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INCLUDING NON-COGNITIVE OUTPUTS IN A MULTIDIMENSIONAL EVALUATION OF EDUCATION PRODUCTION: AN INTERNATIONAL COMPARISON[*]

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Abstract

Non-cognitive education is recognized to be a significant objective on the same level as cognitive education. However, it has been neglected by previous studies that have analyzed efficiency in the education sector, which have exclusively focused on cognitive abilities. The main aim of the current study is to carry out, for the first time in the economic literature, a global evaluation of educational production. We have used information about both affective and cognitive outputs from a sample of 22 OECD countries. We find that there is a link between educational expenditures and affective outputs. However, the link is not clear in the case of the cognitive output. Additionally, the level of economic development of a country is a factor which has a positive influence on educational expenditure efficiency. Neither family support nor the presence of private schools are found to be significant factors in explaining the global efficiency of the education sector.

Keywords: affective education, productive efficiency, DEA

JEL Classification: H52, I21, H40, C61

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1. Introduction.

There has been an increasing interest in the evaluation of the efficiency of public services, and in particular education, in all developed countries over recent decades. Bessent and Bessent (1980) was the first application of Data Envelopment Analysis (DEA), a non-parametric efficiency evaluation technique, to the educational sector. Since then there has been an ever-increasing number of studies analyzing specific problems related to the productive evaluation of education, addressing themes such as the effects of students' socio-economic and family environment or methodological issues surrounding the specification and estimation of the educational production function.[1] The elaboration of output measures has also been frequently analyzed, from both institutional and academic points of view (Gonand et al., 2007). However, up till now the non-cognitive component of educational output has been completely ignored in the literature.

When evaluating the efficiency of public services, the selection of the outputs is a decisive issue (Smith, 1997). Generally speaking, the identification and measurement of output variables should take into account both the social demands on public service and production targets. At the same time, the output variables should permit us to make a correct and fair evaluation of the productive units. The multidimensional character of education output has long been recognized (see, for example, Bloom et al., 1956). The education economics literature has highlighted two different components of the educational output: cognitive education (intellectual abilities and specific knowledge) and non-cognitive education (affective values and social and personal attitudes). Moreover, there is a consensus in the literature with regard to the significance of both these components of educational output in the sense that schools should not only transmit knowledge but also provide social and personal guidance which facilitate labour and social integration, the ability to communicate and interrelate, respect for the environment, and personal and socio-political responsibility (Pring, 1984; Lang et al., 1998; Best, 2003). The inclusion of several non-cognitive abilities as key aims of the educational

[1] See Worthington (2001) for a review of the literature related to the evaluation of the education sector efficiency.

system underscores the high value that societies attributes to affective education.

However, as far as we are aware, there are no studies that have evaluated the efficiency of the education sector taking this non-cognitive component into account. Our aim in this research is to provide an empirical analysis which includes non-cognitive outputs jointly with cognitive output. To do so, we carry out an international comparison of efficiency in the educational sector which allows us to identify differences among countries and institutional frameworks with respect to both educational output dimensions.[2] The data used to design the non-cognitive output measures have been taken from the *World Values Survey* and the *European Values Survey*. We have made use of several questions in these surveys related to affective education, focusing on the population aged between 15 and 20 years old. To measure cognitive skills we use the PISA data base. The methodology used for the efficiency evaluation is DEA, which is the technique generally used for analyzing efficiency in the educational sector in studies which have considered only the cognitive dimension.[3] In the last part of our empirical exercise we study the impact on results of several country features such as the economic level, the presence of private schools in education, and family support for teenagers' education.

The outline of the paper is the following. In the next section, some comments about the importance and role of affective education are made. The following three sections relate to the empirical analysis: Section 3 includes the description and calculation of variables; the methodology used and the results obtained in the efficiency evaluation are presented in Section 4; and Section 5 presents the results of the second-stage analysis. Section 6 concludes.

[2] The authors are conscious that aggregate results obtained in an international comparison have to be taken cautiously, due the differences in historical evolution, social composition, etc. However, this does not take away from the importance of published studies (some of them cited in this research) which compare the productive efficiency of different national educational systems. In an effort to achieve homogeneity, we include exclusively OECD countries in our sample.

[3] See the aforementioned literature review by Worthington (2001).

2. Affective or non-cognitive education: its role in the productive evaluation of educational service

Despite the fact that the relevance of both cognitive and non-cognitive results has long been recognized in the education and teaching literature, non-cognitive features have been ignored in the empirical literature related to educational sector inputs and output. Affective education can be defined as learning that is related to emotions, feelings and passions which motivate and have influence on human actions (Best, 1998). Cohn et al. (1975) proposed the following classification of the most important aspects linked to affective education:

- Self-esteem and environment control.
- Tolerance and respect towards other social groups.
- Citizenship (democratic attitudes and responsibilities).
- Interest in school tasks.
- Healthy lifestyle.
- Potential creative abilities.
- Labour career development.
- Valuation of human achievements (theatre, fine arts, sports, music, science, politics).
- Adaptation to changes.

In the previous list, the first three groups have been especially highlighted in the educational literature, in particular the following: those aspects related to individual features, such as effort, responsibility or self-confidence; features linked to tolerance and personal relationships; and active citizenship (politics, democracy). These are the features which will be considered when selecting affective output variables in the empirical analysis. However, according to Cohn and Geske (1990) it is easier to distinguish between different types of educational outputs than it is to accurately measure them. They point to the difficulty in reaching agreement on the definition of some basic concepts. Thus, while it may be difficult to define the concept of “citizenship”, it is just as difficult to define basic knowledge in Mathematics or Language as there are different exams to measure cognitive abilities. However, the controversy about a generally accepted definition of citizenship has not impeded agreement on several basic concepts such as race or sexual discrimination or certain individual characteristics such as effort or responsibility.

One of the main problems in the characterization of non-cognitive education is how to achieve equilibrium in the sense of setting priorities among interdependent objectives (Ryder and Campbell, 1988). In this respect, some researchers consider that the main aim should consist of identifying a "well-behaved person". For others, the basic issue would be "ethical features", in terms of relationships with other people (Pring, 1984). Finally, several researchers place greatest emphasis on socio-political and democratic attitudes (Hargreaves et al, 1988). However, all these issues are clearly complementary.

According to Atkinson and Hornby (2002), the practices and techniques that improve emotional intelligence have a life-long impact on students and for this reason social and emotional aspects are at least as important as cognitive aspects, if not more so. Several studies suggest than when affective learning has been actively developed, there are important short and long-term consequences for both academic and affective dimensions. For example, the development of cooperation and interaction among groups of students leads to improvements in the environment for learning. This generates better academic outcomes and greater social capital in terms of the ability to integrate and be committed to future social collectives (Watkins et al, 1991; Nixon et al, 1996).

In spite of the above, all of the studies published to date have focused on output variables related only to the cognitive component, constructed using student exam marks (Worthington, 2001). Moreover, few studies have analyzed the efficiency of the education sector from an international perspective (Wilson, 2005; Afonso and St. Aubyn, 2006; Giménez et al., 2007). The problem with carrying out such studies has been a shortage of data and the main reason why non-cognitive outputs have not been considered in empirical studies is the difficulty in obtaining standardized indexes to measure affective abilities (Gray et al., 1986).

Levin (1974) pointed out that care should be taken when interpreting the results of studies where only cognitive outputs are considered. Schools are multi-objective productive units in that they have to ensure that students not only learn specific subjects but also acquire several socio-affective attitudes.

Several original studies that applied DEA to the educational sector (Bessent and Bessent, 1980; Bessent et al., 1982) concluded that one of the three main problems with evaluating efficiency in this context is to get data which allow the construction of output variables which are not restricted to cognitive results. In addition, Smith and Mayston (1987) pointed out that the omission of a significant output can clearly bias the results. According to the experts in this sector, the best solution would consist of complementing cognitive outputs with other abilities and values related to affective or non-cognitive outputs (Gray, 1981; Thanassoulis and Dunstan, 1994; Rico, 1996; Silva Portela and Thanassoulis, 2001; Giménez et al., 2007).

On the other hand, it is possible to find arguments against the inclusion of these kinds of variables in the evaluation of schools (Wagner, 1977; Madaus et al, 1979; Chubb and Moe, 1990). First of all, it has been argued that non-cognitive outputs have less importance than cognitive outputs. Secondly, schools are held less responsible for the transmission of these values. And finally, there is a higher probability that these non-cognitive outputs have been nurtured outside schools. However, nowadays the social structures of developed societies are changing in ways which influence young peoples' affective education. Several phenomena such as the lengthening of the workday, the incorporation of women into the labor market, the lack of conciliation between family and work[4], new forms of personal interaction due to new technologies, and the increase in immigration[5] all exert a strong influence on non-cognitive formation. As a consequence, in recent years politicians have been concerned with young peoples' attitudes with respect to social and democratic integration, tolerance, or other affective abilities. Governments have attempted to facilitate informal education at home through legal measures to conciliate labour with family, but at the same time they are trying to complement family efforts by reinforcing the role of the schools in improving young peoples'

[4] According to 2007 data from Spain's Department of Labour and Social Affairs, half of Spanish grandmothers spend an average of 4 hours a day looking after their grandchildren while their parents are working.

[5] In Janmaat (2008) is shown that the civic values and attitudes previously mentioned are not exclusively observed in occidental cultures. In the context of an international study, he concludes that the differences between national and immigrant teenagers are based on different socioeconomic conditions, and not on their ethnic origin.

affective education. This makes it all the more important to consider non-cognitive outputs in the evaluation of educational units.

3. Empirical analysis: data and variables.

In line with the discussion in the previous section, we now describe the variables related to affective abilities which have been included in the empirical analysis. The indexes have been calculated using micro-data taken from the *World Values Survey* and the *European Values Survey*. These surveys are the result of multi-country research into socio-cultural and political change based on representative individual national samples. Data from these surveys are made publicly available for use by researchers interested in how views change with time. We have used the information corresponding to the 1999-2001 wave due to the greater homogeneity and breadth of the questionnaire for our purposes, as well as the greater availability of countries.[6] For each country we have selected those individuals between 15 and 20 years old, and in total we have selected 22 countries, all of which are OECD members[7].

From the questionnaire, nine questions related to non-cognitive education have been selected. The first block includes relevant student qualities or virtues such as effort (EFF), responsibility (RESP) and perseverance (PERSV). In the survey, students are asked whether they consider these features to be important in a person's education.[8] Their descriptive values are presented in Table 1, from which it can be discerned that the students interviewed considered responsibility to be more important than effort or perseverance. On average, the value related to responsibility is almost double those of effort and perseverance.

[6] As we will show below, the years of the survey are not exactly the same for all the countries included in our sample.
[7] The countries considered and the exact year when the corresponding survey was carried out are the following: Austria (1999), Belgium (1999), Canada (2000), Republic of Korea (2001), Czech Republic (1999), Denmark (1999), United States (1999), Finland (2000), France (1999), Germany (1999), Greece (1999), Hungary (1999), Ireland (1999), Iceland (1999), Italy (1999), Luxembourg (1999), New Zealand (1998), Poland (1999), Portugal (1999), Spain (1999-00), Sweden (1999), and the United Kingdom (1999).
[8] The three questions included in this block are dummy variables (0 = not important; 1= important). The common framework of questions was the following: "Here is a list of qualities that children can be encouraged to learn. Which, if any, do you consider to be especially important?"

Table 1. QUALITIES ranking: selected values.

	EFF	RESP	PERS
1º	S. KOREA (0.67)	S. KOREA (0.91)	GREECE (0.65)
2º	PORTUGAL (0.62)	GREECE (0.86)	CANADA (0.56)
3º	UNITED STATES	GERMANY (0.86)	UNITED STATES (0.56)
	…	…	…
20º	SWEDEN (0.07)	UNITED KINGDOM	ICELAND (0.23)
21º	GERMANY (0.06)	NEW ZEALAND	SWEDEN (0.21)
22º	AUSTRIA (0.04)	IRELAND (0.50)	AUST RIA (0.19)
MEAN	0.37	0.74	0.41
STD. DEV.	0.19	0.11	0.12

Source: own elaboration

Secondly, regarding tolerance towards different social groups we have considered three additional questions. Individual were asked about their willingness to share their daily space with different collectives, such as people of different races (RACE), immigrants (INM), and homosexuals (HOMO).[9] Table 2 shows the main descriptive statistics. The lowest-valued social collective is that of homosexuals, with strikingly low minimum values in some countries.

Table 2. TOLERANCE ranking: selected values

	RACE	INM	HOMO
1º	NEW ZEALAND (1.0)	NEW ZEALAND (1.0)	ICELAND (0.98)
2º	AUSTRIA (0.97)	IRELAND (1.0)	SWEDEN (0.96)
3º	ICELAND (0.97)	PORTUGAL (0.98)	DENMARK (0.95)
	…	…	…
20º	ITALY (0.84)	ITALY (0.79)	HUNGARY (0.64)
21º	FINLAND (0.83)	CZECH REP. (0.79)	POLAND (0.60)
22º	S. KOREA (0.82)	S. KOREA (0.64)	S. KOREA (0.29)
MEAN	0.91	0.89	0.81
STD.	0.05	0.08	0.15

Source: own elaboration

The third and final block is related to valuations of citizenship and democracy. Interviewees were asked about their interest in politics (INT), and we included two additional questions related to the individuals' valuation of

[9] As with the previous block, the three questions included here are dummy variables. To the following question: "Would you have a problem with having a member of the following collective as a neighbour?", the interviewee could answer: 0 = no or 1= yes. We have re-codified the variable inversely.

democratic systems. In particular, we include the interviewees' opinion about the idea that democracies are good for maintaining order (DEMO1), and their opinion about whether they think democracy, even if they recognize that it is not perfect, is the best alternative, (DEMO2).[10] In Table 3 it can be observed that, on average, young people have faith in democratic systems but they are not much interested in politics.

Table 3. POLITICS ranking: selected values

	INT	DEMO1	DEMO2
1º	GERMANY (0.58)	S. KOREA (0.90)	GREECE (0.97)
2º	UNITED STATES	SWEDEN (0.87)	AUSTRIA (0.97)
3º	AUSTRIA (0.47)	ICELAND (0.84)	S. KOREA (0.96)
	…	…	…
20º	POLAND (0.22)	CZECH REP. (0.57)	CANADA (0.84)
21º	FRANCE (0.21)	FRANCE (0.56)	UNITED STATES (0.77)
22º	FINLAND (0.20)	POLAND (0.40)	UNITED KINGDOM
MEAN	0.35	0.73	0.89
STD.	0.10	0.12	0.06

Source: own elaboration

As is well-known, the use of DEA requires a high number of productive units compared with the number of variables included in the analysis in order to correctly identify the efficient units. Taking into account the sample size, it is therefore necessary to aggregate the information. Principal Components Analysis has sometimes been used in the literature to achieve this. However, making use of the homogeneity inside each of the three blocks/groups, we have used the simpler method of obtaining one variable per block by summing up the values of the three questions in each block. We thus summarize the information from nine questions into three variables which are representative of affective education. Table 4 shows some descriptive statistics related to these non-cognitive outputs.

[10] The three questions in this block have a scaled response from 1 to 4. For example, to the question "How interested would you say you are in politics?" the interviewee could answer 1= very interested, 2= somewhat interested, 3 = not very interested, 4= not at all interested. In order to homogenize this variable, responses were re-coded into a dummy variable: 1= if individual is very interested or somewhat interested, and 0= if he/she is not very interested or not interested at all.

Table 4. Descriptive statistics: affective and cognitive outputs

	MEAN	*STD. DEV.*	*MAX.*	*MIN.*
Y1 (QUALITIES)	1.52	0.26	2.12	1.00
Y2 (TOLERANCE)	2.63	0.25	2.93	1.76
Y3 (POLITICS)	1.98	0.21	2.32	1.49
Y4 (PISA)	501.22	24.73	546.00	441.00

Source: own elaboration

Regarding cognitive output, we have used the information from the PISA international report for the year 2000, which corresponds to the period of the affective data. The OECD Programme for International Student Assessment (PISA) tries to evaluate several aspects of the knowledge and abilities of students who are close to finishing obligatory secondary school. PISA tests are carried out every three years, and in each wave there is a specific area: *Reading* (in 2000), *Mathematics* (in 2003) and *Sciences* (in 2006), with problem-solving being a specific topic in PISA 2003. The programme is carrying out a second phase of evaluations in 2009 (*Reading*), 2012 (*Mathematics*) and 2015 (*Sciences*). The main area in each wave takes up approximately 66% of the study, with the two remaining areas accounting for 17% each. This permits a broad and detailed view about students' education every nine years, with an approximation to their evolution every three years. As we are using the 2000 report, we will use the results related to *Reading* as it was the main area of that wave.[11] Some descriptive statistics of our cognitive output are shown in Table 4.

Having identified and defined the output variables, the task remains of choosing the input variables to be used in the educational production process. The study of the impact that physical and human resources have on school outputs has traditionally been a central topic in the literature. However, the profileration of studies on this issue has not yielded clear-cut evidence on the relationship between schools' resources and outputs.[12] Despite the lack of agreement on the existence of a significant relationship between educational

[11] For more detailed information about the PISA reports and the design of the 2000 wave, see Adams and Wu (2002).

[12] For a classic view about the topic, see Hanushek (1986). The same author points out in Hanushek (1998) that the weak relationship that is sometimes detected between school resources and results is a consequence of the current organization and incentives framework at schools. Thus, resources matter, but the problem is that they are not always well used.

expenditure and outcomes, this should be interpreted with caution due to the problems surrounding this issue.[13] It is thus quite dangerous to conclude that schools' resources do not have any impact on students' learning and abilities, and school expenditure is generally used as an input in analyses of efficiency in the education sector.

In accordance with the previous literature, therefore, we use the education expenditure per student as the input variable, considering this an index of the relative effort that governments make in order to improve young people's education. Here, we have a choice between two alternatives: the expenditure corresponding to the year of the survey, or the average value of this expenditure over the period 1998-2001. If we compare this average with the value of the year in which the survey was carried out, a strong correlation is observed. To make use of the greatest information possible we decided to use the average. Table 5 shows the statistics, where the data have been taken from the OECD, the IMF and EUROSTAT. We observe a high dispersion in the values, ranging from 2,500 euro per student in the case of Denmark to around 300 euro in the case of South Korea or Poland.

Table 5. Descriptive statistics: relative public expenditure in Education (average 1998-2001)

	MEAN	STD. DEV.	MAX.	MIN.
EXP (euro per student)	1,062.24	543.48	2,530.63	318.79

Source: OECD, IMF, EUROSTAT

Given the lack of consensus in the literature, before turning to the application we explore the relationship between expenditure and outputs. Regarding affective output, we find significant and positive correlations with two of the three variables (tolerance and democratic values). For the variable related to personal features, the correlation is positive but not significant. We determined that this result was produced by the outlying values of three

[13] According to Hanushek (1986), the lack of statistical significance can reveal problems with the data. Goldhaber and Brewer (1997) point out that the majority of studies have methodological deficiencies. Along the same lines, Hedges et al. (1994) and Dewey et al. (2000) have questioned the irrelevance the impact of resources on educational results. The debate remains open.

countries of the sample.[14] Eliminating these values, the correlation becomes significant and positive. To complement the above analysis, we constructed an aggregate variable by summing up the values of the three affective outputs and found a positive and significant correlation between this aggregate affective output and educational expenditure. However, the relationship between expenditure and cognitive output is not clear, in that we found a positive but non-significant relationship between both variables. This result is in line with previous studies.

4. Methodology and results

The methodology we use to evaluate affective education production efficiency is Data Envelopment Analysis (DEA). This non-parametric technique is especially suited to analyzing efficiency in the education sector.[15] DEA, based on mathematical programming, has evolved significantly since it originally appeared in the paper by Charnes et al. (1978). Thus, several extensions of the basic methodology have since appeared, adapting the original technique to the features of different sectors, to the nature of the variables used, or to the objectives involved.[16]

In this study, we have applied the variable returns to scale DEA model (Banker et al., 1984), oriented to output maximization. Variable returns to scale methodology is more flexible than other specifications, and it is especially appropriate for the educational sector where modeling the production process is complicated. However, higher flexibility is usually correlated with lower ability to discriminate when the number of observations is not high. In spite of this inconvenience, we have preferred to use variable returns over the alternative of constants returns to scale, the latter being a very restrictive assumption in the context of the education sector.[17] On the other hand, the objective of output maximization is perfectly appropriate in the context of current educational

[14] These countries were Austria, Sweden and Denmark, where the educational expenditure and two dimensions of affective output (tolerance and democratic values) have high values. However, very low values were reported for the question related to effort as a necessary quality in individuals' education.

[15] For a review of the advantages of this technique in the context of education, see Worthington (2001).

[16] See Cooper et al. (2004) and Thanassoulis (2001).

[17] In fact, where possible, variable returns to scale model is unanimously applied in the literature.

policies, in that the aims of public policies with regard to education are usually focused on maximizing the results obtained from assigned resources rather than saving resources maintaining the output level.

One final methodological decision needs to be taken. As we mentioned above, we consider four output variables: three linked to affective output and one to cognitive output. If we directly include the four outputs in the analysis, we would implicitly be giving more weight to affective education over cognitive education. As we want neither to predominate, one way of providing more symmetry between the outputs would be to aggregate the three affective variables into one. However, as this option would lead to a significant information loss, we rejected it in favour of applying an extended DEA model based on weight restrictions.

The enormous flexibility of DEA allows the assignment of null weights to some outputs, thereby permitting the construction of global indicators based on only one educational dimension, ignoring the remaining dimensions. However, this procedure is not appropriate if all dimensions are held to be important. As an alternative to completely free weights, it is possible to assign a specific weight to each output variable. This would allow us to obtain a global index by a simple ratio analysis, but the entire flexibility of model disappears and the weight-setting would in any case be subjective. As an intermediate alternative between these extremes (free or fixed weights), there exists an extension of DEA which has been commonly applied in recent years: the weights restriction model.[18] The aim of this technique is to avoid the efficiency evaluation being based on only one or a few of the variables considered in the analysis. Thus, we can avoid an excessive specialization by imposing minimum and maximum weights for all the variables included. In this way, and depending on the selected constraint, it is possible to guarantee that all dimensions be considered in the global index. While maintaining the flexibility of the DEA model, the mechanism selects the value of each weight that maximizes the value of each individual index.

[18] This extension was initially proposed by Dyson and Thanassoulis (1988). On its evolution and the extensions to the model, see Allen et al. (1997).

Having justified the methodology used, we need to restrict the weights in the most appropriate way. In our case, two aims were simultaneously pursued. First, we wished to ensure that the cognitive output did not have a very different weight from affective output, and to do so we assigned weights ranging from 40% to 60%. Secondly, we wanted to ensure that the three dimensions of affective output played a role in the evaluation. To achieve this, we assigned weights between 10% and 30% to each affective variable.

In analyzing the results, we focus on two aspects: the identification of efficient units and the values obtained by inefficient units.

As can be observed in Table 6, four countries of the total sample (22) are efficient: Canada, Ireland, South Korea and New Zealand. These countries maximized affective education given their resources but there are differences between them. On the one hand, South Korea and Ireland have a low level of expenditure per student but they obtained above average values in all the output variables.[19]. Canada and New Zealand, on the other hand, are closed to the average expenditure but they are in the top positions in all the output rankings. DEA identified Canada (14 appearances) and Korea (13 appearances) as the reference models for each of these two different types of efficient behavior.

The average efficiency index corresponding to inefficient units is around 0.95, implying that there are not large differences among countries and that there is not much scope for improvements in results[20]. The precise interpretation of the efficiency index value is that is shows the potential radial improvement of all the variables considered simultaneously (i.e., in an output maximization model it implies that, on average, inefficient units could improve all their outputs by 5%, maintaining their expenditure constant). However, the index does not provide information about non-radial slacks, which are quite large for some inefficient units especially in relation to individual qualities[21] and input[22] variables. Some countries such as the United States, Germany, Spain,

[19] There is an exception regarding one dimension in each country: the output related to personal qualities in the case of Ireland, and the results linked to tolerance in the case of South Korea.
[20] Luxembourg registers the minimum efficiency index value (0.90).
[21] This is, for instance, of Sweden (potential improvement of 84%), Austria (64%) or Poland (37%).
[22] Denmark (66%) and Sweden (48%) are the countries with highest slacks in this variable.

Italy or Hungary have very low or null slacks, so their potential improvements are almost exclusively in terms of their radial component.

Table 6. DEA results.

COUNTRY	EFFICIENCY INDEX
REPUBLIC OF KOREA	1.00
IRELAND	1.00
CANADA	1.00
NEW ZEALAND	1.00
ICELAND	0.99
FINLAND	0.98
UNITED STATES	0.98
PORTUGAL	0.98
GERMANY	0.98
SPAIN	0.97
CZECH REPUBLIC	0.97
GREECE	0.97
AUSTRIA	0.96
UNITED KINGDOM	0.96
DENMARK	0.95
SWEDEN	0.95
HUNGARY	0.95
BELGIUM	0.94
FRANCE	0.94
POLAND	0.94
ITALY	0.94
LUXEMBOURG	0.90

5. Analysis of explanatory factors: second stage analysis

In order to extend our empirical study, we carry out a second stage analysis. This kind of analysis, which is very common in studies that evaluate economic and technical efficiency[23], consists of finding explanatory factors for inefficient behaviour. To do so, it is frequent to use regression analysis (generally a Tobit, as the efficiency indexes are censored), using as a dependent variable the value of the efficiency indexes obtained in the first stage and as independent variables certain environmental factors (institutional, legal,

[23] In the education sector, the study by McCarty and Yaisawarng (1993) was the first to carry this out. Nowdays, this is a generalized procedure in research in this field.

etc). If these factors are found to be statistically significant, it can be concluded that they contribute to explaining inefficient performance.[24]

For our second stage analysis we selected three factors which considered relevant in explaining why educational expenditures lead to better or worse relative results. First of all, and as mentioned in the introduction, we consider the role of family support in teenagers' education. As we have included affective outputs as part of the global educational output, it seems appropriate to check whether the importance that society gives to family life has a significant complementary effect on educational results. To test this, we use the information from the replies to two questions in the surveys considered in the previous empirical exercise (*World Values Survey* and *European Values Survey)*, using the values for all individuals (i.e., of all ages): the first refers to the importance of family in the interviewee's life (*FAM1*), and the second is the interviewee's valuation of whether it is positive to pay more attention to family life (*FAM2*).

The other explanatory variables selected are the income level and the proportion of students in private schools. Both factors have theoretical support (more unanimous in the first case than in the second) as potential explanatory features of educational success. Regarding socioeconomic characteristics, the literature has shown the socioeconomic environment to be the factor with most weight in explaining educational results. To evaluate this effect, the explanatory variable used was the per capita income level (INCO) in each country in US dollars. With respect to private schools, there are several studies which support

[24] The literature of the distinction between environmental factors and non-controllable inputs can be somewhat confusing. Sometimes they are used synonymously, but their methodological treatment in an efficiency evaluation exercise should be different. The first group refers to exogenous factors which do not have a role as input/output variables but which have an influence in explaining efficiency results. As such, they should be included in a second stage analysis. The second group comprises inputs in the production process (in that they are positively correlated with outputs) whose value is not decided by the producer. Thus, they should be included in the first stage (DEA analysis). However, the classification into one group or the other is often not easy. The family support variables in our study are a case in point. To resolve this doubt, we tested their correlation with the output variables. As we did not find any correlation, we finally included them as environmental factors.

the superiority in efficiency terms of private over public education.[25] Thus, we include the percentage of pupils in each country who study in public schools (PUBL). Information on both variables has been taken from OECD statistics.

Table 7. Second stage results

Variable	Coefficient	t- Statistic
CONST	51.91	1.49
FAM1	28.12	0.78
FAM2	10.52	0.91
INCO	135.13*	1.77
PUBL	4.91	1.43

* Significant at 10% level

Source: own elaboration

The results of the second stage analysis are shown in Table 7. It can be observed that some factors, such as family support and the relative presence of private schools, do not have a significant impact on results.[26] However, the variable linked to the socioeconomic environment is significant, in accordance with the results of previous studies. In those countries with a higher income level, student learning is made easier in both the cognitive and affective dimensions. This is the reason they obtain higher returns from their public educational expenditures than other countries with lower income levels.

[25] The discussion about public-private management in education began with the study by Coleman et al. (1982). In this study, using educational return equations they conclude that private schools were more effective than public ones in training students, even after controlling for socioeconomic differences. Further studies have focused on evaluating the net quality of different samples of public and private schools, once all extreme variables which condition school production are eliminated. The conclusions obtained by this literature are mixed. On one hand, some studies reaffirm the findings of Coleman et al. (Chubb and Moe, 1990, Jiménez et al., 1991; Bedi and Garg, 2000). On the other, the superiority of private schools either disappears when some controls are included into the analysis (Goldhaber, 1996; Sander, 1996), or is reduced to some specific output dimensions (Williams and Carpenter, 1991) or groups of students (Figlio and Stone, 1997). For a review, see Mancebón and Muñiz (2008).

[26] The lack of explanatory power of family variables reinforces the idea of the growing role of schools as complementary support in social and affective values. However, the non-significant role of private schools is not surprising given the disagreement in the literature regarding the results of private and public schools.

6. Summary

The interest in evaluating the efficiency of the educational sector has increased in recent years. This sector, along with health, is one of the most researched fields in public economics. However, despite the importance given to non-cognitive outputs in the analysis of educational outcomes, this kind of variable has been omitted in previous empirical studies. This study tries to remedy this by defining and measuring several non-cognitive outputs, and then using them to analyze the relative efficiency of educational production taking into account both cognitive and affective outputs.

The data used to obtain the non-cognitive outputs have been taken from the *World Values Survey* and *European Values Survey.* In accordance with the theoretical literature, three blocks of questions have been selected. These are related to personal qualities, such as effort, responsibility and perseverance; to tolerance and group interactions; and to active citizenship and democratic values.

After commenting on some of the more interesting features of the results on non-cognitive education in our sample, we analyze the relationship between public educational expenditure and cognitive and non-cognitive results. In our sample, the relationship is positive and statistically significant for the case of affective education. However, in the case of the cognitive output, the relationship is positive but non statistically significant, being this result a usual finding obtained from each country‘s PISA results.

We carry out an international comparison. From our results from the first stage of the empirical analysis (DEA evaluation) we do not observe a high dispersion of the efficiency indexes. However, our analysis shows that several countries could achieve significant improvements in some outputs, especially when we focus on the non-radial component. We identify the best performing or reference countries, which is Canada in the group of countries with a high level of educational expenditure, and South Korea in the group with a low level of educational expenditure.

In a second stage empirical analysis we selected three features which we considered could have an impact on educational results in the sense of being explanatory factors of inefficient/efficient performance: the importance of family life (as a support for teenagers’ affective education), the socioeconomic environment (the most important factor according to the previous literature) and the proportion of students in private schools (to test whether they obtain higher efficiency levels than those in public schools). Our results show that the socioeconomic environment is the only significant factor in explaining efficient behaviour.

We finish by proposing two possible future extensions of this study. First of all, we would like to carry out a dynamic analysis in order to get more consistent results. Secondly, we would like to try to obtain more information on variables related to affective education in order to extend the analysis to other dimensions of non-cognitive output.

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