2018a, b) rely on self-selected online survey data, which makes the generalizations difficult, these two studies highlight two important issues with *eSports*-related gambling. First, they provide evidence that underage gambling often takes place. Second, they underline convergence of gambling and the consumption of *eSports* via skin gambling and loot boxes.

Loot boxes are virtual items that players can buy with real or in-game currency, and which can be redeemed for a random selection of further virtual items, ranging from purely cosmetic items for a game character to game-changing equipment such as weapons or armor. One can equate loot boxes to gambling, because when a player opens a loot box, the items inside might not be what the player wants or they could be useless for a particular character. This could entice the player to spend more money to buy more loot boxes until he or she hits the jackpot.

In 2017, the Entertainment Software Rating Board (ESRB), which rates games for age appropriateness and factors like violence or sexuality, issued a statement saying that ESRB does not consider loot boxes to be gambling,[20] rather loot boxes are similar in principle collectible card games: players do not always get what they want but they always get something. The Entertainment Software Association, which represents game companies, stated that loot boxes "are a voluntary feature in certain video games that provide players with another way to obtain virtual items that can be used to enhance their in-game experiences" and that "they are not gambling".[21]

Despite these statements, in November 2017, Rep. Chris Lee of Hawaii proposed legislation that would prohibit the sale of games containing loot boxes to minors (House Bill 2686) and require game publishers to publicly disclose the odds of obtaining specific items from randomized loot boxes in their games (House Bill 2727).[22] If passed, the bills will not going to be the first legislation concerning the loot box practices. In 2017, Belgium's gambling authority decided that purchasable loot boxes constitute gambling[23] since they

[20] https://kotaku.com/esrb-says-it-doesnt-see-loot-boxes-as-gambling-1819363091

[21] https://www.cnbc.com/2017/11/22/state-legislators-call-eas-game-a-star-wars-themed-online-casino-preying-on-kids-vow-action.html

[22] https://arstechnica.com/gaming/2018/02/no-video-game-loot-boxes-for-buyers-under-21-says-proposed-hawaii-bills/

[23] https://www.engadget.com/2017/11/22/belgium-moves-to-ban-star-wars-battlefront-2-style-loot-boxes/

mix "money and addiction". In April 2018, video game loot boxes declared illegal under Belgium gambling laws. If video game publishers fail to comply, they can face a fine of 800,000 euros and up to five years in prison.

So far, the existing research on *eSports*-related gambling activities identified participants, specific practices and issues of this newly emergent and rapidly growing market. Yet there a lot of work remains to be done in this area.

3. Cheating in *eSports* Contests

Preston, and Szymanski (2003) identify three main categories of cheating practices in sport. The first is sabotage, which corresponds to any activity which reduces the performance of rivals, such as illegally restraining or assaulting competitors, or provoking illegal responses from competitors. The second is doping, which is defined as the ingestion of illicit substances or use of illicit methods to enhance athletes' performance. The third is match-fixing, the situation when one team makes side payments to the opposite team to make less effort or to referee to make biased decisions, or situations when players or officials can gain monetary benefit from gambling on the outcome of a competition.

Cheating and sabotage takes a slightly different form in *eSports*. Due to the computerized environment of competitions, teams are able to use software cheats in order to increase their chances to win or conduct online attacks to slow and disable an opponent. The gaming industry contains market for cheaters. They can purchase all kinds of digital tools to get around game rules. For example, they can buy modified code which allows gamers' characters to acquire special powers that would give them an unfair advantage over opponents. In 2018, a cybersecurity company Irdeto (2018) conducted an online survey of 5911 online gamers from six countries including China, Germany, Japan, South Korea, UK and US. The results of this *Global Gaming Survey Report* indicate that 60% of online gamers reported their multiplayer gaming experience to be negatively impacted by other players cheating on multiple occasions.

Doping is also a significant problem in *eSports*. After the 2015 doping scandal, when a professional Counter-Strike player admitted in interview that he and his teammates used Adderall while competing in a major *eSports* event, the Electronic Sports League (ESL) – the largest organizer of *eSports* tournaments – released a list of banned substances and announced the introduction of random drug-testing at their events (Holden, Rodenberg and Kaburakis, 2017b). But the general concerns about doping in *eSports* still remain because, apart from ESL, which specializes in League of Legends and Counter-Strike tournaments, there is no independent regulatory body for *eSports*.

There have been several match-fixing incidents at all levels of *eSports* competitions, including top-level tournaments. In 2013, a player and the manager of AHQ Korea, one of the top League of Legends teams, were found guilty of match-fixing.[24] They placed heavy bets against their own team and attempted to throw matches. After the match-fixing scandal in 2014, involving two professional Counter-Strike teams (iBuyPower and NetCodeGuides), Valve announced that 21 Counter-Strike players who were accused of willingly participating in match-fixing in competitive matches were permanently banned from the professional gaming events sponsored by Valve.[25]

The *eSports* Integrity Coalition (ESIC) was established in 2015[26] to combat the unethical described above. The ESIC created documents covering each category of cheating practices: Code of Conduct regulates incentives to win, Anti-Corruption Code deals with match-fixing, and Anti-Doping Policy defines the list of prohibited substances, describes procedures of testing players and specifies sanctions for anti-doping violations.

Aiming to protect the integrity of *eSports*, the ESIC partnered with a plethora of sportsbooks, betting sites, and local state gaming authorities to police integrity in *eSports*. For example, if one of the betting sites detects suspicious betting patterns it will report to the ESIC which, in turn, will investigate potential match-fixing with assistance from local gaming authorities. According to the Interpol (2018), there were 39 significant alerts about possible match-fixing to ESIC in 2017.

Overall, all regular sports cheating practices can be found in *eSports*, but there are some elements specific to *eSports* that can exacerbate the issue. First, the unregulated skins gambling market makes transactions between parties in *eSports* easier, encouraging cheating. Second, the computerized environment of *eSports* allows easy communication between team players and other parties (for example, owners of illegal betting sites), increasing opportunity for collusion. Third, the fact that videogames are essentially programming code introduces completely new tools for cheating, such as modifying the code to gain an unfair advantage. Regular sports does not have any experience in policing these types of unethical behavior. Combating cheating seems like a big challenge

[24] https://www.polygon.com/2014/3/18/5522192

[25] https://kotaku.com/pro-teams-implicated-in-huge-counter-strike-match- xin-1680514379

[26] https://www.esportsintegrity.com/about-us/what-we-do/

ahead for the industry. The issue might be approached from the supply side, by increasing the cost of hacking the code and controlling websites selling cheating tools, or from the demand side by reducing players' incentives to cheat. Finally, all efforts promoting integrity in *eSports* are decentralized and mainly depend on the willingness of a particular tournament organizer to participate. Since the *eSports* industry and its betting market are growing explosively all the issues pointed above will require multidisciplinary research.

VI. CONCLUSIONS

In the last three decades we have been observing an exponential growth in the *eSports* industry, the industry of "organized video games competitions" (Jenny *et al.,* 2017). Today, this industry is well-established both in terms of economic size and participants, and it has promising perspectives taking into account the demographic composition of its audience and its dynamic development (new games, technological improvements etc.).

This paper focuses on three aspects associated with this "new" industry: the structure, the organization and the size of the industry; the characterization of the audience; and the overview of the current research on topic and discussion of the possible directions for the future research. The main findings and conclusions can be summarized as follows:

- The *eSports* industry has more complex structure in comparison to traditional sports, because different agents can play multiple roles. The evidence about the industry revenues and the audience following (the fans who follow *eSports* in different ways) is very promising with a cumulative estimated annual growth rate for the period 2017-21 of 23% and 13.6%, respectively. But the consolidation of this trend relies on building a robust framework to govern both the industry, and financial and economic relationships within it.

- *eSports* and traditional sports participation are complementary, according to different pieces of evidence provided in the paper, supporting previous findings in the literature. The paper also provides some evidence on the profile and opinions of *eSports* participants, which can be useful in the design of marketing strategies in this industry. In particular, *eSports* participants practise team sports more frequently and the participation in organized competitions is higher than for non video gamers. Additionally, the main motivation for practising *eSports* is fun and entertainment, whereas consoles for video games and technological goods are the products which are seen as much representative for advertising in *eSports*.

- The availability of detailed data on individual/team performance allows researchers to use *eSports* setting to study questions related not only to sports economics but also to labor and behavioral economics. Moreover, *eSports* has specific features – computerized nature of the competitions and heavy embeddedness of betting market in the industry – that deserve special attention of researchers.

All in all, the recent evolution of the *eSports* industry is opening the new era in the sports industry. *eSports* will be considered as a new sport, with complementary relationship to the traditional sports, which opens vast opportunities for all stakeholders in the sports industry. At the same time, research based on *eSports* has a potential to contribute, not only, to relevant issues in sports economics, but also in economics, in general.

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About the autors

Isabel Artero Escartín

She is Professor of Applied Economics in the Faculty of Business and Public Management at the Universidad de Zaragoza. She was Deputy Minister for Economy, Treasury and Employment in the regional Government of Aragon from 2003 to 2011. She has been a member of the board of directors of several public enterprises and public-law institutions in Aragon. She is currently a member of the Aragon Economic and Social Council. Her academic and research activity has mainly focused on public sector economics, economic policy, and sports economics.

Eduardo Bandrés Moliné

He is Professor of Applied Economics of the University of Zaragoza since 1996. Doctor of Economic and Business Sciences. Corresponding Academic Fellow of the Royal Academy of Moral and Political Sciences. Regional Minister of Economy, Public Finance and Employment of the Government of Aragon between 1999 and 2006. His Academic and Research activities have mainly focussed on the field of public economics, with special attention on issues associated with public expenditure, distribution of income and the welfare state. He has published numerous articles in national and international scientific journals, as well as several individual books and compilations. He is currently the Director of Public Economy and Welfare at Funcas, Editor of the journal *Cuadernos de Información Económica* and together with José Félix Sanz Sanz Director of the journal *Papeles de Economía Española.*

Ángel Barajas

He is Full Professor and Director of the Department of Finance at the National Research University Higher School of Economics (Russia). He holds a BA degree in Economics and Business from the Universidad Complutense de Madrid, and a PhD degree in Business Administration from the Universidad de Navarra. He was hired as expert consultant by UEFA for the development of its Financial Fair Play program. He was Coordinator of the MBA program in Sport at the Universidad de Vigo. He is currently Director of the Master degree in Management and Analytics for Business at St. Petersburg School of Economics and Management.

David Berri

He is Professor of Economics at Southern Utah University who has spent the last two decades researching -within the field of sports economics- the evaluation of players and coaches, competitive balance, drafting of players, labor disputes, college sports, and gender issues.

Júlia Bosch Jou

She holds a BA degree in Economics and Business and a Master degree in Economic Analysis from the Universitat de Barcelona, as well as a Master degree in Economics from the University of Pennsylvania. She served in the Free Trade Zone Consortium as head of studies and information officer. From 1991 to 2001 she served as economist in the Technical Programing Committee of the Barcelona City Council. In September 1996 she joined the Institute for Territorial Studies at the Universitat Pompeu Fabra (UPF), where she was program director from 2001 to 2011. She presently works as consultant and is a researcher at the Centre d'Estudis UPF Sports _Lab (UPF).

Miquel Carreras Simó

He is graduated in Economics Sciences by Universitat Autònoma de Barcelona. He got a Master and Ph. D. in Economy and Business by Universitat Pompeu Fabra. Actually, he is full professor in the Department of Business at Universitat de Girona. The areas of interest in his research are: sport economics, financial and economic analysis of firms and industrial organization. His research has been published in journals like International *Journal of Sport Finance, Spanish Economic Review, Socio-Economic Planning Sciences* or *International Journal of Revenue Management.*

Pablo Castellanos-García

He is Associate Professor in the Department of Economics at the Universidad de A Coruña. His main research lines are Economic Policy and Sports Economics. He is co-author of the book *Economía, fútbol y bienestar social: El valor de un equipo para una ciudad [Economy, Football, and Social Welfare: The Value of a Club for a Town]* (A Coruña Provincial Council, 2003), and has published several articles in *Estudios de Economía Aplicada, European Sport Management Quarterly, International Journal of Sport Finance, International Journal of Sport Policy and Politics, Journal of Quantitative Analysis in Sports, Journal of Sports Economics, Sport, Business and Management, Rivista di Diritto ed Economia dello Sport,* and *Urban Public Economics Review.*

About the autors

Yulia Chikish

She is graduated from Far Eastern National University in Vladivostok, Russia majoring in Mathematics and Economics. She got her Master degree from Central European University in Budapest, Hungary and she is currently a Ph.D. candidate in West Virginia University. Her research interests include sports economics, urban economics and behavioral economics.

Julio del Corral

He holds both a BA (2002) and a PhD (2009) degree in Economics from the Universidad de Oviedo. He is Tenured Professor (2018) in the Faculty of Law and Social Sciences at the Universidad de Castilla-La Mancha (Ciudad Real campus). His research focuses on efficiency and productivity measurement, Applied Economics, and Sports Economics. He is a member of the editorial board of the *Journal of Sports Economics*. (http://blog.uclm.es/juliocorral/)

Paul Downward

He is Professor of Economics at Loughborough University (UK) and has wide ranging interests in sport. He has published several books on the Economics of Sports and is currently co-editing a *Handbook on Sports Economics.* He is the editor of *European Sport Management Quarterly* and also a member of the Executive Board of the European Association for Sport Management. He is president of the European Association of Sports Economics. He has published in high quality journals with recent publications in *European Journal of Public Health, European Journal of Sport Science, Social Science & Medicine* and *Journal of Sports Economics*.

Manuel Espitia-Escuer

He is Full Professor of Business Organization at the Universidad de Zaragoza. He holds a BA degree from the Universidad de Barcelona, and a PhD degree from the Universidad de Zaragoza. He has authored numerous papers in the field of business administration, in particular on valuation, productivity, and growth and internationalization strategies, which have been published in journals such as *International Management Review, Journal of Economics and Business Organization, Applied Financial Economics, Journal of Sports Economics, Management Decisions, Spanish Economic Review, Investigaciones Económicas,* and *Moneda y Crédito.* He has conducted research work for institutions such as the Spanish Professional Football League (LFP), Funcas (Savings Banks Foundation), BBVA bank, the Institute for Financial Studies (IEF), and the governments of Catalonia (Generalitat) and Aragon.

David Forrest

He is professor of Economics in the University of Liverpool Management School. He has published on a wide range of topics in the economics of sport and the economics of gambling behaviour. Match-fixing issues lie at the interface between these two fields and he has engaged heavily in attempts to protect integrity, advising governments, regulators, the courts and player unions.

Rodney Fort

He is professor of Sport Management at the University of Michigan and recognized internationally as an authority on sports economics and business. In over 100 articles and monographs, and 6 books, his work covers sports topics as diverse as sport itself. Professor Fort is a regular speaker on sports issues and has been a keynote speaker at international sports congresses and a panelist at various universities and institutes. He has testified before the U.S. Senate, the New Zealand Commerce Commission, his signature is on Amicus Briefs to the Supreme Court of the U.S. and government regulatory agencies. He also has been featured on national television, cable news channels, and National Public Radio.

Jaume García Villar

He is Full Professor of Applied Economics at the Universitat Pompeu Fabra. He holds a PhD degree in Economics from the London School of Economics and Political Science. He was Director of the Spanish National Statistics Institute (INE) (2008-2011), and is a member of the European Statistical Governance Advisory Board. His areas of expertise are: microeconometrics, sports economics, labor economics, health economics, game theory, and consumer behavior analysis. His works have been published in scientific journals such as: *Oxford Bulletin of Economics and Statistics, Health Economics, Journal of Sports Economics, International Journal of Sport Finance, Applied Economics, Empirical Economics* and *Journal of Housing Economics,* among others.

About the autors

Lucía Isabel García-Cebrián

She is Tenured Professor of Business Organization at the Universidad de Zaragoza. Her research focuses on the efficiency of football clubs both in the Spanish Professional Football League and the UEFA Champions League, and her works have been published in the following journals: *Journal of Sports Economics, European Sport Management Quarterly, Managerial and Decision Economics, Management Decision, Journal of Physical Education and Sport, International Journal of Sport Management and Marketing, Sport, Business and Management, Athens Journal of Sports,* and *Oikonomia & Ahtlitismos*.

Pedro García- del-Barrio

He is Associate Professor of Economics in the Universitat Internacional de Catalunya. His teaching experience also includes the universities of Navarra and Pompeu Fabra. He holds a MSc degree in Economics from the University of Southampton (2000), and a PhD degree from the Universidad de Navarra (2002). His main fields of research are labour economics and sport economics. He is Academic Director of MERIT (www.meritsocialvalue.com), and has published articles in various academic journals: *Applied Economics, Labour, Journal of Sports Economics, Managerial and Decision Economics, Review of Industrial Organization, Economic Modelling, Journal of Economics, Economics of Governance,* etc.

Brad R. Humphreys

He is Professor of Economics in the Department of Economics, College of Business and Economics at West Virginia University. He received his PhD in economics from the Johns Hopkins University. He was named the 2017 Benedum Distinguished Scholar in Social and Behavioral Sciences at West Virginia University. He previously held positions at the University of Illinois at Urbana-Champaign and the University of Alberta. His research on Sports Economics has been published in academic journals in economics and policy analysis. He has published more than 100 papers in peer-reviewed journals in economics and public policy.

Stefan Kesenne

He is Emeritus Professor in Economics at the University of Antwerp (UA) where he has been teaching Econometrics, Macroeconomics, Labour

Economics and Sports Economics. His most important research area was, and still is, Sport Economics. He has published in many internationally reviewed journals and is the author of the well-known textbook: *The Economic Theory of Professional Team Sports, an analytical treatment,* sec.ed., Elgar, 2014. He is also a member of the Editorial Board of the *Journal of Sports Economics* and of the Scientific Committee of CIES in Switzerland.

Fernando Lera López

He is Tenured Professor of Applied Economics at the Universidad Pública de Navarra, and a member of the Institute for Advanced Research in Business and Economics at that same university. One of his key research areas is Sports Economics, having particularly focused on sports participation and spending and their social and economic effects. He has published articles in the most prestigious specialized journals at the international level, such as the *Journal of Sport Management, Journal of Sport Economics, International Journal of Sport Finance, European Sport Management Quarterly, Sport Management Review, Journal of Sports Sciences,* and *European Journal of Sport Science.*

Cristina Muñiz

She is an Associate Professor in the Department of Economics at the University of Oviedo (Spain). She has an expertise in applying econometric models to examine the engagement of individuals in leisure activities, with particular interest in sports and cultural activities. She has also recently published papers on Ecotourism and Labour Economics. She is a member of the editorial board of the *European Sport Management Quarterly (ESMQ).* She has also membership of various Spanish sports economics associations and has carried out various stays in prestigious international research centres in Germany, Switzerland and the United Kingdom.

Carles Murillo Fort

He is Emeritus Professor of Applied Economics at the Universitat Pompeu Fabra (UPF) in Barcelona. He is academic coordinator of the Centre d'Estudis UPF Sports_Lab, and Director of the Master degree program in Sports Management at the Barcelona School of Management, both attached to the UPF. He is Chairman of the Board of Directors of SEED (Spanish Society of Sports Economics), and a member of the Board of Directors of the Sports Industry in Catalonia (Indescat) Cluster. His research is primarily focused on the weight of the sports sector, the legacy and impact of sporting events, as well as on sports management in the field of professional competition.

Ignacio Palacios-Huerta

Ignacio earned a bachelor in Mathematical Economics from the Universidad del Pais Vasco UPV/EHU, and a Masters and a PhD in Economics from University of Chicago. His doctoral thesis was directed by Nobel Prize in Economics, Gary Becker, and Kevin Murphy. He is currently professor of Economics, Management and Strategy at the London School of Economics. He has previously taught at Brown University, University of Chicago, and Dartmouth College, and was National Fellow at Stanford University. He has published in prestigious international academic publications, such as *American Economic Review, Econometrica, Review of Economics Studies,* Princeton University Press and MIT Press.

Levi Pérez

He is associate professor in the Department of Economics in the University of Oviedo, Spain. His research in the economics of gambling has led to a significant number of publications and research grants, including participation in two grants from the Spanish Government to research on microeconometric aspects of individual behaviour. He also had some research contracts with the Spanish National Lottery Agency to investigate the demand for lottery and sports betting.

Josep Maria Raya

He is Full Professor at the School of Social Sciences and Business (ESCSE), located in the Mataró Tecnocampus and attached to the Universitat Pompeu Fabra. His key research areas are housing economics, tourism, and sport. He has published papers in more than 25 JCR journals, such as: *Journal of Housing Economics, Regional Science and Urban Economics, Papers in Regional Science, Regional Studies, Tourism Management, European Sport Management Quarterly,* and *Journal of Sports and Social Issues.* He has furthermore participated in several research projects whose purpose was to estimate the impact of a sporting event or a tourism activity.

About the autors

Plácido Rodríguez Guerrero

He is Full Professor of the University College Department of Economics at the Universidad de Oviedo. He holds BA degrees in both Economics and Business Studies and Law, as well as a PhD degree in Economics. He is Director of the Gijón Sport Economic Observatory Foundation (FOED) since 4 October 2007. He was Chairman of the International Association of Sports Economists (IASE) from 30 June 2010 to 4 December 2014, and its honorary chairman from that date onwards. He is also one of the nine founders of the European Association of Sports Economics (ESEA). He is the oldest founding member of the Spanish Society of Sport Economists (SEED). He is research coordinator of the 2015 Research Group on Economics of Leisure, Culture and Sports (ELCS) at the Universidad de Oviedo. He has organized over twenty international conferences on Sports Economics. He received the 2018 Larry Hadley Service Award granted by the North American Association of Sports Economists (NAASE). He was President of the Real Sporting de Gijón football club (1989-1992).

Ramón Sala-Garrido

He is Full Professor of Mathematics for Economics and Business at the Universitat de Valencia. He has devoted part of his research work to sport and the analysis of football teams and players. His works have been published in journals such as *Omega (The International Journal of Management Science), European Sport Management Quarterly, Journal of Quantitative Analysis in Sports, Estudios de Economía Aplicada,* and *Fútbol Profesional* (official journal of the Spanish Professional Football League), among others. He was also editor of the book *Economía del deporte en tiempos de crisis (Sports Economics in Times of Crisis).*

Luis Carlos Sánchez

He holds a BA degree in Business Administration and Management from the Universidad de Oviedo, and a Master degree in Economic-Financial Management from the Center for Financial Studies (CEF). He was runner up for the AECA Award for articles on business administration (2005), as well as for the Financial Studies Award for articles on accountancy and business administration (2006). He won the CESGAR Award for his research on mutual guarantee societies (2009). At present, he is risk analyst in a financial entity, and is pursuing a doctorate at the Universidad de Vigo.

About the autors

Patricio Sánchez-Fernández

He holds a PhD degree in Economics from the Universidad de Vigo, and a Postgraduate Diploma in Marketing and Enterprise Skills from the Galway Institute of Technology (Ireland). He is currently active in the Department of Financial Economics and Accountancy, as well as in the GEN (Governance and Economics Research Network) research group at the Universidad de Vigo. He was a member of the research team for competitive projects at the national level, having conducted research on Economics, business management, tourism, and sport. He is Deputy Director of the Galicia Economic Forum, having contributed to the yearly Report on the Socioeconomic Situation since its inception in 2014.

José Manuel Sánchez-Santos

He holds a PhD degree in Economics from the Universidade da Coruña, where he is Tenured Professor in the Department of Economics. His research focuses on socio-economics, economic policy, and sports economics. In this latter research area, he has co-authored the book *Economía, fútbol y bienestar social: El valor de un equipo para una ciudad [Economy, Football, and Social Welfare: The Value of a Club for a Town]* (A Coruña Provincial Council, 2003), and has published several articles in journals such as *Estudios de Economía Aplicada, Rivista di Diritto ed Economia dello Sport, European Sport Management Quarterly, International Journal of Sport Finance, Journal of Quantitative Analysis in Sports,* and *Journal of Sports Economics.*

Rob Simmons

He is Professor of Economics at Lancaster University Management School. He has published widely on empirical topics within sports economics such as player salaries, impact of diversity on team performance, racial discrimination, superstar effects in sports and also various aspects of audience demand including fan responses to corruption.

María José Suárez Fernández

She holds a PhD degree in Economics from the Universidad de Oviedo, where she is Tenured Professor. She was visiting post-doctoral fellow at the University College London. She has collaborated in several research projects supported by public institutions. Her research focuses on the economics of labor, culture, and sports. She has published articles in both international and national scientific journals such as: *European Journal of Health Economics, Labour Economics, Review of the Economics of the Household, Journal of Sports Economics, International Journal of Sport Finance, Journal of Cultural Economics, Revista de Hacienda Pública, Spanish Economic Review,* and *Revista de Economía Aplicada.*

Stefan Szymanski

He is the Stephen J. Galetti Professor of Sport Management at the University of Michigan. Prior to moving to Michigan he was a professor of Economics at London Business School, Imperial College Business School and Cass Business School. His research in sports has focused mainly on the theory of contests with its application to sports and empirical work on the relationship between financial resources and sporting performance.

Juan de Dios Tena Horrillo

He is academic researcher at the University of Liverpool (United Kingdom) and the Università degli Studi di Sassari (Italy). In 2004 he obtained a PhD degree from the University of Newcastle Upon Tyne, and went on to work for the Tel Aviv University (Israel), the Universidad de Concepción (Chile), and the Universidad Carlos III de Madrid (Spain). His research focuses on applied econometrics, with particular emphasis on sports, health, and education economics.

Carlos Varela-Quintana

He holds both a BA degree (1997) and a PhD degree (2017) in Economics from the Universidad de Oviedo. He was statistics analyst for market research in the private sector for seventeen years. Presently, he is Adjunct Professor in the Jovellanos Faculty of Commerce, Tourism and Social Sciences at the Universidad de Oviedo (Gijón campus). His research focuses on Sports Economics, Tourism Economics, Marketing, and Behavioral Economics.

Published issues

Sports (and) Economics

...The firm in professional sports is indeed in a peculiar position vis-à-vis our accepted way of looking at the firm in a competitive market. The basic proposition can be called the Paradox of Louis-Schmelling. (p.1)

Walter C. Neale (1964). «The Peculiar Economics of Professional Sports». *The Quarterly Journal of Economics, 78(1),* pp. 1-14.

Sportometrics is different. It is the application of economic theories to the behavior of athletes to explain what they do and to see if what they do can help to explain the behavior of people in other professions and settings. Instead of being about the «economics of sports,» sportometrics introduces the idea of «sports as economics».

Robert D. Tollison (2008). Sportometrics. In D. Henderson (ed.), *The Concise Encyclopedia of Economics* (pp. 471-473). Indianapolis: Liberty Fund.

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C/ Caballero de Gracia, 28
Madrid, 28013, Spain
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