De conformidad con la base quinta de la convocatoria del Programa de Estímulo a la Investigación, este trabajo ha sido sometido a evaluación externa anónima de especialistas cualificados a fin de contrastar su nivel técnico.

ISSN: 1988-8767

La serie DOCUMENTOS DE TRABAJO incluye avances y resultados de investigaciones dentro de los programas de la Fundación de las Cajas de Ahorros.
Las opiniones son responsabilidad de los autores.
Abstract

Nowadays, in the development of new products it becomes necessary to recognise the importance wielded by agents external to the firm as a source of innovation activities. The complexity and dynamism of present environments make it obligatory to complement the internal knowledge base with others coming from outside, and thus a distinction is made between internal and external innovation sources. Since the former have been adequately studied and analysed in the literature, the present work aims to make progress in knowing the latter. For this purpose, an analysis has been made of the influence of nine types of cooperation with external agents on three indicators of innovatory effort in twenty industrial and service sectors in Spain. These indicators have been: the total intensity of innovation activities, the intramural R&D intensity and the extramural R&D intensity. The findings indicate the existence of very diverse effects on the basis of the partner chosen to cooperate with.

KEYWORDS: R&D cooperation, external innovation sources, innovatory effort, innovation intensity, intramural R&D, extramural R&D.

JEL Classification: O32

(*)Corresponding author: Phone: +34 987 291000 Ext.: 5473 - Fax: +34 987 29 17 50, E-mail: gloria.sanchez@unileon.es
1. INTRODUCTION

The environment in which economic activity takes place in most countries is characterised by a great deal of dynamism and complexity. Brusque changes in technology, in customers and competitors mean that firms have to renew themselves continuously in order to survive and in many cases, those changes take the form of seeking new ways of carrying out their activities, which include innovation activities.

Traditionally, economists in studying innovation processes used as their starting point the premise that product manufacturers were the starting point of these processes. In opposition to this, researchers on technological and organisational change have shown that if the manufacturer is assumed to be the only source of innovations, this considerably limits the view of the innovation process (von Hippel, 1988, 2005). For example, in the evolutionary view of technological change a modern innovation process is assumed, characterised not just by the need for feedback among the different stages, but also by the multidisciplinary nature of inputs and the many sources of relevant information for firms (Rosenberg, 1976, 1982). Similarly, in the literature on strategic management and specifically with the Resource Based Approach -RBV- (Penrose, 1959; Rumelt, 1984; Teece, 1984; Wernerfelt, 1984; Barney, 1991, Peteraf, 1993) it has been shown that agents from outside the firm constitute an important resource in the present-day competitive framework, particularly as far as the development of new products and processes is concerned.

In accordance with these ideas, variations in the performance of firms competing in the same industry could be explained by differences in their provision and use of resources (Barney, 1986a, 1986b, 1991, 2001; Peteraf, 1993; Wernerfelt, 1984) and these resources also include the sources of innovation used by firms.

Within this framework, it is thought that firms having valuable, rare, non-substitutable and inimitable resources will be able to achieve and maintain over time a position of advantage with regard to their competitors (Barney, 1995: 56). Consequently, it is not difficult to understand that in the midst of a large diversity of resources owned by a firm, tangible and intangible, the latter will be the ones offering the greatest chances of becoming a source of competitive advantage (Ray et. al., 2004). These intangible ones can be amassed in the firm and their origin could be found in relationships that the former maintains with external agents in questions of innovation. Their high tacit component and social complexity (Dierickx y
Cool, 1989; Peteraf, 1993) makes these resources difficult for any competitor to identify and/or reproduce.

In accordance with these ideas, it is important for the firm to cooperate with other agents for the development of innovations (Mowery and Rosenberg, 1989; Arora and Gambardella, 1990), thus extending their possibilities and ways of learning. These external sources may have very different origins, from users to component and material suppliers and other agents involved in the innovation process (von Hippel, 1988, 2005; Arora and Gambardella, 1990; Gemünden et. al., 1992; Powell et. al., 1996).

Although in recent years the knowledge of cooperation in innovation activities has become considerably greater, there are still many aspects of this phenomenon requiring further attention. Among some of the questions outstanding is the study of the effects that external information sources exert on the intensity of innovation activity and on the strategy for acquiring technology.

In studies at firm level, the analysis of these relationships is not easy due to a problem of endogeneity between the two variables. An important body of empirical evidence has found that innovatory effort influences on the decision to cooperate for the development of innovations (Colombo and Garrone, 1996; Fritsch and Lukas, 2001; Tether, 2002; Belderbos et. al., 2004; Bönte and Keilbach, 2005; Bayona et. al., 2006) and a small group of studies has analysed the inverse causality, that is, the effects of cooperation on innovatory effort (D’Aspremont and Jacquemin, 1988, 1990; Katz and Ordover, 1990; Colombo and Garrone, 1996; Kaiser, 2002). This latter set of studies has been motivated by comparing the hypothesis that cooperation increases firms’ innovatory effort and that this can be transformed into a source of competitive advantage.

Industry-level analyses could be appropriate to analyse these aspects, since they do not suffer from endogeneity problems in the sample selection (Callejón and García-Quevedo, 2005) and have also the advantage of used more accessible data, so it facilitates comparisons with other countries. In accordance with this evidence, we propose an aggregate study at industry level pursuing two aims: firstly, to determine what type of partner in cooperation has the greatest impact on the innovation intensity and, secondly, to discover the influence of these partners in how industries distribute internal technology development or buying-in as a source of competitive advantage.
Unlike other studies, as a novelty nine different types of cooperation are used, including cooperation with: 1) other firms within the same group, 2) customers, 3) suppliers, 4) competitors and firms from the same sector, 5) experts and consultants, 6) commercial laboratories or R&D firms, 7) universities, 8) public R&D agencies and 9) public technological centres. Furthermore, the effect of these sources has been calculated by using different indicators of innovatory effort and specifically three: 1) total intensity of innovation activities, 2) intramural R&D intensity and, 3) extramural R&D intensity. This latter distinction is made with the object of obtaining conclusions concerning the effect of cooperation with various external agents on the level of internal or external technological development.

The work is structured as follows. In Section 2 the theoretical framework of the paper is presented, offering a review of the most important reasons for cooperating in R&D with certain external agents. In section 3, there is a description of the methodology and data used as well as the sample of Spanish sectors from the viewpoint of their innovatory effort and the use of external agents for developing innovations. Section 4 records the findings and the discussion of the empirical analysis. Section 5 presents the main conclusions of the study, as well as future lines of research.

2. COOPERATION WITH EXTERNAL AGENTS FOR THE DEVELOPMENT OF INNOVATIONS

Currently, the idea that the innovation process is only originated in manufacturing firms has been completely rejected. Nowadays, the importance of having sources of information and knowledge located outside the firm has been well enough demonstrated, although other recent studies also remark the importance of internal sources of innovation (Baranano et. al., 2005). In this context, throughout the literature it has been recognised that firms’ performance will depend to a great extent on their ability to find, absorb and handle these sources in a productive fashion (Cohen and Levinthal, 1990).

The convenience of complementing the firm’s internal knowledge base with external sources was initially recognised by Alfred Marshall in 1925. In his work, he stressed how important it was for economic progress that firms should develop positive externalities through a market-based organisation (Marshall, 1925:335). Furthermore, those external
sources can be quite diverse, ranging from customers, suppliers of components and materials to competitors or other agents involved in the innovation process (von Hippel, 1988, 2005).

In this line, the R&D department of any firm is not the sole source of innovation activities. In a general sense, innovation sources are divided into two types: internal versus external (some of which are detailed in Figure 1). The former are related to the innovative activities carried out within the firm, especially in R&D, marketing and production departments. The second comprise: (a) market-based sources (such as competitors, buying embodied or disembodied technology, customers or users, experts and consultants, suppliers of equipment, materials, components and software, technological centres, commercial laboratories or R&D firms, etc.), (b) educational centres or research centres, among which there are public or private research institutes and universities and, (c) general publicly available information, regarding published patents, conferences, professional meetings and journals, fairs and exhibitions.

However, when obtaining information needed to develop innovations, firms have followed two types of strategy: generating this knowledge in-house or buying in, in other words, make or buy, in the terminology of Veugelers and Cassiman (1999) or Santamaría (2001). On the other hand, in recent times analysts have noticed a third hybrid form for obtaining this knowledge: cooperation with other agents in innovation activities (Navarro, 2002).

The above-mentioned comments make it clear that firms are different with regard to the innovation sources they use and, as a consequence, in their innovatory effort. Thus, knowing the source of innovation activity will be a determining factor in improving competitive advantage.

But, what is more, the motives for cooperating with one type of agent or another are very diverse, and this information is highly useful for a better understanding of the phenomenon of cooperation. Among the most important motivations are those related to technological complexity, risk/costs sharing and funding opportunities (Hagedoorn, 1993; Cassiman and Veugelers, 1998; Bayona et. al., 2003). Thus, following Bayona et. al. (2001) these motives can be classified in two broad categories: (a) technology-related (such as the technological complexity of the industry or reduction in R&D expenditures) and (b) market-linked (such as...
creation of and introduction into new markets or new product launches). Below we list some of these motivations according to the type of agent.

Cooperation with customers and suppliers

Establishing a relationship with customers and suppliers is normally referred to as vertical or non-competitive cooperation, compared to horizontal cooperation, which is that existing between competitors. One of the main motivations for relationships with these agents is the high degree of efficiency achieved compared to other types of collaboration to conclude the innovation process in new products or process (Tether, 2002; Bayona et. al., 2003; Santamaría and Rialp, 2007). In other cases, emphasis is given to the importance of this collaboration from the viewpoint of developing innovative activities and creating knowledge for firms (Tunisimi and Zanfei, 1998). They are also usually the favourite partners when the goals pursued by firms are of a commercial nature -breaking into new markets, internationalisation, etc.- (Bayona et. al., 2001, Santamaría and Rialp, 2007).

Specifically in the case of customers, the information provided by these agents is particularly valuable in the case of complex technologies and/or products (Tether, 2002) or when the product presents high levels of novelty (Amara and Landy, 2005). This is due to the fact that user experience in handling them maybe very helpful both in improving existing design and in thinking up new models or applications. The joint development of a piece of technology with customers makes a contribution to improving market share or strengthening the firm’s product credibility (Tether, 2002). Thanks to interaction with these partners, the firm acquires a profound knowledge of their needs, and can put this information to use to forecast the likely competitive success of a new idea (Gemünden et. al., 1992).

Moreover, thanks to newly developed techniques¹ for working with these agents in innovation, it is possible to go beyond the improvement in the known qualities of the product or service, and even make it to identify needs which, in many cases, the customers themselves are unaware of as yet. This allows present day firms to deal rapidly with changes in consumer tastes as experienced by modern societies (von Hippel and Katz, 2002). As well as improving product design, these methods of collaboration provide other advantages such as a more

---

¹ For example, the Extreme Programming (XP) analysed by Gassmann et. al. (2006).
controlled development of the innovation process, with fewer costs and time, etc. (Jeppesen, 2002).

On the other hand, interest in relationships between manufacturing firms and their suppliers sprang up from the eighties onwards on the basis of the success of Japanese manufacturers of cars and electronic products, a success ascribed, among other factors, to the close relationships maintained by both groups of agents for the development of innovations (Bidault et. al., 1998). In the West and most specifically in the United States and the United Kingdom, the recent trend in large firms to downsize and concentrate on their core competences, has led greater collaboration with suppliers to ensure the supply of quality inputs (Berderbos et. al., 2004).

It is worth their while to go to suppliers in sectors characterised as having a highly competitive and changing environment where different types of research are required to maintain competitive position (Peters and Becker, 1998). In similar fashion to what happens with customers they facilitate the development of new products and processes and their adaptation to the market, improve their quality or increase the productivity and flexibility of the firm (Chung and Kim, 2003). Another important motivation for collaborating with suppliers is that they help to reduce production costs (Atallah, 2002) as well as the costs and risks involved in new product development (Chung and Kim, 2003).

Cooperation with competitors

Relationships with competitors are also known as horizontal cooperation and, however strange it may appear, they are a very common type of cooperation. These agreements are interesting because they contribute to strengthening international competitiveness in firms, industries and countries and to solving some of the problems related to market failures as well as other technological deficiencies found in them (Harabi, 2002). In spite of this, some authors are more in favour of vertical cooperation since they regard it as leading to greater investment in R&D, higher levels of outputs and greater welfare (Steurs, 1995).

At a private level firms participating in this type of agreement are seeking, among others, two aims: (a) to exploit economies of scale and range in R&D and, (b) take advantage of synergies which may arise from private contributions of knowledge and capability made by each partner to the common project. There is also the reduction of investment risk and market
uncertainty, as well as overcoming financial difficulties which may affect a firm when starting up R&D activities -the costs are shared- (Harabi, 2002).

But in addition to the incentives which might lead a firm to have a relationship with a competitor, in this type of collaboration the risks incurred are greater than in other categories. These risks basically are related to the possibility of anti-competitive behaviour (Tether, 2002), as well as with the fact that the firms’ key knowledge may fall into the hands of competitors quite involuntarily –involuntary spillovers- (Casiman and Veugelers, 2002; Miotti and Sachwald, 2003). Thus, these relationships occur in protected areas or using knowledge which is not key to the firm. That is, working areas are sought where common problems frequently crop up, whilst those where there might be rivalry are avoided (Tether, 2002; Cassiman and Veugelers, 2002). For these reasons, relationships with these agents are normally restricted to carrying out basic research and establishing standards in the sector (Gemünden et. al., 1992; Tether, 2002), with collaboration in research projects where no rivalry exists.

**Cooperation with agents of the public R&D system**

Unlike what happens in the case of collaboration with competitors, cooperation with public agents does not imply any type of commercial risk, since these agents are not looking to apply their research in the market, but rather they are geared to generating R&D knowledge of a basic or generic nature (Miotti and Sachwald, 2003).

Research centres and universities play an important role in developing technological innovations since they make important contributions in new scientific and technological knowledge (Drejer and Jørgensen, 2005). They contribute to increase firms’ technological and research capabilities, and make easier to work close to the technological frontier (Miotti and Sachwald, 2003). Thus, the fundamental reason for making use of them is to acquire such knowledge, which in most cases is basic in nature (Cassiman and Veugelers, 1998; Davenport et. al., 1999; Bayona et. al., 2000).

However, although currently these agents are not sufficiently ready to deal with the demand for more specific knowledge, there is a trend towards a change in this direction (Santoro and Chakrabarti, 1999). In this sense, it is worth pointing out that in certain cases the firm may make have access to specialized knowledge flows (spillovers) and to the results of
public research carried out by these organizations, with the aim of exploiting technological opportunities which may spring up from this basic research (Mohen and Hoareau, 2003).

Possibly, one of the prime motives for taking part in this type of collaboration might be the chance of obtaining public funds to carry out research\(^2\) (Davenport *et. al.*, 1999; Bayona *et. al.*, 2001; Cassiman and Veugelers, 2002; Miotti and Sachwald, 2003; Fontana *et. al.*, 2006). Along these lines and, in order to encourage relations between industry and research institutes, policy-makers, in many cases, have considered the existence of this type of links to be a requisite for choosing projects worth subsidising with public funds.

As well as the search for knowledge, many firms collaborating with universities and public research centres are spurred on by the fact of sharing risks (Cassiman and Veugelers, 1998) though other studies show that although risk reduction is one of the main reasons for cooperation in innovation activities, it is less so when the firm collaborates with agents of the public R&D system (Davenport *et. al.*, 1999; Montoro-Sánchez *et. al.*, 2006).

In any case, this type of relationship should never be a replacement for in-house R&D investment since, as occurs with the other outside agents, the firm needs to have an important in-house R&D capability to be able to absorb the scientific knowledge that might be provided by any of these agents (Cohen and Levinthal, 1990).

*Cooperation with experts and consultants*

Often any of the agents of the public R&D system mentioned in the previous paragraph is too slow and does not react completely to firms’ expectations as far as development of innovations is concerned. Occasionally, this leads to the need to seek alternative sources of information and knowledge. In this way, experts and consultants are seen as a good solution to this problem (Tether, 2002), in the sense that they can provide applied knowledge as well as more specialised information and skills.

The contributions made by this type of agents to firms are not only related to cost savings but also include a wide diversity of valuable inputs for the development of the innovation process. In this sense, it can be mentioned the possibility of sharing experiences, helping the

\(^2\) Many of the relationships of cooperation set up with universities and research centres take place within the framework of programs for promoting research, both national and international.
firms in defining and articulating its specific needs in innovation, offering ideas on new needs and solutions or transferring ideas among firms, etc. (Bessant and Rush, 1995).

Furthermore, the fact of collaborating with experts and consultants unconnected with the firm provides a different viewpoint to that which may be held by those working inside it. The company staff is familiar with their own products and processes. And this normally acts as a brake on thinking up new possibilities. These agents pass on new and different information regarding the context in which the firm and its products operate, and this gives rise to the production of a larger number of innovative ideas (Bruce and Morris, 1998).

3. METHODOLOGY, DATA AND SAMPLE

In this work our aim is to make a quantitative analysis of the effect that cooperation with nine types of external agents has on the innovatory effort of the Spanish productive sector. The attempt is to identify, from among nine possible partners considered here, which has a significant impact on this effort and on the technology access strategy.

To achieve this aim, it could be possible to formulated three regression equations for the comparison of three models, corresponding to the three dependent variables: total intensity of innovation activities, intramural R&D intensity and extramural R&D intensity. However, as the error terms of the three models are likely to be correlated, an extension of regression model known as multivariate model (Greene, 2000) is usually a more appropriate estimator. The multivariate regression model has the following specification:

\[ Y_1 = \alpha + \beta_1 X_{1i} + \ldots + \beta_9 X_{9i} + \varepsilon_i \]  
\[ Y_2 = \alpha + \beta_1 X_{1i} + \ldots + \beta_9 X_{9i} + \varepsilon_i \]  
\[ Y_3 = \alpha + \beta_1 X_{1i} + \ldots + \beta_9 X_{9i} + \varepsilon_i \]

3. Total intensity of innovation activities refers, not only to intramural and extramural R&D activities, but also to the effort shown in other activities such as training, acquiring new knowledge, introducing innovations into the market, design and other preparations, acquiring machinery and equipment, etc. (INE, 2003). Nonetheless, since intramural and extramural R&D are the activities accounting for the major share of innovation expenditure (65% of total expenditure in activities for innovation), they are more interesting for carrying out an individualised analysis.

4. Anyway, we also present the results of three independent regression models in order to offer more robust results. The Appendix 1 offers these estimations and as can be seen, they do not differ from those of the multivariate model.
Where \( Y_{1,\ldots,3} \) refer to the innovatory effort and \( X_{i_1,\ldots,9} \) correspond to the nine types of cooperation. In Table 1 the measurements of the model’s variables are described.

The data come from a sample of twenty sectors (see Tables 1 and 3) which make up the group of manufacturing and service firms in the Spanish economy. The information has been provided by the National Institute of Statistics (INE, 2003) and specifically on its Encuesta sobre Innovación Tecnológica (survey on technological innovation in firms) corresponding to the period 2001-2003. It is worth pointing out that this survey has been designed to provide information on the structure of the innovation process (R&D and other innovative activities) and enables the relationship between this process and firms’ technological strategy, the factors influencing their capability to innovate and firms’ economic performance to be shown.

In the period studied it can be seen (see Appendix 1) that the sectors which record the highest levels of innovation activities intensity were industrial sectors and more specifically, the Transport Machinery and Material sector, the Textile, Clothing, Leather and Footwear sector and Chemical Products sector. On the service side, the outstanding areas are Real Estate and Services to Companies, along with the Communication sector. As for the sectors making the least effort in innovation, compared to their turnover, we found Building and Energy and Water on the industry side and Financial Brokering and Commerce and Catering on the service side.

So far as intramural R&D intensity is concerned, in the case of manufactures once more the outstanding sectors are Chemical Products and Transport Machinery and Material, the efforts of which in R&D activities accounted for 1.52% and 0.92% of turnover respectively and, as far as services are concerned, those of Real Estate and Services to Companies, with 1.26% of their turnover. The sectors with the lowest intensity for in-house R&D activities during this period were once again the Building industry, with 0.05% and Commerce and Catering, Transport and Warehousing services, with values of 0.03% and 0.08% of their turnover, respectively.

It is worth highlighting that in comparison with the intensity of in-house R&D activities, extramural R&D intensity was considerably lower, in general in all sectors, except for the cases of Building (0.06% in extramural R&D compared to 0.05% for intramural R&D) and that of services to Commerce and Catering (0.02% in extramural R&D compared to 0.03% for intramural R&D). In this section the sectors with the highest intensities turned out to be
exactly the same ones as in the previous case for manufacturing firms (Transport Machinery and Material and Chemical Products), whereas in the service sectors once again the outstanding cases were Real Estate and Services to Companies and Communications. The sectors devoting the least to extramural R&D were Food, Beverages and Tobacco in the first group, and those of Transport and Warehousing, along with Public, Social and Collective Services in the second group.

Furthermore, several studies indicate that cooperation levels are very different according to the type of sector (Hladik, 1985; Link and Bauer, 1989; Hagedoorn, 1993; Wang, 1994). In this context, there is no doubt that consideration of these sectoral differences becomes an important aspect when evaluating the effects of cooperation with different agents on the intensity of innovation activities in the productive sector.

Thus, in order to carry out this study, nine external sources with which cooperation for innovation could be possible have been considered (see Table 2). Specifically in Spain and only considering innovative firms or those with innovations in progress or unsuccessful ones (EIN), it is possible to highlight that 40% of these firms cooperated with suppliers, 26.9% did so with universities and 19.2% cooperated with experts and consultants. Those 5,710 firms which cooperated in innovation in the period 2001-2003 accounted for 15% of the total of the Spanish productive sector.

Regarding the form of cooperation by sector and taking into account the total number of firms in each sector (see Appendix 2) it can be seen that, in general terms, the clearly outstanding sector was Chemical Products, where 18.56% of the firms carried out some type of cooperation in this area. With lower levels of cooperation, between 10% and 12%, were the Metallurgy, Recycling and Transport Machinery and Material industries. With regard to services, Financial Brokering had the highest percentage of firms cooperating in innovation (10.6%).

If the type of agent with which cooperation took place is taken into account, the leading role corresponded to the universities, particularly in the case of Chemical Products (8.38%) and in Energy and Water industries (6.71%). Similarly, cooperation with experts and consultants was also important in the Recycling sector (6.66%) and cooperation with technological centres in the case of the Metallurgical industry (5.79%).
4. RESULTS OF THE STATISTICAL ANALYSIS AND DISCUSSION

Previous studies have shown that R&D intensity in firms is dependent on the number of cooperation agreements which have been conducted in previous years (Colombo and Garrone, 1996) and that cooperation has a positive influence in general on firms’ innovation intensity (Kaiser, 2002). Many of the findings of this study point in this direction, but, what is more, we have considered the specific effect of different types of agents and different indicators of innovation strategy. This represents an important contribution to this field of research.

The findings in Table 3 show that total intensity of innovation activities at the industry level showed a positive and significant rise thanks to cooperation with customers and suppliers. In the former case, the findings are the opposite of those presented in other works which recognise that collaboration with customers during the development of innovation reduces innovation costs (Thomke and Nimgade, 1998; Herstatt and von Hippel, 1992; Jeppesen, 2002, 2005; Chan and Lee, 2004; Henkel and von Hippel, 2004; von Hippel, 2005). Nevertheless, there also exist other studies, for example, that of Lillien et. al. (2002) which have found that when there is cooperation with customers innovation costs increase or Tether (2002), who found a positive relationship between cooperation with customers and R&D intensity. Different arguments can be put forward to explain these findings. Firstly, cooperation with customers is frequently analysed in certain sectors and not with aggregate data as in this case. This could justify the difference between the findings of this study and those who have worked at firm level. Secondly, this type of cooperation could make it necessary to make investment in R&D geared to adapting the productive process to the new product or service designs thought up by the customer. Finally, it has also been pointed out in the literature that this type of cooperation could raise costs stemming from the means that the firm must provide to the customer for his information to be relevant for the innovation process.

Different studies have analysed the importance of different types of partners when cooperating and have found that customers are the most appreciate external source of information, followed by suppliers, both in Spain and in other countries (Baumert and Martínez, 2007; Bierly and Daly, 2007). Spanish firms cooperating with customers are mainly firms in hi-tech sectors (Bayona et. al., 2003) whose contribution to the total industrial expenditure in R&D is high and they support the continuity of innovation activities in their firms. This trend also explains the findings obtained in the case of cooperation with suppliers,
which also has a significant and positive influence on innovatory effort. This result is in accordance with other previous studies which have shown that vertical cooperation leads to higher R&D investments (Steurs, 1995). These findings can be explained if it is considered that effective collaboration with these agents requires a suitable infrastructure in which collaboration can be installed, which means spending more in research and development (Pérez Pérez and Sánchez, 2002).

If we take into account the distribution of R&D expenditures, cooperation with customers stimulates the development of the firm’s internal potential and the acquisition of outside technology. That is, this type of cooperation favours complementarities between the two strategies for obtaining technology. Even though, it can be deduced from the literature that availability of external technology could reduce investment in in-house research and, consequently, the firm’s competitive advantage, there are arguments to support the benefit of a complementary relationship between these two variables (Arora and Gambardella, 1990; 1994; Den Hertog and Thurik, 1993; Veugelers, 1997; Veugelers and Cassiman, 1999; Narula, 2001; Tsai and Wang, 2007). These complementarities are capitalised as long as there exists a certain absorption capability (Cohen and Levinthal, 1990; Veugelers, 1997). In this context, in-house R&D activities could serve to modify and improve the acquisition of external technology (Veugelers and Cassiman, 1999), an aspect which is determining for converting knowledge deriving from customers into a profitable activity.

The findings also indicate that cooperation with competitors or firms in the same sector increases the intensity of intramural R&D. The reasoning that would lie behind this is that bearing in mind that in this way the firm shares certain knowledge with its competitors, it will at the same time have to seek a way of maintaining an advantageous position against them and one way would be to raise its in-house R&D efforts, for example, by developing new, more efficient productive processes or even making use of patents. Additionally, for the Spanish case, the positive influence of this type of cooperation finds a relationship with public funds. The study by Heijs et. al. (2007) shows how subsidies geared to increasing firms’ R&D investment also stimulated technological cooperation with firms in the same sector.

From the side of cooperation with agents from the public R&D system, this serves to strengthen technological capabilities (Cassiman and Veugelers, 2002, Miotti y Sachwald, 2003, Santamaria y Rialp, 2007) even if in our study a certain degree of interference among the three types of public agents has been found. And indeed, the motivations leading to
cooperation with each of these partners are different (Montoro-Sánchez et. al., 2006). In the case of buying in technology, on the one hand, cooperation with universities increases extramural R&D expenditures, presumably because of firms financing some of the innovation activities of those institutions to be able to have access to their research results and maintain follow up technological advances which might give rise to new products or processes. The consequence of this could be the promoting of the buying in of technology in those areas where the productive sector is technologically rather backward. Moreover, this cooperation takes place in many cases to guarantee access to public funds, which encourages the buying of external technology. On the other hand, the study shows that cooperation with public R&D agencies reduces these external expenditures and does not displace them towards in-house technology production. In Spain, these agencies stand as an alternative to the market in offering low-cost access to technological installations, equipment and services.

The findings also show that cooperation with public technological centres reduces in-house R&D investment. The fact that they are non-profit-making organizations gives greater confidence in the relationship with them and this, to a certain extent, can be transformed into a greater delegation of innovation activities and less concern over protecting the findings of these tasks (Santamaría and Rialp, 2007). Moreover, the easy access to the results of these research centres, enables technological opportunities to be exploited which might arise from their basic research (Mohen and Hoareau, 2003) without the need for any in-house effort. Although Spanish firms continue to argue that one of the main problems faced by this cooperation is that time limits are not met, they often go to these centres to replace their in-house R&D efforts.

5. CONCLUSIONS

At this moment in time the development of innovations cannot be based exclusively upon the firm’s internal resources. Given the difficulty involved in obtaining the resources needed for innovation activities, firms are forced to collaborate with external agents to accede to complementary resources, and this has led to a sharp increase in the number of cooperation agreements in innovation. However, there are still many aspects of this phenomenon to be explored.

For this reason, we have presented an exploratory work which aims to contribute to the knowledge of these relationships by providing empirical evidence on the influence which
collaboration with different external agents might wield on the total intensity of innovation activities, intramural R&D intensity and extramural R&D intensity in the Spanish productive sector. With this aim a total of twenty sectors have been considered and cooperation with nine different types of agents: 1) other firms within the same group, 2) customers, 3) suppliers, 4) competitors and firms from the same sector, 5) experts and consultants, 6) commercial laboratories or R&D firms, 7) universities, 8) public R&D agencies, and 9) public technological centres.

With this research we have provided an answer to two interesting questions referring to the phenomenon of cooperation in Spain. On the one hand, we have observed that cooperation with customers is what has the greatest impact on the intensity of innovation activities of manufacturing and service sectors in this country. Secondly, different effects have been observed on how sectors make the distribution between in-house technology development and buying-in according to the type of partner.

In this last case, the findings have indicated that cooperation with customers and suppliers produces a significant, positive increase in total intensity of innovation activities in the productive sector. It has also been noticed that cooperation with customers has been the only type to produce a significant stimulus both in in-house generation and buying technology from outside. In a certain way, it could be said that cooperation with customers proves to be an indicator of how importantly the firm regards innovation, since the greater this cooperation, the greater the number of resources that are devoted to innovation activities. This is one of the principal contributions of our study and it is particularly relevant for Spanish firms. The fact is that suppliers have proved to be the most frequently used partners in Spain whereas cooperation with customers is not very well developed. So it would be worthwhile to encourage and implement strategies to strengthen cooperation with these agents in questions of innovation.

Bearing in mind the way in which firms distribute R&D expenditure, the study has found that cooperation with competitors increases intramural R&D intensity. Presumably, firms sharing certain knowledge with their competitors will at the same time have to find a way to maintain a position of advantage over them and one way will be to increase their efforts in in-house R&D activities.
From this research the deduction can also be made that there is a certain degree of interference in cooperation with different agents of the public R&D system. Whereas cooperation with universities increases the acquisition of external technology, cooperation with public R&D agencies reduces it. This reveals that firms have engaged in cooperation for different reasons and that in some cases cooperation has been viewed as a means for obtaining technology and not as a support mechanism for the innovation process. The study also shows that cooperation with public technological centres significantly reduces internal technology development. These findings have important implications both for managers and policy makers. They have the chance to introduce changes into the private and public R&D system by looking at the area in which each of these agents is most efficient and distributing tasks so that innovative activity is stimulated beyond simple R&D.

Nonetheless, though the model proposed in this work explains around the eighty of the variation in innovatory effort in the Spanish productive sector, future research could extend the analysis by including variables allowing a comparative study to be made between sectors. Moreover, the relation between the type of agent and the innovation output could be considered.
Figure 1. Internal and external sources of innovation activities

**Internal Sources**
- Marketing Department
- R&D Department
- Production Department

**External Sources**
- **Market-based sources:**
  - Competitors and firms from the same sector
  - Buying embodied and disembodied technology
  - Customers/users
  - Consultants and experts
  - Suppliers (materials, software, components, etc.)
  - Others
- **Educational or research centres:**
  - Public/Private research institutes
  - Universities
- **General public available information:**
  - Published patents
  - Conferences
  - Professional meetings/journals
  - Fairs/Exhibitions

Source: Own elaboration
Table 1. Description of the variables

<table>
<thead>
<tr>
<th>Dependent representative variables of innovatory effort</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Intensity of innovation activities</td>
<td>(Innovation activity expenditures/Turnover) x 100</td>
</tr>
<tr>
<td>Intramural R&amp;D intensity</td>
<td>(Internal R&amp;D expenditures/Turnover) x 100</td>
</tr>
<tr>
<td>Extramural R&amp;D intensity</td>
<td>(External R&amp;D expenditures/Turnover) x 100</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Independent representative variables of cooperation with external agents</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Coop. other firms within same group</td>
<td>% of firms in the sector that have cooperated with firms of the same group</td>
</tr>
<tr>
<td>Coop. customers</td>
<td>% of firms in the sector that have cooperated with customers</td>
</tr>
<tr>
<td>Coop. suppliers</td>
<td>% of firms in the sector that have cooperated with suppliers</td>
</tr>
<tr>
<td>Coop. competitors</td>
<td>% of firms in the sector that have cooperated with competitors</td>
</tr>
<tr>
<td>Coop. experts and consultants</td>
<td>% of firms in the sector that have cooperated with experts and consultants</td>
</tr>
<tr>
<td>Coop. commercial laboratories/R&amp;D firms</td>
<td>% of firms in the sector that have cooperated with commercial laboratories/R&amp;D firms</td>
</tr>
<tr>
<td>Coop. universities</td>
<td>% of firms in the sector that have cooperated with universities</td>
</tr>
<tr>
<td>Coop. public R&amp;D agencies</td>
<td>% of firms in the sector that have cooperated with public R&amp;D agencies</td>
</tr>
<tr>
<td>Coop. public technological centres</td>
<td>% of firms in the sector that have cooperated with public technological centres</td>
</tr>
</tbody>
</table>
Table 2. Innovation cooperation by type of partner, 2001-2003

<table>
<thead>
<tr>
<th>EIN firms with innovation cooperation with:</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Other firms within the same group</td>
<td>835</td>
<td>14.6</td>
</tr>
<tr>
<td>- Customers</td>
<td>733</td>
<td>12.8</td>
</tr>
<tr>
<td>- Suppliers</td>
<td>2283</td>
<td>40.0</td>
</tr>
<tr>
<td>- Competitors and other firms from the same industry</td>
<td>668</td>
<td>11.7</td>
</tr>
<tr>
<td>- Experts and consultants</td>
<td>1095</td>
<td>19.2</td>
</tr>
<tr>
<td>- Commercial laboratories and R&amp;D firms</td>
<td>454</td>
<td>8.0</td>
</tr>
<tr>
<td>- Universities</td>
<td>1534</td>
<td>26.9</td>
</tr>
<tr>
<td>- Public R&amp;D agencies</td>
<td>673</td>
<td>11.8</td>
</tr>
<tr>
<td>- Public technological centres</td>
<td>900</td>
<td>15.8</td>
</tr>
</tbody>
</table>

* The same firm can cooperate with several partners.
Table 3. Results of multivariate regression model

<table>
<thead>
<tr>
<th>Tipo de cooperación</th>
<th>MODEL 1 Total innovation activity intensity</th>
<th>MODEL 2 Intramural R&amp;D intensity</th>
<th>MODEL 3 Extramural R&amp;D intensity</th>
</tr>
</thead>
<tbody>
<tr>
<td>-(Constants)</td>
<td>0.144</td>
<td>0.223</td>
<td>0.091</td>
</tr>
<tr>
<td>- Coop. other firms within same group</td>
<td>-0.731</td>
<td>-0.303</td>
<td>-0.212</td>
</tr>
<tr>
<td>- Coop. customers</td>
<td>1.587**</td>
<td>0.704**</td>
<td>0.343***</td>
</tr>
<tr>
<td>- Coop. suppliers</td>
<td>0.401*</td>
<td>0.074</td>
<td>0.010</td>
</tr>
<tr>
<td>- Coop. competitors</td>
<td>0.890</td>
<td>0.439*</td>
<td>-0.005</td>
</tr>
<tr>
<td>- Coop. experts and consultants</td>
<td>-0.488</td>
<td>-0.129</td>
<td>-0.191</td>
</tr>
<tr>
<td>- Coop. commercial labs/R&amp;D firms</td>
<td>1.420</td>
<td>0.185</td>
<td>0.131</td>
</tr>
<tr>
<td>- Coop. universities</td>
<td>-0.426</td>
<td>-0.100</td>
<td>0.328**</td>
</tr>
<tr>
<td>- Coop. public R&amp;D agencies</td>
<td>-0.234</td>
<td>0.077</td>
<td>-0.550**</td>
</tr>
<tr>
<td>- Coop. public technological centres</td>
<td>-0.293</td>
<td>-0.126*</td>
<td>-0.467</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.796</td>
<td>0.894</td>
<td>0.773</td>
</tr>
</tbody>
</table>

* = $p \leq 10\%$, ** = $p \leq 5\%$, *** = $p \leq 1\%$
## Appendix 1. Measurements of Total Expenditure in Innovation Activities. Expenditure on intramural R&D and extramural R&D by sectors and Intensity of these activities as part of Turnover during the period 2001-2003

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>Turnover</th>
<th>Total expenditures in innovation activities (Millions of euros)</th>
<th>Total intensity of innovation activity (%)</th>
<th>Intramural R&amp;D expenditures (Millions of euros)</th>
<th>Intramural R&amp;D intensity (%)</th>
<th>Extramural R&amp;D expenditures (Millions of euros)</th>
<th>Intramural R&amp;D intensity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Sectors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Extractive and Oil Industries</td>
<td>29863.56</td>
<td>176.20</td>
<td>0.59</td>
<td>70.07</td>
<td>0.23</td>
<td>28.21</td>
<td>0.09</td>
</tr>
<tr>
<td>2. Food, Beverages and Tobacco</td>
<td>71448.98</td>
<td>421.55</td>
<td>0.59</td>
<td>125.12</td>
<td>0.18</td>
<td>36.55</td>
<td>0.05</td>
</tr>
<tr>
<td>3. Textile, Clothing, Leather and Footwear</td>
<td>19528.28</td>
<td>466.73</td>
<td>2.39</td>
<td>69.87</td>
<td>0.36</td>
<td>15.68</td>
<td>0.08</td>
</tr>
<tr>
<td>4. Wood, Paper, Publishing and Graphic Arts</td>
<td>33787.43</td>
<td>236.51</td>
<td>0.70</td>
<td>54.78</td>
<td>0.16</td>
<td>17.12</td>
<td>0.05</td>
</tr>
<tr>
<td>5. Chemical Products</td>
<td>42892.07</td>
<td>995.10</td>
<td>2.32</td>
<td>652.68</td>
<td>1.52</td>
<td>202.40</td>
<td>0.47</td>
</tr>
<tr>
<td>6. Rubber and Plastic Materials</td>
<td>14520.73</td>
<td>158.28</td>
<td>1.09</td>
<td>72.63</td>
<td>0.50</td>
<td>14.93</td>
<td>0.10</td>
</tr>
<tr>
<td>7. Diverse non-Metallic Mineral Products</td>
<td>26321.75</td>
<td>150.03</td>
<td>0.57</td>
<td>51.60</td>
<td>0.20</td>
<td>23.74</td>
<td>0.09</td>
</tr>
<tr>
<td>8. Metallurgy</td>
<td>19878.66</td>
<td>133.19</td>
<td>0.67</td>
<td>47.11</td>
<td>0.24</td>
<td>15.14</td>
<td>0.08</td>
</tr>
<tr>
<td>9. Metal Industries</td>
<td>26964.30</td>
<td>345.14</td>
<td>1.28</td>
<td>116.07</td>
<td>0.43</td>
<td>18.05</td>
<td>0.07</td>
</tr>
<tr>
<td>10. Transport Machinery and Material</td>
<td>119713.44</td>
<td>2956.92</td>
<td>2.47</td>
<td>1107.07</td>
<td>0.92</td>
<td>1064.49</td>
<td>0.89</td>
</tr>
<tr>
<td>11. Diverse Manufacturing Industries</td>
<td>11900.00</td>
<td>78.54</td>
<td>0.66</td>
<td>32.94</td>
<td>0.28</td>
<td>10.06</td>
<td>0.08</td>
</tr>
<tr>
<td>12. Recycling Industries</td>
<td>961.46</td>
<td>8.56</td>
<td>0.89</td>
<td>5.31</td>
<td>0.55</td>
<td>0.72</td>
<td>0.08</td>
</tr>
<tr>
<td>13. Energy and Water Industries</td>
<td>24513.71</td>
<td>85.80</td>
<td>0.35</td>
<td>55.58</td>
<td>0.23</td>
<td>16.22</td>
<td>0.07</td>
</tr>
<tr>
<td>14. Building Industries</td>
<td>131492.78</td>
<td>236.69</td>
<td>0.18</td>
<td>72.02</td>
<td>0.05</td>
<td>83.74</td>
<td>0.06</td>
</tr>
<tr>
<td>Service Sectors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Commerce and Catering</td>
<td>359308.06</td>
<td>1113.86</td>
<td>0.31</td>
<td>107.93</td>
<td>0.03</td>
<td>711.09</td>
<td>0.20</td>
</tr>
<tr>
<td>16. Transport and Warehousing</td>
<td>75060.82</td>
<td>547.94</td>
<td>0.73</td>
<td>56.66</td>
<td>0.08</td>
<td>20.55</td>
<td>0.03</td>
</tr>
<tr>
<td>17. Communication</td>
<td>39461.93</td>
<td>430.14</td>
<td>1.09</td>
<td>121.21</td>
<td>0.31</td>
<td>108.35</td>
<td>0.27</td>
</tr>
<tr>
<td>18. Financial Brokering</td>
<td>131930.00</td>
<td>395.79</td>
<td>0.30</td>
<td>144.27</td>
<td>0.11</td>
<td>67.32</td>
<td>0.05</td>
</tr>
<tr>
<td>19. Real Estate and Services to Companies</td>
<td>112455.06</td>
<td>2001.70</td>
<td>1.78</td>
<td>1412.80</td>
<td>1.26</td>
<td>323.07</td>
<td>0.29</td>
</tr>
<tr>
<td>20. Public, Social and Collective Services</td>
<td>34192.11</td>
<td>259.86</td>
<td>0.76</td>
<td>58.96</td>
<td>0.17</td>
<td>17.90</td>
<td>0.05</td>
</tr>
</tbody>
</table>

Millions of euros
Source: Own elaboration from INE data.
Appendix 2. Cooperation in innovation in the period 2001-2003 according to type of partner and economic sector

<table>
<thead>
<tr>
<th>SECTOR</th>
<th>Total firms</th>
<th>Firms involved in innovation cooperation (%)(^*)</th>
<th>Same group</th>
<th>Custom.</th>
<th>Supplier</th>
<th>Compet./firms of same sector</th>
<th>Experts and consultants</th>
<th>Commerc. lab/R&amp;D firms</th>
<th>Univer.</th>
<th>Public R&amp;D agencies</th>
<th>Public technol. centres</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Extractive and Oil Industries</td>
<td>820</td>
<td>2.80</td>
<td>0.12</td>
<td>0.12</td>
<td>0.61</td>
<td>0.73</td>
<td>0.61</td>
<td>0.73</td>
<td>1.34</td>
<td>0.49</td>
<td>0.49</td>
</tr>
<tr>
<td>2. Food, Beverages and Tobacco</td>
<td>5881</td>
<td>5.46</td>
<td>0.49</td>
<td>0.39</td>
<td>1.92</td>
<td>0.36</td>
<td>1.02</td>
<td>0.77</td>
<td>1.87</td>
<td>0.85</td>
<td>1.19</td>
</tr>
<tr>
<td>3. Textile, Clothing, Leather and Footwear</td>
<td>6373</td>
<td>3.15</td>
<td>0.11</td>
<td>0.24</td>
<td>1.88</td>
<td>0.49</td>
<td>0.55</td>
<td>0.30</td>
<td>0.27</td>
<td>0.24</td>
<td>0.53</td>
</tr>
<tr>
<td>4. Wood, Paper, Publishing and Graphic Arts</td>
<td>5783</td>
<td>3.34</td>
<td>0.36</td>
<td>0.10</td>
<td>1.71</td>
<td>0.31</td>
<td>0.35</td>
<td>0.21</td>
<td>0.50</td>
<td>0.16</td>
<td>0.55</td>
</tr>
<tr>
<td>5. Chemical Products</td>
<td>2171</td>
<td>18.56</td>
<td>3.09</td>
<td>3.27</td>
<td>3.04</td>
<td>2.12</td>
<td>3.36</td>
<td>2.44</td>
<td>8.38</td>
<td>4.24</td>
<td>3.87</td>
</tr>
<tr>
<td>6. Rubber and Plastic Materials</td>
<td>1503</td>
<td>9.05</td>
<td>1.60</td>
<td>1.66</td>
<td>1.86</td>
<td>0.67</td>
<td>1.26</td>
<td>0.60</td>
<td>2.20</td>
<td>1.00</td>
<td>2.46</td>
</tr>
<tr>
<td>7. Diverse non-Metallic Mineral Products</td>
<td>3703</td>
<td>5.13</td>
<td>0.32</td>
<td>0.19</td>
<td>1.76</td>
<td>0.76</td>
<td>0.54</td>
<td>0.19</td>
<td>1.19</td>
<td>0.49</td>
<td>1.62</td>
</tr>
<tr>
<td>8. Metallurgy</td>
<td>743</td>
<td>11.97</td>
<td>2.15</td>
<td>1.08</td>
<td>4.04</td>
<td>1.48</td>
<td>1.35</td>
<td>1.21</td>
<td>3.50</td>
<td>1.35</td>
<td>5.79</td>
</tr>
<tr>
<td>9. Metal Industries</td>
<td>7655</td>
<td>5.28</td>
<td>0.56</td>
<td>1.02</td>
<td>2.73</td>
<td>0.43</td>
<td>1.18</td>
<td>0.13</td>
<td>0.86</td>
<td>0.21</td>
<td>0.74</td>
</tr>
<tr>
<td>10. Transport Machinery and Material</td>
<td>7056</td>
<td>10.96</td>
<td>1.77</td>
<td>1.98</td>
<td>3.57</td>
<td>1.11</td>
<td>2.24</td>
<td>1.22</td>
<td>4.28</td>
<td>1.28</td>
<td>3.00</td>
</tr>
<tr>
<td>11. Diverse Manufacturing Industries</td>
<td>3628</td>
<td>3.75</td>
<td>0.22</td>
<td>0.30</td>
<td>0.80</td>
<td>0.25</td>
<td>1.21</td>
<td>0.66</td>
<td>0.69</td>
<td>0.36</td>
<td>0.85</td>
</tr>
<tr>
<td>12. Recycling Industries</td>
<td>120</td>
<td>11.66</td>
<td>0.83</td>
<td></td>
<td>4.16</td>
<td>1.67</td>
<td>6.66</td>
<td>0.83</td>
<td>3.33</td>
<td></td>
<td>0.83</td>
</tr>
<tr>
<td>13. Energy and Water Industries</td>
<td>358</td>
<td>8.94</td>
<td>2.24</td>
<td>0.56</td>
<td>2.79</td>
<td>2.79</td>
<td>1.68</td>
<td>2.24</td>
<td>6.71</td>
<td>3.07</td>
<td>5.03</td>
</tr>
<tr>
<td>14. Building Industries</td>
<td>35108</td>
<td>0.79</td>
<td>0.10</td>
<td>0.01</td>
<td>0.18</td>
<td>0.01</td>
<td>0.01</td>
<td>0.29</td>
<td>0.02</td>
<td>0.27</td>
<td>0.04</td>
</tr>
<tr>
<td>15. Commerce and Catering</td>
<td>41189</td>
<td>2.04</td>
<td>0.24</td>
<td>0.11</td>
<td>1.20</td>
<td>0.30</td>
<td>0.37</td>
<td>0.06</td>
<td>0.19</td>
<td>0.16</td>
<td>0.04</td>
</tr>
<tr>
<td>16. Transport and Warehousing</td>
<td>8482</td>
<td>2.72</td>
<td>0.88</td>
<td>0.52</td>
<td>0.93</td>
<td>0.08</td>
<td>0.53</td>
<td>0.01</td>
<td>0.18</td>
<td>0.11</td>
<td>0.04</td>
</tr>
<tr>
<td>17. Communication</td>
<td>966</td>
<td>6.73</td>
<td>1.66</td>
<td>0.83</td>
<td>4.76</td>
<td>0.52</td>
<td>1.55</td>
<td>0.41</td>
<td>2.28</td>
<td>0.52</td>
<td>0.62</td>
</tr>
<tr>
<td>18. Financial Brokering</td>
<td>1142</td>
<td>10.60</td>
<td>1.84</td>
<td>0.26</td>
<td>4.99</td>
<td>1.58</td>
<td>3.15</td>
<td>0.26</td>
<td>2.63</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>19. Real Estate and Services to Companies</td>
<td>20212</td>
<td>4.71</td>
<td>0.77</td>
<td>1.15</td>
<td>1.62</td>
<td>0.90</td>
<td>0.93</td>
<td>0.47</td>
<td>1.85</td>
<td>1.09</td>
<td>0.80</td>
</tr>
<tr>
<td>20. Public, Social and Collective Services</td>
<td>10889</td>
<td>2.80</td>
<td>0.65</td>
<td>0.06</td>
<td>1.78</td>
<td>0.23</td>
<td>0.23</td>
<td>0.06</td>
<td>0.28</td>
<td>0.45</td>
<td>0.14</td>
</tr>
</tbody>
</table>

\* The same firm can cooperate with several partners.

Source: Own elaboration from INE data.
### Appendix 1. Results of three independent regression models

<table>
<thead>
<tr>
<th>Tipo de cooperación</th>
<th>Modelo 1</th>
<th>Modelo 2</th>
<th>Modelo 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total innovation activity intensity</td>
<td>Intramural R&amp;D intensity</td>
<td>Extramural R&amp;D intensity</td>
</tr>
<tr>
<td>(Constantes)</td>
<td>0.144</td>
<td>0.023</td>
<td>0.091</td>
</tr>
<tr>
<td>Cooper. other firms within same group</td>
<td>-0.731</td>
<td>-0.303</td>
<td>-0.212</td>
</tr>
<tr>
<td>Cooper. customers</td>
<td>1.587***</td>
<td>0.704***</td>
<td>0.343**</td>
</tr>
<tr>
<td>Cooper. suppliers</td>
<td>0.401**</td>
<td>0.074</td>
<td>0.010</td>
</tr>
<tr>
<td>Cooper. competitors</td>
<td>0.890</td>
<td>0.439*</td>
<td>-0.005</td>
</tr>
<tr>
<td>Cooper. experts and consultants</td>
<td>-0.488</td>
<td>-0.129</td>
<td>-0.191</td>
</tr>
<tr>
<td>Cooper. commercial labs/R&amp;D firms</td>
<td>1.420</td>
<td>0.185</td>
<td>0.131</td>
</tr>
<tr>
<td>Cooper. universities</td>
<td>-0.426</td>
<td>-0.100</td>
<td>0.328**</td>
</tr>
<tr>
<td>Cooper. public R&amp;D agencies</td>
<td>-0.234</td>
<td>0.077</td>
<td>-0.550**</td>
</tr>
<tr>
<td>Cooper. public technological centres</td>
<td>-0.293</td>
<td>-0.126*</td>
<td>-0.047</td>
</tr>
</tbody>
</table>

### R² Statistic of the Models

<table>
<thead>
<tr>
<th></th>
<th>Modelo 1</th>
<th>Modelo 2</th>
<th>Modelo 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>R²</td>
<td>0.796</td>
<td>0.895</td>
<td>0.773</td>
</tr>
</tbody>
</table>

* = p≤10%, ** = p≤5%, *** = p≤1
REFERENCES


Barney, J.B. (1986b): “Organizational Culture: Can it be a source of sustained competitive advantage?”.


*Documento de trabajo, DT/00*, Universidad Pública de Navarra.


Generation Process for New Product Development”.


Últimos números publicados

159/2000 Participación privada en la construcción y explotación de carreteras de peaje
Ginés de Rus, Manuel Romero y Lourdes Trujillo

160/2000 Errores y posibles soluciones en la aplicación del Value at Risk
Mariano González Sánchez

161/2000 Tax neutrality on saving assets. The spahish case before and after the tax reform
Cristina Ruza y de Paz-Curbera

162/2000 Private rates of return to human capital in Spain: new evidence
F. Barceinas, J. Oliver-Alonso, J.L. Raymond y J.L. Roig-Sabaté

163/2000 El control interno del riesgo. Una propuesta de sistema de límites
riesgo neutral
Mariano González Sánchez

164/2001 La evolución de las políticas de gasto de las Administraciones Públicas en los años 90
Alfonso Utrilla de la Hoz y Carmen Pérez Esparrells

165/2001 Bank cost efficiency and output specification
Emili Tortosa-Ausina

166/2001 Recent trends in Spanish income distribution: A robust picture of falling income inequality
Josep Oliver-Alonso, Xavier Ramos y José Luis Raymond-Bara

167/2001 Efectos redistributivos y sobre el bienestar social del tratamiento de las cargas familiares en el nuevo IRPF
Nuria Badenes Plá, Julio López Laborda, Jorge Onrubia Fernández

168/2001 The Effects of Bank Debt on Financial Structure of Small and Medium Firms in some European Countries
Mónica Melle-Hernández

169/2001 La política de cohesión de la UE ampliada: la perspectiva de España
Ismael Sanz Labrador

170/2002 Riesgo de liquidez de Mercado
Mariano González Sánchez

171/2002 Los costes de administración para el afiliado en los sistemas de pensiones basados en cuentas de capitalización individual: medida y comparación internacional.
José Enrique Devesa Carpio, Rosa Rodríguez Barrera, Carlos Vidal Meliá

172/2002 La encuesta continua de presupuestos familiares (1985-1996): descripción, representatividad y propuestas de metodología para la explotación de la información de los ingresos y el gasto.
Llorenç Pou, Joaquín Alegre

173/2002 Modelos paramétricos y no paramétricos en problemas de concesión de tarjetas de credito.
Rosa Puertas, María Bonilla, Ignacio Olmeda
Mercado único, comercio intra-industrial y costes de ajuste en las manufacturas españolas.
José Vicente Blanes Cristóbal

La Administración tributaria en España. Un análisis de la gestión a través de los ingresos y de los gastos.
Juan de Dios Jiménez Aguilera, Pedro Enrique Barrilao González

The Falling Share of Cash Payments in Spain.
Santiago Carbó Valverde, Rafael López del Paso, David B. Humphrey

Effects of ATMs and Electronic Payments on Banking Costs: The Spanish Case.
Santiago Carbó Valverde, Rafael López del Paso, David B. Humphrey

Factors explaining the interest margin in the banking sectors of the European Union.
Joaquín Maudos y Juan Fernández Guevara

Los planes de stock options para directivos y consejeros y su valoración por el mercado de valores en España.
Mónica Melle Hernández

Yener Altunbas, Santiago Carbó y Phil Molyneux

The Euro effect on the integration of the European stock markets.
Mónica Melle Hernández

In search of complementarity in the innovation strategy: international R&D and external knowledge acquisition.
Bruno Cassiman, Reinhilde Veugelers

Fijación de precios en el sector público: una aplicación para el servicio municipal de suministro de agua.
Mª Ángeles García Valiñas

Estimación de la economía sumergida es España: un modelo estructural de variables latentes.
Ángel Alañón Pardo, Miguel Gómez de Antonio

Causas políticas y consecuencias sociales de la corrupción.
Joan Oriol Prats Cabrera

Loan bankers’ decisions and sensitivity to the audit report using the belief revision model.
Andrés Guiral Contreras and José A. Gonzalo Angulo

El modelo de Black, Derman y Toy en la práctica. Aplicación al mercado español.
Marta Tolentino García-Abadillo y Antonio Díaz Pérez

Does market competition make banks perform well?.
Mónica Melle

Efficiency differences among banks: external, technical, internal, and managerial.
Santiago Carbó Valverde, David B. Humphrey y Rafael López del Paso
190/2004 Una aproximación al análisis de los costes de la esquizofrenia en España: los modelos jerárquicos bayesianos
F. J. Vázquez-Polo, M. A. Negrín, J. M. Cavasés, E. Sánchez y grupo RIRAG

191/2004 Environmental proactivity and business performance: an empirical analysis
Javier González-Benito y Óscar González-Beníto

192/2004 Economic risk to beneficiaries in notional defined contribution accounts (NDCs)
Carlos Vidal-Meliá, Inmaculada Domínguez-Fabian y José Enrique Devesa-Carpio

193/2004 Sources of efficiency gains in port reform: non parametric malmquist decomposition tfp index for Mexico
Antonio Estache, Beatriz Tovar de la Fé y Lourdes Trujillo

194/2004 Persistencia de resultados en los fondos de inversión españoles
Alfredo Ciriaco Fernández y Rafael Santamaría Aquilué

195/2005 El modelo de revisión de creencias como aproximación psicológica a la formación del juicio del auditor sobre la gestión continuada
Andrés Guiral Contreras y Francisco Esteso Sánchez

196/2005 La nueva financiación sanitaria en España: descentralización y prospectiva
David Cantarero Prieto

197/2005 A cointegration analysis of the Long-Run supply response of Spanish agriculture to the common agricultural policy
José A. Mendez, Ricardo Mora y Carlos San Juan

198/2005 ¿Refleja la estructura temporal de los tipos de interés del mercado español preferencia por la liquidez?
Magdalena Massot Perelló y Juan M. Nave

199/2005 Análisis de impacto de los Fondos Estructurales Europeos recibidos por una economía regional: Un enfoque a través de Matrices de Contabilidad Social
M. Carmen Lima y M. Alejandro Cardenete

200/2005 Does the development of non-cash payments affect monetary policy transmission?
Santiago Carbó Valverde y Rafael López del Paso

201/2005 Firm and time varying technical and allocative efficiency: an application for port cargo handling firms
Ana Rodríguez-Álvarez, Beatriz Tovar de la Fé y Lourdes Trujillo

202/2005 Contractual complexity in strategic alliances
Jeffrey J. Reuer y Africa Ariño

203/2005 Factores determinantes de la evolución del empleo en las empresas adquiridas por opa
Nuria Alcalde Fradejas y Inés Pérez-Soba Aguilar

Elena Olmedo, Juan M. Valderas, Ricardo Gimeno and Lorenzo Escot
<table>
<thead>
<tr>
<th>Año</th>
<th>Título</th>
<th>Autor(as)</th>
</tr>
</thead>
<tbody>
<tr>
<td>205/2005</td>
<td>Precio de la tierra con presión urbana: un modelo para España</td>
<td>Esther Decimavilla, Carlos San Juan y Stefan Sperlich</td>
</tr>
<tr>
<td>206/2005</td>
<td>Interregional migration in Spain: a semiparametric analysis</td>
<td>Adolfo Maza y José Villaverde</td>
</tr>
<tr>
<td>207/2005</td>
<td>Productivity growth in European banking</td>
<td>Carmen Murillo-Melchor, José Manuel Pastor y Emili Tortosa-Ausina</td>
</tr>
<tr>
<td>209/2005</td>
<td>La elasticidad de sustitución intertemporal con preferencias no separables intratemporalmente: los casos de Alemania, España y Francia.</td>
<td>Elena Márquez de la Cruz, Ana R. Martínez Cañete y Inés Pérez-Soba Aguilar</td>
</tr>
<tr>
<td>211/2005</td>
<td>Permanent income, convergence and inequality among countries</td>
<td>José M. Pastor and Lorenzo Serrano</td>
</tr>
<tr>
<td>212/2005</td>
<td>The Latin Model of Welfare: Do 'Insertion Contracts' Reduce Long-Term Dependence?</td>
<td>Luis Ayala and Magdalena Rodríguez</td>
</tr>
<tr>
<td>213/2005</td>
<td>The effect of geographic expansion on the productivity of Spanish savings banks</td>
<td>Manuel Illueca, José M. Pastor and Emili Tortosa-Ausina</td>
</tr>
<tr>
<td>214/2005</td>
<td>Dynamic network interconnection under consumer switching costs</td>
<td>Ángel Luis López Rodríguez</td>
</tr>
<tr>
<td>215/2005</td>
<td>La influencia del entorno socioeconómico en la realización de estudios universitarios: una aproximación al caso español en la década de los noventa</td>
<td>Marta Rahona López</td>
</tr>
<tr>
<td>216/2005</td>
<td>The valuation of spanish ipos: efficiency analysis</td>
<td>Susana Álvarez Otero</td>
</tr>
<tr>
<td>217/2005</td>
<td>On the generation of a regular multi-input multi-output technology using parametric output distance functions</td>
<td>Sergio Perelman and Daniel Santín</td>
</tr>
<tr>
<td>218/2005</td>
<td>La gobernanza de los procesos parlamentarios: la organización industrial del congreso de los diputados en España</td>
<td>Gonzalo Caballero Miguez</td>
</tr>
<tr>
<td>219/2005</td>
<td>Determinants of bank market structure: Efficiency and political economy variables</td>
<td>Francisco González</td>
</tr>
<tr>
<td>220/2005</td>
<td>Agresividad de las órdenes introducidas en el mercado español: estrategias, determinantes y medidas de performance</td>
<td>David Abad Diaz</td>
</tr>
</tbody>
</table>
Tendencia post-anuncio de resultados contables: evidencia para el mercado español
Carlos Forner Rodríguez, Joaquín Marhuenda Fructuoso y Sonia Sanabria García

Human capital accumulation and geography: empirical evidence in the European Union
Jesús López-Rodríguez, J. Andrés Faíña y Jose Lopez Rodriguez

Auditors' Forecasting in Going Concern Decisions: Framing, Confidence and Information Processing
Waymond Rodgers and Andrés Guiral

José Ramón Cancelo de la Torre, J. Andrés Faíña and Jesús López-Rodriguez

The effects of ownership structure and board composition on the audit committee activity: Spanish evidence
Carlos Fernández Méndez and Rubén Arrondo García

Cross-country determinants of bank income smoothing by managing loan loss provisions
Ana Rosa Fonseca and Francisco González

Incumplimiento fiscal en el irpf (1993-2000): un análisis de sus factores determinantes
Alejandro Estellér Moré

Region versus Industry effects: volatility transmission
Pilar Soriano Felipe and Francisco J. Climent Diranzo

Concurrent Engineering: The Moderating Effect Of Uncertainty On New Product Development Success
Daniel Vázquez-Bustelo and Sandra Valle

On zero lower bound traps: a framework for the analysis of monetary policy in the ‘age’ of central banks
Alfonso Palacio-Vera

Reconciling Sustainability and Discounting in Cost Benefit Analysis: a methodological proposal
M. Carmen Almansa Sáez and Javier Calatrava Requena

Can The Excess Of Liquidity Affect The Effectiveness Of The European Monetary Policy?
Santiago Carbó Valverde and Rafael López del Paso

Inheritance Taxes In The Eu Fiscal Systems: The Present Situation And Future Perspectives.
Miguel Angel Barberán Lahuerta

Bank Ownership And Informativeness Of Earnings.
Víctor M. González

Waymond Rodgers, Paul Pavlou and Andres Guiral.

Francisco J. André, M. Alejandro Cardenete y Carlos Romero.
Santiago Carbó-Valverde, Francisco Rodríguez-Fernández y Gregory F. Udell.

238/2006  Trade Effects Of Monetary Agreements: Evidence For Oecd Countries.  
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano.

Marcos Álvarez-Díaz y Gonzalo Caballero Miguez.

240/2006  La interacción entre el éxito competitivo y las condiciones del mercado doméstico como determinantes de la decisión de exportación en las Pymes.  
Francisco García Pérez.

241/2006  Una estimación de la depreciación del capital humano por sectores, por ocupación y en el tiempo.  
Inés P. Murillo.

Manuel A. Gómez.

Jose Manuel Cordero-Ferrera, Francisco Pedraja-Chaparro y Javier Salinas-Jiménez

244/2006  Did The European Exchange-Rate Mechanism Contribute To The Integration Of Peripheral Countries?.  
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano

Marta Pascual and David Cantarero

Salvador Rojí Ferrari and Ana Gonzalez Marcos

247/2006  Testing For Structural Breaks In Variance With additive Outliers And Measurement Errors.  
Paulo M.M. Rodrigues and Antonio Rubia

Joaquín Maudos and Juan Fernández de Guevara

Desiderio Romero Jordán, José Félix Sanz Sanz y César Pérez López

250/2006  Regional Income Disparities in Europe: What role for location?.  
Jesús López-Rodriguez and J. Andrés Faíña

251/2006  Funciones abreviadas de bienestar social: Una forma sencilla de simultanear la medición de la eficiencia y la equidad de las políticas de gasto público.  
Nuria Badenes Plá y Daniel Santín González

252/2006  “The momentum effect in the Spanish stock market: Omitted risk factors or investor behaviour?”.
Luis Muga and Rafael Santamaria

253/2006  Dinámica de precios en el mercado español de gasolina: un equilibrio de colusión tácita.  
Jordi Perdiguero García
José M. Pastor, Empar Pons y Lorenzo Serrano

255/2006 Environmental implications of organic food preferences: an application of the impure public goods model.
Ana María Aldanondo-Ochoa y Carmen Almansa-Sáez

José Félix Sanz-Sanz, Desiderio Romero-Jordán y Santiago Álvarez-García

257/2006 La internacionalización de la empresa manufacturera española: efectos del capital humano genérico y específico.
José López Rodríguez

María Martínez Torres

259/2006 Efficiency and market power in Spanish banking.
Rolf Färe, Shawna Grosskopf y Emili Tortosa-Ausina.

260/2006 Asimetrícas en volatilidad, beta y contagios entre las empresas grandes y pequeñas cotizadas en la bolsa española.
Helena Chuliá y Hipòlit Torró.

José Antonio Ortega.

262/2006 Accidentes de tráfico, víctimas mortales y consumo de alcohol.
José Mª Arranz y Ana I. Gil.

263/2006 Análisis de la Presencia de la Mujer en los Consejos de Administración de las Mil Mayores Empresas Españolas.
Ruth Mateos de Cabo, Lorenzo Escot Mangas y Ricardo Gimeno Nogués.

Ignacio Álvarez Peralta.

Jaime Vallés-Giménez y Anabel Zárate-Marco.

266/2006 Health Human Capital And The Shift From Foraging To Farming.
Paolo Rungo.

Juan Luis Jiménez y Jordi Perdigueró.

Desiderio Romero-Jordán y José Félix Sanz-Sanz.

269/2006 Banking competition, financial dependence and economic growth
Joaquín Maudos y Juan Fernández de Guevara

270/2006 Efficiency, subsidies and environmental adaptation of animal farming under CAP
Werner Kleinhans, Carmen Murillo, Carlos San Juan y Stefan Sperlich

272/2006 Riesgo asimétrico y estrategias de momentum en el mercado de valores español Luis Muga y Rafael Santamaría

273/2006 Valoración de capital-riesgo en proyectos de base tecnológica e innovadora a través de la teoría de opciones reales Gracia Rubio Martín

274/2006 Capital stock and unemployment: searching for the missing link Ana Rosa Martínez-Cañete, Elena Márquez de la Cruz, Alfonso Palacio-Vera and Inés Pérez-Soba Aguilar

275/2006 Study of the influence of the voters’ political culture on vote decision through the simulation of a political competition problem in Spain Sagrario Lantarón, Isabel Lillo, Mª Dolores López and Javier Rodrigo

276/2006 Investment and growth in Europe during the Golden Age Antonio Cubel and Mª Teresa Sanchis

277/2006 Efectos de vincular la pensión pública a la inversión en cantidad y calidad de hijos en un modelo de equilibrio general Robert Meneu Gaya

278/2006 El consumo y la valoración de activos Elena Márquez y Belén Nieto


280/2006 Three measures of returns to education: An illustration for the case of Spain María Arrazola y José de Hevia

281/2006 Composition of Firms versus Composition of Jobs Antoni Cunyat

282/2006 La vocación internacional de un holding tranviario belga: la Compagnie Mutuelle de Tramways, 1895-1918 Albetre Martínez López

283/2006 Una visión panorámica de las entidades de crédito en España en la última década. Constantino García Ramos


285/2006 Los intereses belgas en la red ferroviaria catalana, 1890-1936 Albetre Martínez López

286/2006 The Governance of Quality: The Case of the Agrifood Brand Names Marta Fernández Barcala, Manuel González-Díaz y Emmanuel Raynaud

287/2006 Modelling the role of health status in the transition out of malthusian equilibrium Paolo Rungo, Luis Currais and Berta Rivera

288/2006 Industrial Effects of Climate Change Policies through the EU Emissions Trading Scheme Xavier Labandeira and Miguel Rodríguez
Globalisation and the Composition of Government Spending: An analysis for OECD countries
Norman Gemmell, Richard Kneller and Ismael Sanz

La producción de energía eléctrica en España: Análisis económico de la actividad tras la liberalización del Sector Eléctrico
Fernando Hernández Martínez

Further considerations on the link between adjustment costs and the productivity of R&D investment: evidence for Spain
Desiderio Romero-Jordán, José Félix Sanz-Sanz and Inmaculada Álvarez-Ayuso

Una teoría sobre la contribución de la función de compras al rendimiento empresarial
Javier González Benito

Agility drivers, enablers and outcomes: empirical test of an integrated agile manufacturing model
Daniel Vázquez-Bustelo, Lucía Avella and Esteban Fernández

Testing the parametric vs the semiparametric generalized mixed effects models
Maria José Lombardía and Stefan Sperlich

Nonlinear dynamics in energy futures
Mariano Matilla-García

Estimating Spatial Models By Generalized Maximum Entropy Or How To Get Rid Of W
Esteban Fernández Vázquez, Matías Mayor Fernández and Jorge Rodríguez-Valez

Optimización fiscal en las transmisiones lucrativas: análisis metodológico
Félix Domínguez Barrero

La situación actual de la banca online en España
Francisco José Climent Diranzo y Alexandre Momparler Pechuán

Estrategia competitiva y rendimiento del negocio: el papel mediador de la estrategia y las capacidades productivas
Javier González Benito y Isabel Suárez González

A Parametric Model to Estimate Risk in a Fixed Income Portfolio
Pilar Abad and Sonia Benito

Análisis Empírico de las Preferencias Sociales Respecto del Gasto en Obra Social de las Cajas de Ahorros
Alejandro Esteller-Moré, Jonathan Jorba Jiménez y Albert Solé-Ollé

Assessing the enlargement and deepening of regional trading blocs: The European Union case
Salvador Gil-Pareja, Rafael Llorca-Vivero y José Antonio Martínez-Serrano

¿Es la Franquicia un Medio de Financiación?: Evidencia para el Caso Español
Vanessa Solís Rodríguez y Manuel González Díaz

On the Finite-Sample Biases in Nonparametric Testing for Variance Constancy
Paulo M.M. Rodrigues and Antonio Rubia

Spain is Different: Relative Wages 1989-98
José Antonio Carrasco Gallego
306/2007 Poverty reduction and SAM multipliers: An evaluation of public policies in a regional framework
Francisco Javier De Miguel-Vélez y Jesús Pérez-Mayo

307/2007 La Eficiencia en la Gestión del Riesgo de Crédito en las Cajas de Ahorro
Marcelino Martínez Cabrera

308/2007 Optimal environmental policy in transport: unintended effects on consumers' generalized price
M. Pilar Socorro and Ofelia Betancor

Roberto Ezcurra, Belen Iráizoz, Pedro Pascual and Manuel Rapún

310/2007 Long-run Regional Population Divergence and Modern Economic Growth in Europe: a Case Study of Spain
Maria Isabel Ayuda, Fernando Collantes and Vicente Pinilla

311/2007 Financial Information effects on the measurement of Commercial Banks’ Efficiency
Borja Amor, Maria T. Tascón and José L. Fanjul

312/2007 Neutralidad e incentivos de las inversiones financieras en el nuevo IRPF
Félix Domínguez Barrero

313/2007 The Effects of Corporate Social Responsibility Perceptions on The Valuation of Common Stock
Waymond Rodgers , Helen Choy and Andres Guiral-Contreras

314/2007 Country Creditor Rights, Information Sharing and Commercial Banks’ Profitability Persistence across the world
Borja Amor, Maria T. Tascón and José L. Fanjul

315/2007 ¿Es Relevante el Déficit Corriente en una Unión Monetaria? El Caso Español
Javier Blanco González y Ignacio del Rosal Fernández

316/2007 The Impact of Credit Rating Announcements on Spanish Corporate Fixed Income Performance: Returns, Yields and Liquidity
Pilar Abad, Antonio Díaz and M. Dolores Robles

317/2007 Indicadores de Lealtad al Establecimiento y Formato Comercial Basados en la Distribución del Presupuesto
Cesar Augusto Bustos Reyes y Óscar González Benito

318/2007 Migrants and Market Potential in Spain over The XXth Century: A Test Of The New Economic Geography
Daniel A. Tirado, Jordi Pons, Elisenda Paluzie and Javier Silvestre

319/2007 El Impacto del Coste de Oportunidad de la Actividad Emprendedora en la Intención de los Ciudadanos Europeos de Crear Empresas
Luis Miguel Zapico Aldeano

320/2007 Los belgas y los ferrocarriles de vía estrecha en España, 1887-1936
Alberte Martínez López

321/2007 Competición política bipartidista. Estudio geométrico del equilibrio en un caso ponderado
Isabel Lillo, Mª Dolores López y Javier Rodrigo

322/2007 Human resource management and environment management systems: an empirical study
Mª Concepción López Fernández, Ana Mª Serrano Bedía and Gema García Piqueres
323/2007 Wood and industrialization. evidence and hypotheses from the case of Spain, 1860-1935. Iñaki Iriarte-Goñi and María Isabel Ayuda Bosque


325/2007 Monetary policy and structural changes in the volatility of us interest rates. Juncal Cuñado, Javier Gomez Biscarri and Fernando Perez de Gracia

326/2007 The productivity effects of intrafirm diffusion. Lucio Fuentelsaz, Jaime Gómez and Sergio Palomas


328/2007 El grado de cobertura del gasto público en España respecto a la UE-15 Nuria Rueda, Begoña Barruso, Carmen Calderón y Mª del Mar Herrador

329/2007 The Impact of Direct Subsidies in Spain before and after the CAP'92 Reform Carmen Murillo, Carlos San Juan and Stefan Sperlich

330/2007 Determinants of post-privatisation performance of Spanish divested firms Laura Cabeza García and Silvia Gómez Ansón

331/2007 ¿Por qué deciden diversificar las empresas españolas? Razones oportunistas versus razones económicas Almudena Martínez Campillo

332/2007 Dynamical Hierarchical Tree in Currency Markets Juan Gabriel Brida, David Matesanz Gómez and Wiston Adrián Risso

333/2007 Los determinantes sociodemográficos del gasto sanitario. Análisis con microdatos individuales Ana María Angulo, Ramón Barberán, Pilar Egea y Jesús Mur

334/2007 Why do companies go private? The Spanish case Inés Pérez-Soba Aguilar

335/2007 The use of gis to study transport for disabled people Verónica Cañal Fernández

336/2007 The long run consequences of M&A: An empirical application Cristina Bernad, Lucio Fuentelsaz and Jaime Gómez

337/2007 Las clasificaciones de materias en economía: principios para el desarrollo de una nueva clasificación Valentín Edo Hernández

338/2007 Reforming Taxes and Improving Health: A Revenue-Neutral Tax Reform to Eliminate Medical and Pharmaceutical VAT Santiago Álvarez-García, Carlos Pestana Barros y Juan Prieto-Rodriguez

339/2007 Impacts of an iron and steel plant on residential property values Celia Bilbao-Terol

341/2007 ¿Cómo organizar una cadena hotelera? La elección de la forma de gobierno
Marta Fernández Barcala y Manuel González Díaz

342/2007 Análisis de los efectos de la decisión de diversificar: un contraste del marco teórico “Agencia-Stewardship”
Almudena Martínez Campillo y Roberto Fernández Gago

343/2007 Selecting portfolios given multiple eurostoxx-based uncertainty scenarios: a stochastic goal programming approach from fuzzy betas
Enrique Ballesteros, Blanca Pérez-Gladish, Mar Arenas-Parra and Amelia Bilbao-Terol

344/2007 “El bienestar de los inmigrantes y los factores implicados en la decisión de emigrar”
Anastasia Hernández Alemán y Carmelo J. León

Andrea Martinez-Noya and Esteban García-Canal

346/2007 Diferencias salariales entre empresas públicas y privadas. El caso español
Begoña Cueto y Nuria Sánchez- Sánchez

347/2007 Effects of Fiscal Treatments of Second Home Ownership on Renting Supply
Celia Bilbao Terol and Juan Prieto Rodríguez

348/2007 Auditors’ ethical dilemmas in the going concern evaluation
Andres Guiral, Waymond Rodgers, Emiliano Ruiz and Jose A. Gonzalo

Susana Morales Sequera y Carmen Pérez Esparrells

350/2007 Socially responsible investment: mutual funds portfolio selection using fuzzy multiobjective programming
Blanca Mª Pérez-Gladish, Mar Arenas-Parra , Amelia Bilbao-Terol and Mª Victoria Rodríguez-Uría

351/2007 Persistencia del resultado contable y sus componentes: implicaciones de la medida de ajustes por devengo
Raúl Iñiguez Sánchez y Francisco Poveda Fuentes

352/2007 Wage Inequality and Globalisation: What can we Learn from the Past? A General Equilibrium Approach
Concha Betrán, Javier Ferri and Maria A. Pons

353/2007 Eficacia de los incentivos fiscales a la inversión en I+D en España en los años noventa
Desiderio Romero Jordán y José Félix Sanz Sanz

354/2007 Convergencia regional en renta y bienestar en España
Robert Meneu Gaya

355/2007 Tributación ambiental: Estado de la Cuestión y Experiencia en España
Ana Carrera Poncela

356/2007 Salient features of dependence in daily us stock market indices
Luis A. Gil-Alana, Juncal Cuñado and Fernando Pérez de Gracia

357/2007 La educación superior: ¿un gasto o una inversión rentable para el sector público?
Inés P. Murillo y Francisco Pedraja
358/2007 Effects of a reduction of working hours on a model with job creation and job destruction
Emilio Domínguez, Miren Ullibarri y Idoya Zabaleta

359/2007 Stock split size, signaling and earnings management: Evidence from the Spanish market
José Yagüe, J. Carlos Gómez-Sala and Francisco Poveda-Fuentes

360/2007 Modelización de las expectativas y estrategias de inversión en mercados de derivados
Begoña Font-Belaire

361/2008 Trade in capital goods during the golden age, 1953-1973
Mª Teresa Sanchis and Antonio Cubel

362/2008 El capital económico por riesgo operacional: una aplicación del modelo de distribución de pérdidas
Enrique José Jiménez Rodríguez y José Manuel Feria Domínguez

363/2008 The drivers of effectiveness in competition policy
Joan-Ramon Borrell and Juan-Luis Jiménez

364/2008 Corporate governance structure and board of directors remuneration policies: evidence from Spain
Carlos Fernández Méndez, Rubén Arrondo García and Enrique Fernández Rodríguez

365/2008 Beyond the disciplinary role of governance: how boards and donors add value to Spanish foundations
Pablo De Andrés Alonso, Valentín Azofra Palenzuela y M. Elena Romero Merino

366/2008 Complejidad y perfeccionamiento contractual para la contención del oportunismo en los acuerdos de franquicia
Vanessa Solís Rodríguez y Manuel González Díaz

367/2008 Inestabilidad y convergencia entre las regiones europeas
Jesús Mur, Fernando López y Ana Angulo

368/2008 Análisis espacial del cierre de explotaciones agrarias
Ana Aldanondo Ochoa, Carmen Almansa Sáez y Valero Casanovas Oliva

369/2008 Cross-Country Efficiency Comparison between Italian and Spanish Public Universities in the period 2000-2005
Tommaso Agasisti and Carmen Pérez Esparrells

370/2008 El desarrollo de la sociedad de la informació n en España: un análisis por comunidades autónomas
María Concepción García Jiménez y José Luis Gómez Barroso

371/2008 El medioambiente y los objetivos de fabricación: un análisis de los modelos estratégicos para su consecución
Lucía Avella Camarero, Esteban Fernández Sánchez y Daniel Vázquez-Bustelo

372/2008 Influence of bank concentration and institutions on capital structure: New international evidence
Víctor M. González and Francisco González

373/2008 Generalización del concepto de equilibrio en juegos de competición política
Mª Dolores López González y Javier Rodrigo Hitos

374/2008 Smooth Transition from Fixed Effects to Mixed Effects Models in Multi-level regression Models
María José Lombardía and Stefan Sperlich
375/2008 A Revenue-Neutral Tax Reform to Increase Demand for Public Transport Services
Carlos Pestana Barros and Juan Prieto-Rodriguez

376/2008 Measurement of intra-distribution dynamics: An application of different approaches to the European regions
Adolfo Maza, María Hierro and José Villaverde

377/2008 Migración interna de extranjeros y ¿nueva fase en la convergencia?
María Hierro y Adolfo Maza

378/2008 Efeto de la Reforma del Sector Eléctrico: Modelización Teórica y Experiencia Internacional
Ciro Eduardo Bazán Navarro

379/2008 A Non-Parametric Independence Test Using Permutation Entropy
Mariano Matilla-García and Manuel Ruiz Marín

380/2008 Testing for the General Fractional Unit Root Hypothesis in the Time Domain
Uwe Hassler, Paulo M.M. Rodrigues and Antonio Rubia

381/2008 Multivariate gram-charlier densities
Esther B. Del Brio, Trino-Manuel Ñíguez and Javier Perote

382/2008 Analyzing Semiparametrically the Trends in the Gender Pay Gap - The Example of Spain
Ignacio Moral-Arce, Stefan Sperlich, Ana I. Fernández-Sainz and Maria J. Roca

383/2008 A Cost-Benefit Analysis of a Two-Sided Card Market
Santiago Carbó Valverde, David B. Humphrey, José Manuel Liñares Zegarra and Francisco Rodríguez Fernandez

384/2008 A Fuzzy Bicriteria Approach for Journal Deselection in a Hospital Library
M. L. López-Avello, M. V. Rodríguez-Uría, B. Pérez-Gladish, A. Bilbao-Terol, M. Arenas-Parra

385/2008 Valoración de las grandes corporaciones farmacéuticas, a través del análisis de sus principales intangibles, con el método de opciones reales
Gracia Rubio Martín y Prosper Lamothe Fernández

386/2008 El marketing interno como impulsor de las habilidades comerciales de las pymes españolas: efectos en los resultados empresariales
Mª Leticia Santos Vijande, Mª José Sanzo Pérez, Nuria García Rodríguez y Juan A. Trespalacios Gutiérrez

387/2008 Understanding Warrants Pricing: A case study of the financial market in Spain
David Abad y Belén Nieto

388/2008 Aglomeración espacial, Potencial de Mercado y Geografía Económica: Una revisión de la literatura
Jesús López-Rodríguez y J. Andrés Faíña

389/2008 An empirical assessment of the impact of switching costs and first mover advantages on firm performance
Jaime Gómez, Juan Pablo Maícas

390/2008 Tender offers in Spain: testing the wave
Ana R. Martínez-Cañete y Inés Pérez-Soba Aguilar
<table>
<thead>
<tr>
<th>Número</th>
<th>Título</th>
<th>Autor(es)</th>
</tr>
</thead>
<tbody>
<tr>
<td>391/2008</td>
<td>La integración del mercado español a finales del siglo XIX: los precios del trigo entre 1891 y 1905</td>
<td>Mariano Matilla García, Pedro Pérez Pascual y Basilio Sanz Carnero</td>
</tr>
<tr>
<td>392/2008</td>
<td>Cuando el tamaño importa: estudio sobre la influencia de los sujetos políticos en la balanza de bienes y servicios</td>
<td>Alfonso Echazarra de Gregorio</td>
</tr>
<tr>
<td>393/2008</td>
<td>Una visión cooperativa de las medidas ante el posible daño ambiental de la desalación</td>
<td>Borja Montaño Sanz</td>
</tr>
<tr>
<td>394/2008</td>
<td>Efectos externos del endeudamiento sobre la calificación crediticia de las Comunidades Autónomas</td>
<td>Andrés Leal Marcos y Julio López Laborda</td>
</tr>
<tr>
<td>395/2008</td>
<td>Technical efficiency and productivity changes in Spanish airports: A parametric distance functions approach</td>
<td>Beatriz Tovar &amp; Roberto Rendeiro Martín-Cejas</td>
</tr>
<tr>
<td>396/2008</td>
<td>Network analysis of exchange data: Interdependence drives crisis contagion</td>
<td>David Matesanz Gómez &amp; Guillermo J. Ortega</td>
</tr>
<tr>
<td>397/2008</td>
<td>Explaining the performance of Spanish privatised firms: a panel data approach</td>
<td>Laura Cabeza García and Silvia Gomez Anson</td>
</tr>
<tr>
<td>398/2008</td>
<td>Technological capabilities and the decision to outsource R&amp;D services</td>
<td>Andrea Martínez-Noya and Esteban García-Canal</td>
</tr>
<tr>
<td>399/2008</td>
<td>Hybrid Risk Adjustment for Pharmaceutical Benefits</td>
<td>Manuel García-Goñi, Pere Ibern &amp; José María Inoriza</td>
</tr>
<tr>
<td>400/2008</td>
<td>The Team Consensus–Performance Relationship and the Moderating Role of Team Diversity</td>
<td>José Henrique Dieguez, Javier González-Benito and Jesús Galende</td>
</tr>
<tr>
<td>401/2008</td>
<td>The institutional determinants of CO₂ emissions: A computational modelling approach using Artificial Neural Networks and Genetic Programming</td>
<td>Marcos Álvarez-Díaz, Gonzalo Caballero Miguez and Mario Soliño</td>
</tr>
<tr>
<td>402/2008</td>
<td>Alternative Approaches to Include Exogenous Variables in DEA Measures: A Comparison Using Monte Carlo</td>
<td>José Manuel Cordero-Ferrera, Francisco Pedraja-Chaparro and Daniel Santín-González</td>
</tr>
<tr>
<td>403/2008</td>
<td>Efecto diferencial del capital humano en el crecimiento económico andaluz entre 1985 y 2004: comparación con el resto de España</td>
<td>Mª del Pópulo Pablo-Romero Gil-Delgado y Mª de la Palma Gómez-Calero Valdés</td>
</tr>
<tr>
<td>404/2008</td>
<td>Análisis de fusiones, variaciones conjeturales y la falacia del estimador en diferencias</td>
<td>Juan Luis Jiménez y Jordi Perdiguero</td>
</tr>
<tr>
<td>405/2008</td>
<td>Política fiscal en la uem: ¿basta con los estabilizadores automáticos?</td>
<td>Jorge Uxó González y Mª Jesús Arroyo Fernández</td>
</tr>
<tr>
<td>406/2008</td>
<td>Papel de la orientación emprendedora y la orientación al mercado en el éxito de las empresas</td>
<td>Óscar González-Benito, Javier González-Benito y Pablo A. Muñoz-Gallego</td>
</tr>
<tr>
<td>407/2008</td>
<td>La presión fiscal por impuesto sobre sociedades en la unión europea</td>
<td>Elena Fernández Rodríguez, Antonio Martínez Arias y Santiago Álvarez García</td>
</tr>
</tbody>
</table>
The environment as a determinant factor of the purchasing and supply strategy: an empirical analysis
Dr. Javier González-Benito y MS Duilio Reis da Rocha

Cooperation for innovation: the impact on innovatory effort
Gloria Sánchez González and Liliana Herrera