

TWO QUALITY FACTORS IN THE EDUCATION SYSTEM: TEACHING STAFF AND SCHOOL AUTONOMY. THE CURRENT STATE OF RESEARCH

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Abstract

The assessment of the impact of different factors on the education production function has been on the Economics of Education agenda since the Coleman Report of 1966. Since then, the empirical evidence has sufficiently established the importance of the socioeconomic situation of pupils (and their classmates). But, independently of these factors, what is the margin for action in educational policy, through the (re)allocation of human and material resources and their organisation, to improve the quality of the educational process and its results?

This question defines a broad range of research that has produced contradictory answers. Many of these studies point towards there being a very small, even inexistent, impact for inputs based on material and human resources. The purpose of this article is to establish the current state of knowledge that emerges from the literature of this line of research in two specific areas. Firstly, with regard to the effect of teaching staff, we focus on research on aspects regarding their quality and characteristics (specifically levels of knowledge and training, experience, salaries and gender) and on their quantity (reflected in pupil/teacher ratios and class sizes). Secondly, within the area of the effect of the autonomy of the schools, we explore what, according to the most recent research, the effect is of different types of autonomy on educational results, paying special attention to the relation established between autonomy and accountability by means of external evaluation.

Keywords: Teachers; autonomy; educational quality

JEL Codes: H52; I2

1. Introduction

Analysis of the factors that influence pupil performance (above all approached through the use of the education production function) has been on the research agenda of the Economics of Education since the Coleman Report of 1966. Since then the empirical evidence has established well enough the importance of the personal characteristics of pupils as well as their socioeconomic situation (and that of their classmates). Independently of these factors it is possible to ask what the margins are for education policies, through the (re)allocation of human and material resources and their organisation, to improve the quality of the educational process and its results. This question defines a very broad range of research that has produced contradictory answers. Many of these point towards there being a very small, even inexistent, capacity of school inputs (especially material resources, although in some studies human resources as well) to improve the performance of pupils, an idea already noted in the above mentioned report by Coleman.

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This type of research is of vital importance because it makes it possible to know which factors increase the quality of education and, as a consequence, how resources should be allocated. In addition these increases in the quality of graduates improve productivity, incomes and economic growth (Hanushek and Kimko, 2000; Hanushek and Woessmann, 2008).

Methodologically there is a predominance of regression studies around the education production function even though studies do exist using alternative techniques such as data envelopment analysis. From the evidence provided by Machin (2008), Dearden et al. (2009) and Hanushek and Woessmann (2010) it should be pointed out that the most recent regression studies try to solve the problems that this type of analysis entails (primarily endogeneity, which prevents causality from being determined). Because of this they use certain methods that are sometimes concerned with the selection of samples (such as social experiments or quasi-experiments where specific programs entail the random allocation of pupils in classrooms or schools) and sometimes with techniques that put the regression method on the same level as a natural experiment (differences in differences, instrumental variables, matching). The application of more sophisticated econometric methods (simultaneous equations, two-step analysis, multilevel models etc.) can also be found.

The purpose of this article is to establish the current state of knowledge that emerges from the literature of this line of research. We concentrate specifically in two areas: teaching staff and the autonomy of school management.

The structure of the article is as follows. In section 2 the role of teaching staff in improving the quality of education is analysed. Specifically, in sub-section 2.1 variables are considered that refer to their quantity (pupil/teacher ratios and class size), while in sub-section 2.2 factors related to quality and various characteristics of teaching staff (their level of training, knowledge, experience, salaries and gender) are examined. The third section explores the effect of school autonomy on educational results, paying special attention to two specific relations: that between autonomy and the ownership of the school and that between autonomy and accountability through external evaluations. We conclude in section 4.

2. Teachers and the quality of education

As has been pointed out in the previous section, the most recent empirical evidence will be presented here regarding the effect of the quantity and the quality of teaching staff on pupil performance.

2.1 Quantitative analysis of the effect of teaching staff on the quality of education

The studies that have considered the quantitative effects of teaching staff on the performance of pupils (in tests of knowledge or competence) can be found within a framework of wider analysis concerned with the effect of the entire set of resources dedicated to education (education expenditure, material resources and, more recently, information technology). Traditionally, these evaluations were carried out through

international analysis at a macroeconomic level (see Hanushek and Kimko, 2000; Lee and Barro, 2001) and, as a result, tended to reject the existence of a statistically significant relation between the input variables (physical resources) and the output in the education production function. If microeconomic studies are taken into account, the studies and revisions of studies by Hanushek (1986, 1989, 1997, 2003) also show the absence of a relation between educational resources and school achievement. Nevertheless the re-evaluations by Hedges et al. (1994) and Dewey et al. (2000) of the revisions carried out by Hanushek (these authors question his meta-analysis method) estimate a greater role of certain inputs (especially education expenditure) on academic performance. Krueger (1998, 1999) in the United States and Holmlund et al. (2010) in the United Kingdom are in favour of this position, while the revision of studies by Vignoles et al. (2000) can be found in line with Hanushek. And what results have been obtained with regard to the effect of teaching staff on education output?

The literature referring to teachers (in quantitative terms) analyses class size and the number of pupils per teacher (in fact many studies often do not make a distinction between the two variables). The effect of size on educational performance is, in fact, difficult to determine. This is because even though less pupils per classroom allows for more attention from the teacher for each of them this also reduces the number of classmates present from whom the pupils can benefit in their learning process – see, among others, the studies by Hoxby (2000a), Sacerdote (2001) and Zimmer and Toma (2000).

In the analyses that use a country as the unit of analysis, while Lee and Barro (2001) find a positive effect of having lower ratios of pupils to teachers, Hanushek and Kimko (2000) do not point to any influence at all. In a profound revision of the literature Hanushek (1986, 1989, 1997, 2001, 2003) shows that no relation between class-size and educational performance can be established as some studies point towards a positive relation and others to a negative one and for the great majority this relation is statistically non-significant. This vision is the dominant one in other revisions (Hoxby, 2000b; Woessmann and West, 2006; Urquiola, 2006). Even so, the evaluation of Krueger (2003) of the studies analysed by Hanushek turns out to be more favourable to the reduction of class sizes. This position can also be found in the microeconomic analyses, developed in the United States, based on Project STAR, which have the methodological virtue of analysing the effect of class size through a random experiment. As Krueger (1999) points out it was found that smaller class sizes improve educational performance, and not only in the short term (see the evaluations along these lines by Card and Krueger, 1992; Krueger and Whitmore, 2001). Nevertheless, Hanushek (2003, 2011) stresses that the gains made in performance are at the cost of adopting very expensive policies of reducing class sizes, an observation shared by Vignoles et al. (2000) in a revision of studies in the United States and the United Kingdom.

Similarly, with a methodology based on natural experiments, the study by Angrist and Lavy (1999) in Israel shows the beneficial effects of having fewer pupils per teacher in the classroom. However, in this methodological area (natural experiments), Hoxby (2000b) does not find any effect for the class size variable in the performance of pupils in Connecticut (United States) and neither do Leuven et al. (2008) in Norway. Finally, in an

analysis in Kentucky, Borland et al. (2005) point towards classroom size having a decreasing positive effect with an optimum between 21 and 23 pupils.

For the case of Spain, the studies that consider the PISA (Programme for International Student Assessment) database give school resources, including quantitative ones in terms of teaching staff such as class size and pupils per teacher, and especially the former, a very low or inexistent explanatory power (see a revision in Cordero et al., 2013). In fact, the variation in output (performance) attributable to schools is only 20% (Calero and Escardíbul, 2007). Nevertheless, in an analysis by Autonomous Communities, Mora et al. (2010) show the negative effect of the ratio of pupils per teacher on the school dropout rate (lower ratios reduce the dropout rate), while the size of the class is hardly significant.

To sum up, existing studies, including those with the best methodological techniques, do not allow the conclusion to be drawn that reducing class sizes positively influences educational performance. In fact, when a positive relation is observed its effect does not seem to be of a great magnitude in relation to the costs incurred in applying class size reduction policies. This does not mean that in certain contexts this is not an efficient and effective measure, but it does not seem applicable as general policy, at least given the present provision of resources in developed countries.

2.2. Qualitative analysis of the effect of teaching staff on the quality of education

Numerous studies that consider the role of inputs in the education production function have focussed on the quality of the teaching staff. In fact there are two types of study. On the one hand, analyses that introduce a variable referring to teachers in education production functions (in general they include fixed effects related to the teacher in equations describing educational performance). On the other hand, there are studies that go more deeply into the analysis by examining which characteristics of teachers improve educational quality.

The first type of study clearly shows that the teaching staff is important to pupils results (see Rockoff, 2004; Hanushek et al., 2005; Rivkin et al., 2005; Aaronson et al., 2007; Leigh, 2010; Hanushek, 2011). As regards research of the second type, the main results of the empirical evidence are presented below which, even though they demonstrate the difficulties of verifying the specific characteristics of teaching staff that improve the quality of education, do allow some conclusions to be reached.

As regards the training of teachers, the possession of a Master qualification is not related to the performance of the pupils -see Hanushek (2003, 2011). Rivkin et al. (2005), Hanushek and Rivkin (2006), Clotfelter et al. (2007), Harris and Sass (2008), Andersson et al. (2010), and Chingos and Peterson (2011). In this area the literature for the United States casts some doubts on the application of the requirement of full academic qualifications (that is to say with high levels of specific preparation according to state criteria) to be a teacher in various states of the United States. In fact, present empirical evidence does not find any relation between full qualification and the school

achievements of the pupils. No significant differences are even observed between teachers with specific education qualifications and other types of qualification (or without them) –see Murnane and Steele (2007), Clotfelter et al. (2007), Kane et al. (2008) and Chingos and Peterson (2011). Nevertheless, in the area of mathematics, studies in the United States do show a positive relation between the educational achievement of pupils (in secondary school) and the possession of knowledge related to mathematics by teachers, such as a degree or specific courses (Goldhaber and Brewer, 1997; Goe and Sticler, 2008). This type of study not only analyses the qualifications of teaching staff but also their knowledge.

With regard to this various authors evaluate the possible effect the knowledge of teaching staff, usually measured in relation to the tests passed in their qualification or tests taken in order to be able to work as teachers (the studies are mostly focussed on the United States), can have on the performance of pupils. In their revision of articles Hanushek and Rivkin (2006) show uneven results, with a predominance of studies where these tests are irrelevant. Similar results are shown in Harris and Sass (2008) for Florida. However a positive effect does appear for the knowledge demonstrated by the teaching staff in other states and cities in North America –see Clotfelter et al. (2007), Boyd et al. (2008), Cantrell et al. (2008), Chingos and Peterson (2011)- as well as in Peru (Metzler and Woessmann, 2010). In addition, for the case of Kentucky, Kukla-Acevedo (2009) finds a complementary relation between the knowledge and the experience of teaching staff.

Concerning the experience of teachers, the studies by Rivkin et al. (2005), and those already mentioned by Clotfelter et al. (2007), Kane et al. (2008), Harris and Sass (2008) and Chingos and Peterson (2011), as well as the revisions by Vignoles et al. (2000), Hanushek (2003), Hanushek and Rivkin (2006) and Metzler and Woessmann (2010) allow the conclusion to be drawn that this is relevant, with a positive effect on the performance of pupils that is mostly not lineal in time. In fact the improvement effect caused by experience seems to be concentrated at the very beginning of teaching work (from 2-5 years and in some cases as early as 2-3 years) to decrease later. However, an exception is the analysis by Hanushek and Luque (2003) for various countries in the Trends in International Mathematics and Science Study (TIMMS), in which hardly any significance is found for this variable in the different countries examined.

Another of the elements of education policy evaluated in a variety of studies concerns the salaries of teachers. In the revision of studies of education production functions for the United States Hanushek (1986, 2003) shows that in 73% of the cases analysed the salary variable associated with teachers was not significant. Even so, when it is significant, in 20% of cases it influences positively and only in 7% negatively. Nevertheless, as Dolton and Marcenaro-Gutiérrez (2011) point out it should be underlined that these analyses use samples from the United States, with little variability in quality and salaries for observing differences between the salaries of the teachers and the results of the pupils. Moreover, the study by Loeb and Page (2000), for the US, which introduces corrections to traditional estimations, such as the use of panel data and econometric techniques that correct for endogeneity, concludes that there does exist a positive relation between teaching staff salaries and educational performance.

Specifically, they point out that a 10% increase in teachers' wages would reduce dropout rates between 3%-6%.

For studies in other countries results are obtained similar to the above ones, though with more significance of the salary of the teaching staff for the performance of the pupils in relative terms (even though the distance is less between studies that show a positive effect and those that point to a negative one): in 54% of cases this variable is not significant, in 31% the influence is positive and in 15% negative. This lack of significance in most of the studies is also underlined in the revisions by Vignoles et al. (2000) and Hanushek and Rivkin (2006).

At international level, with samples from many different countries, Lee and Barro (2001) show that the salaries of teaching staff do not always significantly influence the performance of pupils (as well as their influence being less than that of the variable associated with class size). Even so, a replica of this study carried out by Sequeira and Robalo (2008) does find significance for the salaries of teaching staff in the performance of pupils in all of the samples. In addition, in a study that extends that carried out by Lee and Barro (2001), with data coming from TIMMS and PISA, Dolton and Marcenaro (2010) demonstrate an important positive effect of teaching staff salaries on pupil performance in all the disciplines analysed, these being mathematics, science, and reading comprehension (this result persists if salary increases in the period analysed are considered instead of the salary levels themselves). By way of example, an increase of 10% in the salaries of teachers increases the test results of pupils by 5-10% (this improvement also appears with an increase of 5% in the relative position of teachers in the distribution of salaries). Finally, in the case of India, Kingdon and Teal (2007) conclude that the salaries of teachers positively influence the performance of pupils, but only in private schools (not in state schools). These authors assume that this partial effect is due to the fact that improvements in salaries in the private sector are related to teacher payment schemes related to activity (performance-related pay). In the area of salaries, some studies have focussed precisely on the analysis of these payment schemes, as detailed below.

Woessmann (2011) shows the existence of an improvement in results in countries participating in the PISA-2003 with teacher payment schemes related to activity, whether these are at the level of the school, local authority or a higher level. In the analysis pupils in countries with these incentive schemes obtained an increase in results equivalent to 24.8% of a standard deviation in the PISA mathematics and reading tests (and 15% in sciences). This result is similar to that observed in India (Muralidharan and Sundararaman, 2009) and approximately double that found by Lavy (2009) for Israel. It was also found that this type of payment significantly improves the performance of pupils in England (Atkinson et al., 2009) and in Arkansas (Winters et al., 2006). Similarly, considering different types and degrees of application of salary incentive schemes, Figlio and Kenny (2007) underline the positive influence of the existence of salary incentive schemes in schools on the performance of pupils for a sample of schools in the United States. Nevertheless, these authors stress that these incentives should be connected with specific teacher activities, because if they become generalised to practically all the

teaching staff (they are too easy to achieve) they become inefficient. Finally, Woessmann (2011) demonstrates that there is some interaction between salaries and the training of teachers in such a way that the positive influence on the results of pupils produced by the fact that teaching staff have post-graduate qualifications disappears when payment schemes related to activity are introduced.

The last element analysed refers to the gender of teaching staff. Studies of primary education indicate that for the academic performance of the pupils the gender of the teachers is either irrelevant or has the following influence: female teachers have a positive effect on the results of boys and girls. In secondary education the evidence supports the above results showing, in addition, that having a teacher of the same gender as the pupil can improve the performance of the latter (see a revision in Escardíbul and Mora, 2010). Klein (2004) for Israel, Woessmann (2003) for countries participating in the TIMSS test, and Escardíbul and Mora (2010) for Catalonia (Spain) conclude that having female teachers improves the results of boys and girls. As such, the available empirical evidence does not allow us to close the debate on the relation between teacher gender and the academic performance of pupils, even though it stands out that in a good part of the empirical evidence beneficial effects are observed for having female teachers for pupils as a whole. Consequently, the application in some countries (basically Anglo-Saxon) of policies that encourage the recruitment of male teachers so that boys can improve their results (which are not as good as those of the girls) is not justified (see Carrington et al., 2008; Younger and Warrington, 2008; Skelton, 2009).

To sum up, the existing empirical evidence on diverse aspects concerning teachers allows us to conclude, with some reservations, that the knowledge (capability) of the teaching staff, as well as their salary (especially if this is connected to pupil performance) and partially the experience of teachers (at the very beginning of their careers) positively influence the performance of pupils. The method of training or certification and the type of qualification do not seem to have any influence, at least in the United States. In any case, the studies suggest that to improve the educational performance of pupils it is better to invest in the quality of the teachers than in the quantity (by reducing class size). In this area, nevertheless, it will be necessary to continue this type of research, as well as extend it to the analysis of those teaching methods that influence the results of pupils (De Witte and Van Klaveren, 2011; Schwerdt and Wuppermann, 2011; Lavy, 2011).

3. School autonomy and the quality of education

The study of the effect of school autonomy on educational performance comes within a wider area of analysis connected with the characteristics of the schools and the education system as a whole. In this paper we focus only on autonomy, even though its effect on the quality of education is related to other variables such as the ownership of the schools and the presence, or not, of evaluation systems that are external to the schools, such as those carried out by some of the empirical studies reviewed.

A relevant study (based on PISA data) is that by Fuchs and Woessmann (2007). These authors find the following results. Firstly, with regard to budgetary variables, the

existence of autonomy in the allocation of the school budget positively influences the competences acquired by the pupils, while on the contrary, the capacity to establish the global amount of the budget even has a negative effect. Secondly, concerning the curriculum, the capacity to choose academic content and textbooks does not influence performance positively unless the existence of external exams is included as a variable. Finally, as regards teaching staff, the capacity to fix salaries only improves the performance of pupils in countries with external exams. Similarly, autonomy in the recruitment of teachers presents different results in relation to the competence analysed (science, reading or mathematics). However, using data from the TIMSS evaluation, Woessmann (2003) describes a positive effect for this variable on the academic performance of pupils, a similar result to that found by Robin and Sprietsma (2003) with data from PISA-2003 and Naper (2010) in an analysis based on information received by the directors of school districts in Norway.

In another type of analysis Clark (2005) shows the beneficial effects for pupil performance of the greater autonomy of schools in the United Kingdom. To do so the results of pupils were evaluated in state schools that decided to opt out from local education authorities (LEA) after the reform of 1988, and be autonomous with regard to the employment and dismissal of teachers as well as in fixing salaries. In turn Hindrinks et al. (2010) demonstrate the benefits of a greater level of autonomy in management (measured by an index that includes autonomy with regard to teaching staff, the courses and the content offered, evaluation of the pupils and discipline as well as the making and allocation of the budget), in state as well as private schools in Flanders (Belgium), which increase the greater the presence of disadvantaged pupils. Lastly, Woessmann et al. (2009) find positive interactions between autonomy and ownership: private schools obtain better results in countries with a greater level of autonomy in management in the system (in state as well as in private schools).

In the case of Spain, with data from the PISA-2003, Calero and Escardíbul (2007) do not find any significance for different variables related with autonomy in management of schools. Nevertheless, for PISA-2006, Escardíbul (2008) does find that autonomy in budget management benefits the performance of pupils. Similarly, Calero et al. (2010) add to this result the positive significance of autonomy in staff recruitment and a negative one with regard to choice of course content.

From another area of analysis, some studies review the effect of autonomy on the performance of pupils by considering the role of the principals of the centres. Specifically they carry out a fixed effects analysis for the principals in education production functions with positive results (see a revision in Coelli and Green, 2011). In some cases they are explicit about factors that can be influential and they point towards the positive effect of experience and length of service, and the negative effect of rotation (Branch et al., 2008; Clark et al., 2009) and the positive influence of salary (Lavy, 2008).

As can be seen, the studies of autonomy do not allow a clear conclusion to be drawn, even though some predominant results can be obtained. Autonomy in budget management (not in its establishment) and the role of principals appear to be positively

significant to the performance of pupils. Similarly, although the management of teaching staff presents contradictory results, the evidence seems more favourable towards considering it a factor that positively influences the performance of pupils. On the contrary, not very conclusive results are found in the case of school autonomy in the choice of curriculum content. As Fuchs and Woessman (2007) suggest, it could be important to include interactions between autonomy and other variables (such as the presence of external evaluation in the school or school ownership) that change the significance of the former. In this case the institutional environment in which the schools carry out their activity would be decisive.

With regard to the evaluations themselves, it can be underlined, to conclude, that evidence predominates of their positive impact on educational output. In various countries, Woessmann (2003) and Fuchs and Woessmann (2007) underline the fact that pupils who participate in school systems with external exit exams obtain better results; this conclusion can also be seen in Bishop (1997) in the case of Canadian provinces, Bishop et al. (2000) for the United States and Jürges et al. (2005) for the regions of Germany. As Woessmann et al. (2009) indicate, in fact pupils obtain better results in countries that contain methods of external evaluation (accountability), not only of the pupils (the exams already mentioned) but also of the teachers (through internal and external control of the classes) and the schools (such as the comparison of results with other schools at different geographical levels, in the district or nationally).

4. Conclusions

The research on the effect of various inputs in the education production function proposes a diverse set of methodologies and results that do not point, in a homogenous way, in specific directions. The importance of the institutional situation means, in this field, that even in the event that completely uniform methodologies are applied the results will probably vary. This does not mean, however, that we are moving in an area of total uncertainty that would also mean the impossibility of providing recommendations regarding the most desirable education policies. The opposite is more the truth. As the years go by some evidence is being established, and even though it is still to be confirmed in specific institutional situations it can provide good orientation in a context such as the current one, defined to a large extent by severe budget restrictions.

In the case of the effect of the quantity and the quality of the teaching staff the evidence points toward a more substantial influence of quality, in terms of knowledge, experience and the salaries of the teachers. As regards the latter, payment schemes connected with the performance of pupils seem to have a positive influence. On the contrary, it is not possible to conclude, from currently existing evidence, that the quantity of teachers (expressed through class sizes) has a consistently significant positive effect.

Regarding the second quality factor the effect of which has been reviewed in this article, the autonomy of the schools, the empirical evidence is, still, less conclusive than in the case of teaching staff. Even though it cannot be concluded that greater autonomy generally increases educational performance there does seem to be enough empirical

support for the hypothesis that greater autonomy, specifically in the management of the budget, has a positive effect. In the same way various studies find that certain characteristics of school management have a positive effect. The importance of the institutional situation, here as well, is indicated by the relevance of the interactions between, on the one hand, autonomy and ownership and, on the other, between autonomy and the existence of external evaluations.

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