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Aitor Calo-Blanco
Antonio Villar Notario

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Aitor Calo-Blanco[1]
Antonio Villar Notario[1,2]

[1] *PABLO DE OLAVIDE UNIVERSITY*
[2] *THE VALENCIAN INSTITUTE OF ECONOMIC RESEARCH (Ivie)*

Abstract

This working paper analyzes the performance of the Spanish educational system according to the 2006 PISA report, focussing on the equality of opportunity. The basic idea is that a good educational system should produce outcomes that depend basically on the students' effort and not on the students' external circumstances (parental background here). We present a simple formula to estimate the inequality of opportunity and analyze empirically the behaviour of Spain and its constituent regions, both with respect to quality (mean scores) and with respect to the inequality of opportunity. We find that Spain performs better than the European average in terms of equality of opportunity and worse in terms of quality. We also find large and systematic differences between the Spanish regions.

Key words

Quality of education, equality of opportunity, PISA report, regional disparities.

Resumen

Este documento de trabajo analiza, desde el punto de vista de la igualdad de oportunidades, el rendimiento del sistema español de enseñanza secundaria obligatoria. Para ello se utilizan los datos proporcionados por la última edición del Informe PISA. El objetivo de cualquier sistema educativo que se considere a sí mismo como justo debe ser promover resultados académicos que dependan exclusivamente del esfuerzo realizado por los estudiantes. Por lo tanto, dichos resultados no deberían verse condicionados por las circunstancias personales de los alumnos, como es por ejemplo el bagaje cultural de su entorno familiar. El presente documento expone una intuitiva manera de estimar el nivel de igualdad de oportunidades, a la vez que analiza empíricamente la actuación del sistema español, y de sus diferentes comunidades autónomas, tanto en términos de calidad como de oportunidad. La conclusión principal que se obtiene es que los estudiantes españoles presentan mejores niveles de igualdad que los de sus compañeros europeos, si bien su rendimiento académico es marcadamente más bajo. Además, el análisis destapa la existencia de significativas y sistemáticas diferencias entre las distintas regiones españolas.

Palabras clave

Calidad de la educación, igualdad de oportunidades, Informe PISA, disparidades regionales.

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Quality education is the most valuable asset for present and future generations. Achieving it requires a strong commitment from everyone, including Governments, teachers, parents and students themselves. The OECD is contributing to this goal through PISA, which monitors results in education within an agreed framework, allowing for valid international comparisons. By showing that some countries succeed in providing both high quality and equitable learning outcomes, PISA sets ambitious goals for others.

The OECD Secretary General

1. Introduction

THE purpose of this paper is to analyze the performance of the Spanish educational system, from an equality of opportunity viewpoint, according to the data provided by the 2006 PISA. We focus on reading literacy as the reference variable.

The OECD Programme for International Student Assessment (PISA) is the broadest dataset for the evaluation of schoolchildren performance. The PISA report is a triennial world-wide test of 15-year-old schoolchildren's scholastic performance, the implementation of which is coordinated by the OECD. The aim of the PISA study is to test and compare schoolchildren's performance across the world, with a view to improving educational methods and outcomes.

When the results for 2006 were published, there was an intense debate in Spain regarding the poor performance of the Spanish students, specially concerning the reading competence. The results were disappointing (the Spanish average mark is 6.2% below the OCDE average) and apparently worse than those in the former report, as the Ministry of Education confirmed[1]. This low competence in the reading domain can have very negative implications on the students' performance: "Reading skills play a central role in an individual's learning at school. The ability to read and understand instructions and text is a basic requirement of success in all school subjects. The importance of literacy skills does not, however, come to

[1] PISA 2006 Programa para la Evaluación Internacional de Alumnos de la OCDE - Informe Español. Ministerio de Educación y Ciencia. Secretaría General de Educación. Instituto de Evaluación.

an end when children leave school. Such skills are key to all areas of education and beyond, facilitating participation in the wider context of lifelong learning and contributing to individuals' social integration and personal development"[2]. The 2006 PISA report points out, therefore, a very serious problem in the Spanish compulsory educational system. The Spanish students exhibit a comparative disadvantage that is specially worrying in a unified European labour market and when Europe is committed to the integration of tertiary studies.

The PISA database is very rich and allows studying many different aspects, besides the comparison of average scores among countries or regions. Our analysis here has a particular focus: we try to asses the performance of the Spanish educational system, at the compulsory level, from an equality of opportunity viewpoint. This study is in line with those already available for Italy and France [see Checchi and Peragine (2009), (2005), Peragine and Serlenga (2007), Lefranc et al (2007)].

Following Roemer's approach (see Roemer (1993), (1998)), the observed educational outcomes can be regarded as the result of two different factors, *opportunity* and **r***esponsibility*. Responsibility has to do with *effort*, and reflects personal decisions. Opportunity refers to the agents' *external circumstances* (aspects for which agents cannot be held responsible). The key point is that those differences in opportunity are considered as socially unfair. The measurement of those differences in opportunity becomes, therefore, the main methodological issue. The inequality of opportunity analysis aims to measuring to what extent the differences in the observed outcomes correspond to differences in the family environment of schoolchildren rather than to differences in effort.

The set up of our empirical analysis is as follows. For the PISA report there is a sample of more than 19.000 15-year old students, representative of the Spanish population of students and also of the 15-year old students of 10 different regions. Students are classified into four different opportunity categories (called *types*), according to the level of studies of their parents. We distinguish between ten *degrees of effort* that are given by the deciles of the

[2] European Commission. Directorate-General for Education and Culture. European report on quality of school education sixteen quality indicators. Report based on the work of the Working Committee on Quality Indicators. May 2000.

outcome distribution of the different types. The reference variable is the test score in the competence of reading literacy[3]. The inequality of opportunity measure is obtained from the decomposition of the second index of Theil.

The paper is organized as follows. Section 2 describes the reference model that leads to an index of inequality of opportunity in education. We make use of the decomposability properties of Theil inequality indices to arrive at a closed formula that measures the inequality of opportunity among those agents who exert a similar degree of effort.

Section 3 describes the main features of the datasets we use and ponders the relevance of reading literacy as a key element for the evaluation of the educational system.

Section 4 contains the main body of the empirical analysis, for the PISA report. We provide an overview of the Spanish results that includes a comparative analysis of the relative performance of Spain with respect to the former European Union (EU15). Our results indicate that Spain is doing better than the average in terms of equality of opportunity and also that the opposite happens with respect to quality (mean test scores).

Section 5 analyzes the differences between the Spanish regions for the PISA report (those Comunidades Autónomas for which the data are available). We find large regional differences both in terms of inequality of opportunity and in terms of quality of education. There is strong evidence that students from Northern regions are much better trained, in order to access the labour market, than those in the South. The data suggest that those differences partly reflect the regional differences in the funding of public education (expenditure per student).

The policy recommendations that derive from our study are clear: (1) The institutional design of the educational system is not good enough to compete with our neighbours. (2) There are some regions that have to exert an extra effort in organizing and funding public education so that the quality of education improves substantially and the differences in the equality of opportunity diminish.

[3] Similar conclusions are obtained when we analyse the results of the science domain, the main are in the last wave of the report.

2. The Measurement of Inequality of Opportunity in Education

THERE are several approaches that allow measuring the inequality of opportunity. Here we exploit the decomposability properties of inequality indices, much in line with the contributions of Peragine (2002), (2004a,b), Ruiz-Castillo (2003), Villar (2005), Lefranc et al (2007), Silber and Spadaro (2007), or Goerlich and Villar (2009), among others.

2.1. The approach

We consider a society with a finite number of individuals, $N = \{1, 2, ..., n\}$, that can be partitioned into *types*, $t = 1, 2, ..., \tau$, according to some criteria that describe their external circumstances (opportunity). Individuals make decisions that result in outcomes measured by a real-valued function. Those outcomes derive both from the individuals' autonomous decisions (effort) and from their types. That is, for all $i \in N$, $x_i = f(t_i, e_i)$, where x_i is the outcome, t_i the type and e_i the effort (a variable that summarizes all of those factors that may affect outcomes and are not captured by the set of external circumstances). We say that there is equality of opportunity whenever those who exerted the same degree of effort achieve the same outcome, regardless of their types. This amounts to saying that the inequality of opportunity is that inequality corresponding to outcome differences related to the types. And, complementarily, that we are not concerned with those differences related to effort differentials between individuals.

Note that there are two difficulties in this setting. One, that the effort is most likely a non-observable variable. And two, that we cannot directly compare the effort of individuals belonging to different types, as the distribution of effort may well be type dependent.

Roemer (1993, 1998) suggests a practical way of dealing with those two difficulties simultaneously. First, assume that effort is a uni-dimensional variable that is related monotonically to the outcome within each type. Then, define the degree of effort in terms of the quantile distribution of outcomes across types (that is, two agents of different types exert a

similar degree of effort if they are at the same quantile of the outcome distribution of their corresponding types).

We now can define an *effort group* as the set of individuals who exert a comparable degree of effort. The inequality of opportunity can thus be associated with the inequality within effort groups, whereas inequality between effort groups is to be disregarded. We shall assume that there is a given number G of effort groups, $g = 1,2,\ldots,G$.

Next we discuss the choice of an appropriate inequality index that allows us to measure the inequality of opportunity as an aggregate of the inequalities within effort groups.

2.2. The choice of an inequality index

We are looking for an inequality measure that is applicable to a society consisting of several population subgroups. It is only natural to recur to the standard tools in the analysis of income distribution and, in particular, to the class of additively decomposable inequality indices (see Goerlich and Villar (2009) for a detailed discussion).

Let $\mathbf{x} \in \mathbb{R}^{n}_{++}$ denote the vector that describes the distribution of the reference variable in a population N made of n people. An entry x_i of $\mathbf{x}$ represents the outcome of individual i in that society. An inequality index is a function $I : \mathbb{R}^{n}_{++} \to \mathbb{R}$ that provides a real-valued measure of dispersion of any given admissible distribution. We say that an inequality index is *regular* when it satisfies the following basic properties: *symmetry* (permuting outcomes does not change the value of the index), *population replication* (replicating a given population does not change the value of the index), *Dalton's principle of transfers* (a *small* transfer from a "rich" to a "poor" reduces inequality), and *zero homogeneity* ($I(\lambda\mathbf{x}) = I(\mathbf{x})$ for all $\lambda > 0$) .

Consider now the case of a society that consists of *G* different population subgroups, of size n_1, n_2, ..., n_G, with outcome vectors $\mathbf{x}^1$, $\mathbf{x}^2$, ..., $\mathbf{x}^G$. We say that the inequality index *I* is *additively decomposable*, if we can write[4]:

$$I(\mathbf{x}) = \sum_{g=1}^{G} \omega_g(.) I(\mathbf{x}^g) + I\left[\mu(\mathbf{x}^1)\mathbf{1}^1, ..., \mu(\mathbf{x}^G)\mathbf{1}^G\right] \qquad [1]$$

This expression tells us that the inequality in the distribution **x** can be expressed as the sum of two different terms. The first one, $\sum_{g=1}^{G} \omega_g(.) I(\mathbf{x}^g)$, describes the inequality *within* the population subgroups, where $\omega_g(.) > 0$, $g = 1, 2, ..., G$, is the coefficient that determines the relative weight of the *j*th population subgroup as a function of **x** and the size of the population subgroups (n_1, ..., n_G). The second term, $I\left(\mu(\mathbf{x}^1)\mathbf{1}^1, ..., \mu(\mathbf{x}^G)\mathbf{1}^G\right)$, measures the inequality *between* population subgroups (measured by the dispersion of the mean values the groups weighted by the corresponding population size).

To choose "the right" regular and additively decomposable inequality measure we impose two requirements on the coefficients $\omega_g(.)$ in equation [1]: *independence* and *exact decomposability*. Independence requires each $\omega_g(.)$ to be a function of the population shares alone (i.e $\omega_g(.) = h(\frac{n_g}{n})$). In particular, those coefficients are independent on the values of the distribution [see Foster and Shneyrov (2000) for a discussion]. Exact decomposability requires that those coefficients add up to one: $\sum_{g=1}^{G} \omega_g(.) = 1$. This makes the interpretation of [1] much simpler and intuitive, because the within groups component is just a weighted average of the inequality indices of the different population subgroups.

We know from Shorrocks (1980) that any regular and smooth (differentiable) inequality index that is additively decomposable is a member of the generalized entropy family I_θ. Moreover, if we require an exact decomposition of the within groups term we are left

[4] Here $\mathbf{1}^g$ denotes a unit vector of dimension n_g.

with just two members of the family: the first index of Theil, *T*, that corresponds to the value $\theta = 1$ in the entropy family, and the second index of Theil, *T**, that corresponds to $\theta = 0$. Finally, requiring that the coefficients in the decomposition be dependent on the population shares alone excludes the first inequality index.

We can therefore summarize the above discussion as follows:

Claim: *A regular inequality index* $I : \mathbb{R}^n_{++} \to \mathbb{R}$ *satisfies exact additive decomposability with coefficients that depend on the population shares if and only if it is Theil's second index of inequality* [5].

2.3. Measuring inequality of opportunity in education

Consider again our society of reference that consists of $N = \{1,2,\ldots,n\}$ students who are classified into $t = 1,2,\ldots,\tau$ *types*, where a *type* describes the set of students with the same external circumstances (family background). An *effort group* is a collection of students who exert a comparable degree of effort. There are *G* different effort groups, indexed by *g*. A *cell* describes a set of students of the same type with a comparable degree of effort. There are n_{gt} students in cell (*g*,*t*) whose scores are described by the vector $\mathbf{x}^{gt}$. We denote by

N(g) the students in *effort group g*. There are $n_g = \sum_{t=1}^{\tau} n_{gt}$ students in this group with scores

$\mathbf{x}^g = \left[\mathbf{x}^{g1}, \ldots, \mathbf{x}^{g\tau}\right]$, for *g* = 1, 2, ..., *G*. A *score distribution* is a point $\mathbf{x} \in \prod_{g=1}^{G} \mathbb{R}^{n_g}_{++}$. That is,

x_{ig} describes the score of a student $i \in N(g)$. Let $\mu_g = \frac{1}{n_g} \sum_{i \in N(g)} x_{ig}$, denote the average score of effort group *g* for each $g = 1, 2, \ldots, G$, and μ_{gt} the average score of cell (*g*.*t*).

[5] Let us recall here that Theil's second inequality index is given by: $T^*(\mathbf{x}) = \frac{1}{n}\sum_{i=1}^{n} \ln\left(\frac{\mu(\mathbf{x})}{x_i}\right)$ [see Theil (1967)].

We want to measure the performance of the educational system from the equality of opportunity viewpoint. This principle establishes that the inequality between effort groups is not relevant because it reflects the different autonomous choices made by the students. That amounts to saying that equation [1] should be modified by deleting the term $I(\mu(\mathbf{x}^1)\mathbf{1}^1, \ldots, \mu(\mathbf{x}^k)\mathbf{1}^k)$ that measures the inequality *between* effort groups (the observed inequality that is due to the differences in students' efforts). Therefore, the evaluation formula we are looking is the following:

$$I^{Op}(\mathbf{x}) = \sum_{g=1}^{G} \frac{n_g}{n} T^*(\mathbf{x}^g)$$
$$= \sum_{g=1}^{G} \frac{n_g}{n} \left(\frac{1}{n_g} \sum_{i \in N(g)} \ln \frac{\mu_g}{x_i} \right) \qquad [2]$$

Note that we can apply the decomposability property with respect to each effort group, taking now the types as the population subgroups. That is, for each g = 1, 2, ..., G we have:

$$T^*(\mathbf{x}^g) = \sum_{t=1}^{T} \frac{n_{gt}}{n_g} T^*(\mathbf{x}^{gt}) + \sum_{t=1}^{T} \frac{n_{gt}}{n_g} \ln \frac{\mu_g}{\mu_{gt}}$$

That is, the inequality of opportunity in an effort group corresponds to the sum of the inequality within the types that in that group plus a measure of the inequality between those types. Consequently:

$$I^{Op}(\mathbf{x}) = \sum_{g=1}^{G} \frac{n_g}{n} \left[\sum_{t=1}^{T} \frac{n_{gt}}{n_g} T^*(\mathbf{x}^{gt}) + \sum_{t=1}^{T} \frac{n_{gt}}{n_g} \ln \frac{\mu_g}{\mu_{gt}} \right] \qquad [3]$$

In many occasions, for convenience or for lack of more disaggregate data, all the individuals in a given cell are assigned the same value (the mean value of the cell). In that case $T^*(\mathbf{x}^{gt}) = 0$ for all g,t and equation [3] becomes:

$$\widehat{I}^{Op}(\mathbf{x}) = \sum_{g=1}^{G}\sum_{t=1}^{T} \frac{n_{gt}}{n} \ln \frac{\mu_g}{\mu_{gt}} \qquad [4]$$

This is the formula we use in this paper to asses the inequality of opportunity.

3. The Empirical Analysis

ONCE the analytical framework is described, we move towards the empirical analysis. We aim at studying the distribution of cognitive abilities among Spanish fifteen-year old students (students that are finishing their compulsory school and are about to choose between entering the labour market and continuing at school).

In order to make the model operational we need to define three elements: (i) The individuals' cognitive abilities (the outcome); (ii) the way of comparing degrees of effort (the *effort groups*); and (iii) the set of external circumstances (the *types*). Let us explain those choices.

3.1. Cognitive abilities: reading literacy

According to the PISA webpage, reading literacy is not only seen as a necessary foundation for performance in other subject areas within an educational context, but it is also a prerequisite for successful participation in most areas of adult life[6]. Indeed, PISA results suggest that changing and improving students' reading proficiency could have a strong impact on their opportunities in later life. Policy implications will therefore have to be derived at the country level, each country carefully evaluating its own particular pattern of characteristics and their associations with the reading literacy of students.

[6] Reading literacy can be defined as the understanding, using, and reflecting on written texts, in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society.

Moffett and Wagner (1983) contend that reading comprehension is not distinct from general comprehension. The skills required for comprehending texts –such as identifying the main idea, recalling details, relating facts, drawing conclusions, and predicting outcomes– are important in everyday life. One has to be able to identify a general pattern, to recall details, to see relationships, and to draw conclusions from experiences all the time in dealing with everyday issues. Reading experience adds to our own experience and thus advances and enhances the process of learning to live in our society.

The ability to read and understand complex information is important to success in tertiary education, in the workplace, and in everyday life. Achievement in reading literacy is therefore arguably not only a foundation for achievement in other subject areas within the education system, but also a prerequisite for successful participation in most areas of adult life[7].

3.2. Types and effort groups

The variable that defines the types in our study corresponds to the parental educational background. This is a sensible choice, given the purpose of the study, and keeps the methodological approach of other studies (e.g. Checchi and Peragine (2009), (2005), Peragine and Serlenga (2007), Lefranc et al (2007)).

The family background is characterized here by the highest educational level of parents according to the International Standard Classification of Education (ISCED). This classification is reframed in our study as follows: (i) No formal education or primary school (isced 1); (ii) Lower secondary school (isced 2); (iii) Upper secondary vocational school (isced 3.b-c) and upper secondary academic school (isced 3.a-4); (iv) Tertiary education (isced 5-6).

[7] Let us mention, just as a curiosity, that Lewis (2002) claims that some states in the United States use third-grade reading statistics to determine how many prison beds they will need in 10 years' time. Though this might seem far-fetched, it has been reported that half of all adults in U.S. federal prisons cannot read or write at all. The typical 25-year-old male inmate functions two or three grade levels below the grade actually completed (Bellarado, 1986). Lewis, B. (2002), Guide Picks - Top 5 Professional Books about Reading:
http://k-6educators.about.com/library/products/aatp111201.htm?PM=ss03_k-6educators, About, Inc.

Because of the limited number of observations in many cells, we have decided to use just 10 quantiles, and also to merge illiterate parents with parents with primary education[8]. At the time of classing individuals according to the level of effort made we use the usual assumption that individuals at the same percentile of their own type ability distribution have exerted a comparable degree of effort.

3.3. The data

The basic analysis is based on data from the PISA survey, which is carried out by the OECD every three years since 2000. Such a report aims to evaluate the 15 year old students' ability in three different domains: reading, mathematics and science. The score of the test is normalized to a mean of 500 for all OECD Member States with a standard deviation of 100[9].

The PISA report is actually decomposed into three different categories: reading, mathematics and science. Every period of assessment specialises on one particular category, but also tests the other two main areas studied. The subject specialisation is rotated through each PISA cycle. In 2000 the major domain was reading while in 2003 and 2006 were mathematics and science respectively. Therefore, although information for any of the domains is available in all waves, there are some differences in the pieces of information obtained for a specific domain from different periods. However, they are assumed to be statistical significative. Be as it may, nothing better can be done since until the 2009 report is available (data to be published late in 2010).

[8] Clearly, different partitions of the individual traits may induce different results. As Peragine (2002) points out, "in an empirical exercise, with a finite number of quantiles, one could run into the following problem: the fewer the quantiles in which the population is partitioned, the easier the criteria to implement. Possibly, the more the quantiles, the more the cases in which the criteria characterized will fail to rank income distributions, i.e. the less complete will be the rankings. On the other hand, recall that the quantile is our proxy for the unobservable level of responsibility: the more the quantiles, the finer is our approximation of the responsibility exercised. Therefore, there seems to be a trade-off between the goodness of the approximation of the responsibility level and the completeness of our ranking".

[9] Note that this amounts to fixing the units in which score tests are measured.

4. Spain as Pictured by PISA 2006: Overview

4.1. Spain and the European Union (EU15)

We start by considering the performance of Spain with respect to the former European Union (EU15, for short). Figure 1 plots the 2006 measure of inequality of opportunity for Spain and EU15, for each of the different effort groups. On the horizontal axis we have the different 10 effort groups in which we have divided the population. The higher the effort group the individual belongs to, the higher the level of effort made by that particular individual. Therefore, "lazy" students are at the left of the figure whereas "hard-working" ones are located at the right.

Three main features arise from those data. First and foremost, the low levels of inequality they exhibit (think that Theil's second index of inequality when applied to the Spanish income distribution yields a value slightly above 0.1)[10]. Second, an inverse relation between effort and inequality of opportunity. That is, the higher the scores the less dependent are those results on the family background. And third, Spain is well below the average European inequality of opportunity in all effort levels. Those differences, though, decrease as we climb up the effort ladder.

Figure 2 depicts the 2006 mean scores for Spain and EU15, for all effort groups. We observe that Spain is below the European average in all levels of effort above percentile 20, and also that the difference grows with the effort level.

It is worth mentioning that those differences are larger in 2006 than they were in 2000 (that is, in 2006 Spain is further away of the European mean than it was in 2000, both with respect to inequality of opportunity and the mean score values).

[10] Note, however, that the standard deviation of the scores is limited to one fifth of the mean by construction.

FIGURE 1: **Inequality of opportunity in Spain and EU15, PISA 2006**

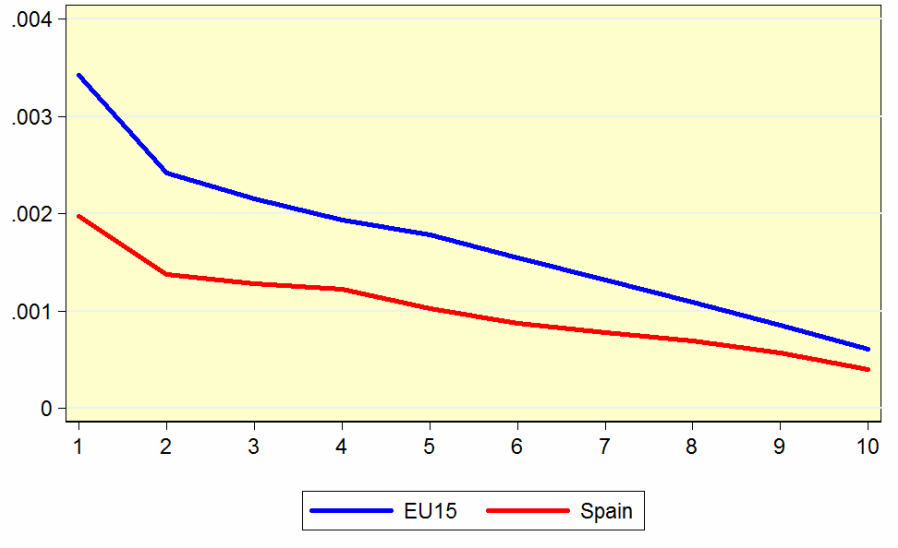


FIGURE 2: **Mean scores in Spain and EU15, PISA 2006**

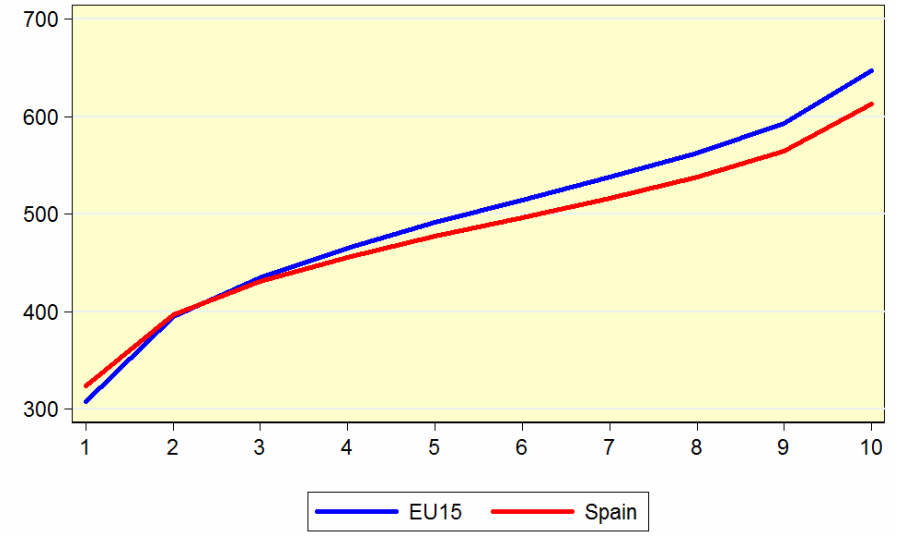
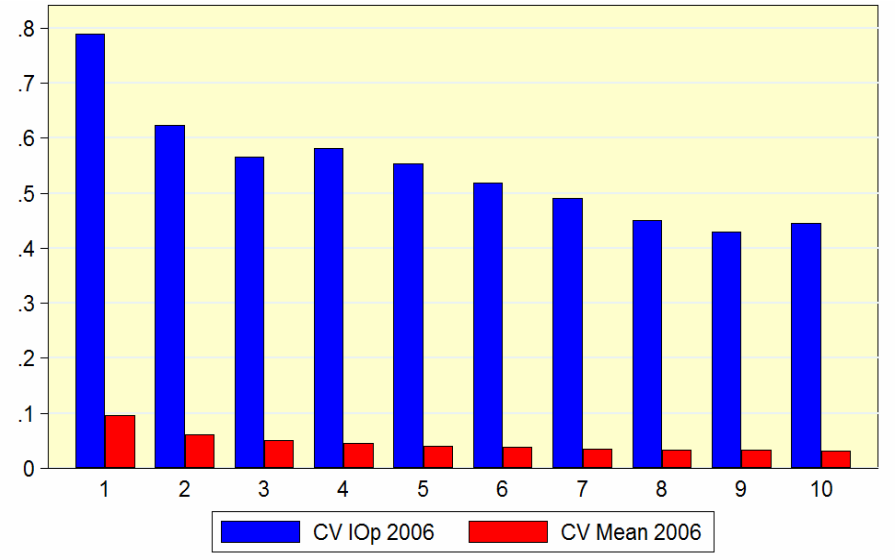


Figure 3 describes the variability across effort groups of the mean scores and the inequality of opportunity values in the EU 15. We measure such variability through the coefficient of variation (the standard deviation normalized by the mean). The data show that: (i) There is much more variability in the inequality of opportunity than in the mean scores; and (ii) The variability is negatively correlated to the effort, for both variables. That is, the mean

score and inequality of opportunity values of the 15 European countries under consideration are more dispersed for lower than for higher effort levels. Or, put more crudely, good students are more similar than bad ones across Europe.

FIGURE 3: **CV of mean scores and IOp EU15, PISA 2006**



4.2. Types and effort groups

Table 1 summarizes the data concerning the average scores per cell. Each row describes the performance of the students whose parents have the same education (type), depending on their effort levels. Each column tells us the average scores of the students who perform a similar degree of effort, depending on their types.

Figure 4 gives a visual summary of those data. The three main features are the following. First, the figure shows a common pattern for all types: a relatively larger difference for the lowest and the highest effort levels and a relatively smooth increase in all of the rest. Second, there is a sensible jump between the lowest educational level and the next one. And third, a notorious Lorenz dominance, that is, for each effort level the scores are monotonic

with respect to the parents' cultural background. Those features are further illustrated in table 2, where some summary information about the types is provided.

The shares in the Spanish population are very close to 10, 20, 30, 40. The scores of students of type IV are 3.5% above the average, whereas the scores of those of type III match the average. The scores of those students of types II and I are 2.1% and 10% below the average, respectively.

TABLE 1: Scores per effort level and type, Spain 2006

Effort levels/ types	1	2	3	4	5	6	7	8	9	10
I	267	344	376	401	425	446	468	491	520	573
II	323	388	420	445	466	485	505	526	551	600
III	329	399	431	456	477	496	516	538	563	612
IV	335	414	449	474	495	515	534	556	582	629
Mean	324	397	431	456	477	497	517	538	564	613

FIGURE 4: Scores per type and effort group, Spain PISA 2006

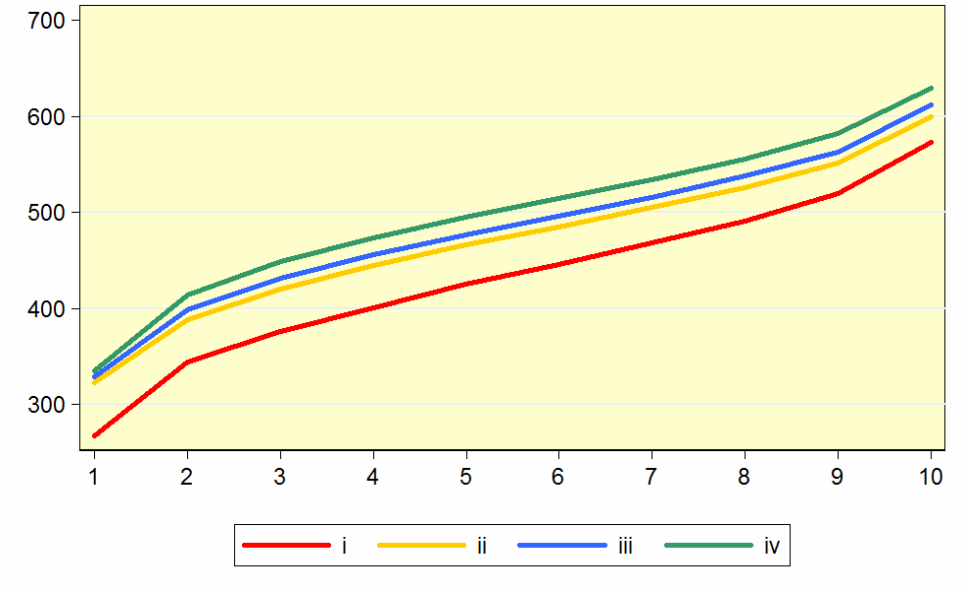


TABLE 2: Types scores and population shares

	Number of students in the sample	Mean of the type	% of population
Type I	1983	431	10.32
Type II	3389	471	17.63
Type III	5957	482	31.00
Type IV	7891	498	41.05
Total	**19220**	**481**	**100**

4.3. Parental education levels and academic achievement

The data we have just presented show that average scores are monotonic with respect to the types for all effort levels. Therefore, the education level of the students' families is a relevant determinant of the expected outcomes. That may be interpreted as pointing out that the relatively poor performance of Spain with respect to Europe is mostly due to its lower levels of human capital. As a consequence, this situation would be temporary and would progressively disappear as the convergence process goes on. Yet, this conclusion is not justified. Things are actually more complex and it does not seem that waiting until the full convergence in the human capital occurs will wipe out the differences.

Table 3 gives us an estimate of the average scores of students of the different types, both in Europe and Spain. We observe that the Spanish students whose families have at most compulsory education (levels I and II), outperform the average European ones, whereas those students with families with non-compulsory education are clearly below the European average. Therefore, the increase in the educational levels of the Spanish population, approaching the European distribution, does not guarantee a convergence in the average performance of the Spanish students.

TABLE 3: Average PISA scores by types. Europe vs Spain

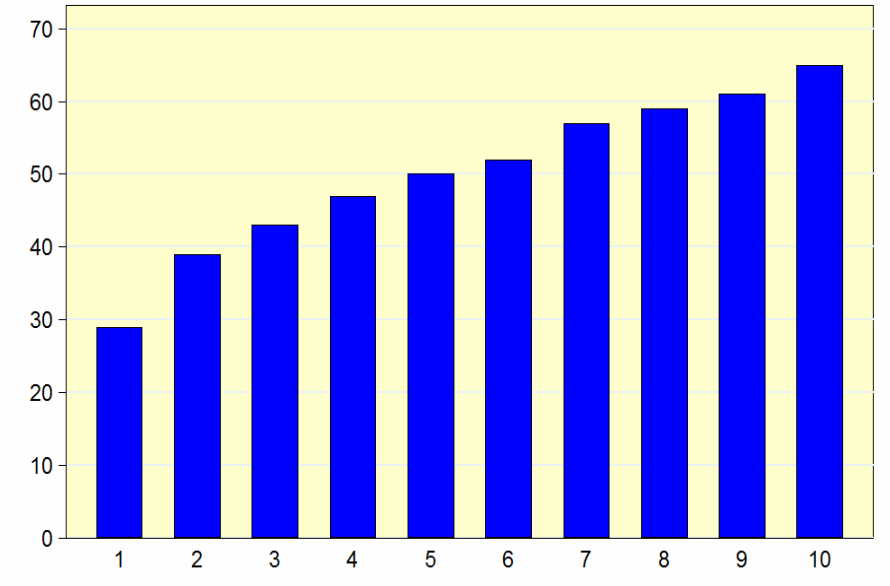
Type	Europe	Spain	Gap
I	429.51	431.11	1.60
II	457.65	470.76	13.11
III	491.44	481.63	-9.82
IV	514.13	498.08	-16.05

As Ciccone and García-Fontes (2008) argue, the differences with respect to the European mean will not be entirely removed when the country catches up with the European average in terms of overall education. In other words, the spread of the tertiary education is not enough to guarantee the academic success of future generations: something else must be done.

4.4. Gender and schooling options

Next we look at the relative performance of girls and boys. We find what we should expect: better average scores for women. The degree of biological maturity of female students at fifteen is clearly higher than that of males. Figure 5 below illustrates this by simply considering the percentage of girls at the different effort levels. The picture is self-explanatory.

FIGURE 5: **Percentage of women per effort group, Spain PISA 2006**

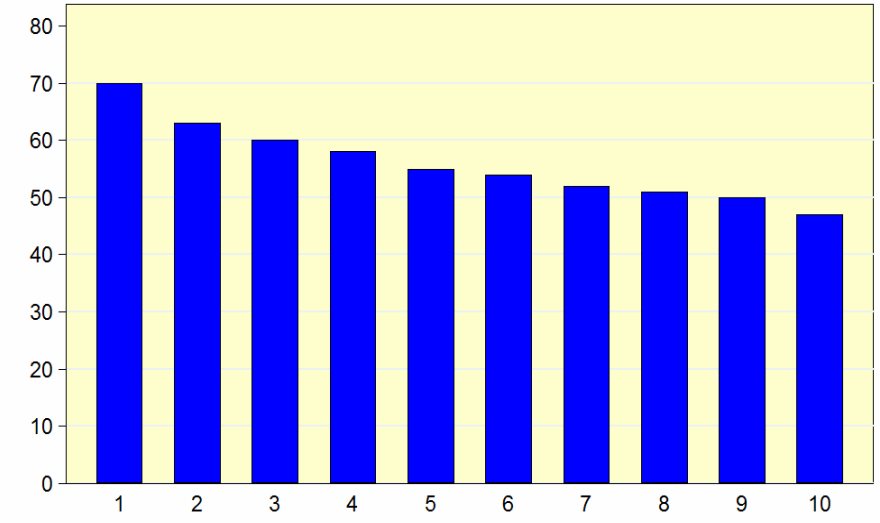


One would expect that those differences reduce once the boys catch up the maturity of the girls[11].

It is also interesting to consider whether the students' outcomes depend on the public or private nature of the school they attend. In Spain some 45% of the students attend private schools at the level of compulsory education (54% in the PISA sample). Most of those schools are *concertadas* or "under agreement" (meaning that they get funds from the state and follow the public rules concerning syllabus and prices).

The results point out to a better performance of the private schools. Figure 6 shows the percentage of students attending public schools per effort level. More than 70% of the students that are at the lower end of the effort scale attend public schools, whereas some 45% are those at the other end, with a clear monotonic path.

FIGURE 6: **Percentage of students attending public schools per effort group, Spain PISA 2006**

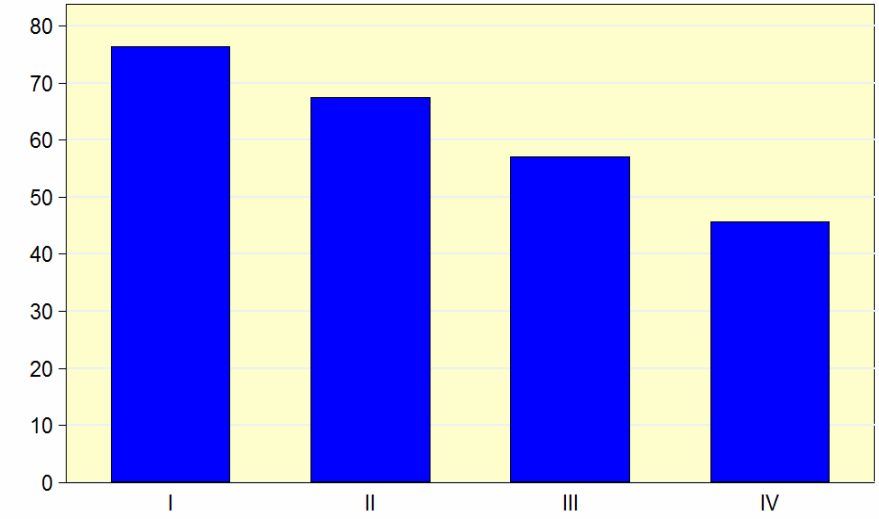


Yet the interpretation of those data is not immediate. In particular one cannot simply conclude that private education produce better results. The reason is that there is a clear correlation between parental background and the choice of school: parents with a higher educa-

[11] However, the specific design of the sample implies that gender has a negligible effect on the results. Following the model by Checchi and Peragine (2005), the same results can be obtained if we carry out the analysis controlling by gender.

tion send more often their off-springs to private schools. Figure 7 shows the percentage of students in the PISA sample attending public schools by type. The larger proportion corresponds to those parents with lower education, and the smaller to those with higher education. Let us recall here that the students' performance is affected substantially by the family environment (education and economic position of the parents) and the peer effect (types of the class-mates). Therefore, those results are partly reflecting family differences and a self-selection phenomenon (see the average scores in Table 2).

FIGURE 7: **Percentage of students attending public schools per level of education of their parents, Spain PISA 2006**



5. Spain and its Regions

5.1. Overview

Spain is administratively divided into 17 regions (or *Comunidades Autónomas*) with a degree of autonomy close to a Federal State. Regions are, in particular, responsible for the handling of education at all levels. Ten of those regions asked the OECD to enlarge the 2006 sample in order to get relevant data at regional level. Those regions are (we write the abbreviation followed by the % of the Spanish population they represent): Andalucía (And /

17.84%), Aragón (Ara / 2.86%), Asturias (Ast / 2.41%), Cantabria (Can / 1.27%), Castilla y León (CyL / 5.65%), Catalonia (Cat / 15.96%), Galicia (Gz / 6.19%), La Rioja (LRj / 1.35%), Navarra (Na / 0,69%) and Basque Country (PV / 4.77%). We also include a pseudo-region called Rest (Rest / 41.03%)[12].

We present in tables 4, 5 and 6 a summary of the results concerning the inequality of opportunity and the test scores, by regions and effort levels[13].

The analysis of the coefficient of variation across effort groups in Spain shows that, as it was the case in the EU15, there is a much higher variability in the inequality of opportunity than in the mean scores. Note that Galicia and Andalucía exhibit coefficients of variations of both variables that are above the Spanish ones. Castilla y León has more than average variability in inequality of opportunity and less in mean scores. Catalonia and the Rest of Spain show the opposite behaviour. All other regions have smaller variability in both variables.

Even though is not immediately evident, the data show a similar pattern among different groups of regions, concerning the average IOp and mean quality values. Thus, in order to facilitate the discussion, we propose to cluster the regions into three large "areas", as follows[14]: Northern Area (Ara, Ast, Can, CyL, Gz, LRj, Nav, and PV), Central-Eastern Area (Cat and Rest), Southern Area (Andalucía). The Northern area represents the 25% of the Spanish population, whereas the Central-Eastern and the Southern areas represent the 57% and the 18%, respectively.

[12] This “region” includes: Baleares, Canarias, Castilla-La Mancha, Comunidad Valenciana, Extremadura, Madrid, Murcia and the autonomous cities of Ceuta and Melilla.

[13] Table 9 in the appendix shows the decomposition of overall inequality into an ethically acceptable and an ethically offensive part.

[14] As we did for EU15, here the value of Spain is a weighted average of the different regions.

TABLE 4: Inequality of opportunity by regions and effort levels, Spain 2006

	1	2	3	4	5	6	7	8	9	10
Andalucía	0.0055	0.0028	0.0023	0.0021	0.0019	0.0016	0.0013	0.0012	0.0010	0.0006
Aragón	0.0007	0.0013	0.0012	0.0010	0.0010	0.0009	0.0008	0.0007	0.0007	0.0005
Asturias	0.0015	0.0015	0.0010	0.0008	0.0007	0.0007	0.0006	0.0005	0.0005	0.0005
Cantabria	0.0010	0.0011	0.0010	0.0007	0.0006	0.0006	0.0005	0.0006	0.0005	0.0004
Catalonia	0.0029	0.0017	0.0016	0.0015	0.0014	0.0013	0.0012	0.0010	0.0008	0.0005
Cast. y León	0.0012	0.0008	0.0006	0.0005	0.0004	0.0004	0.0003	0.0003	0.0003	0.0001
Galicia	0.0024	0.0009	0.0008	0.0007	0.0006	0.0005	0.0004	0.0004	0.0004	0.0004
La Rioja	0.0013	0.0009	0.0010	0.0010	0.0007	0.0006	0.0005	0.0004	0.0003	0.0004
Navarra	0.0008	0.0009	0.0009	0.0008	0.0007	0.0006	0.0005	0.0004	0.0003	0.0002
Basque Country	0.0014	0.0011	0.0011	0.0010	0.0009	0.0008	0.0007	0.0006	0.0005	0.0004
Rest of Spain	0.0031	0.0019	0.0016	0.0014	0.0013	0.0011	0.0009	0.0009	0.0008	0.0007
Spain W	**0.0031**	**0.0018**	**0.0016**	**0.0014**	**0.0013**	**0.0011**	**0.0009**	**0.0008**	**0.0007**	**0.0006**

TABLE 5: Test scores by regions and effort levels, Spain 2006

	1	2	3	4	5	6	7	8	9	10
Andalucía	297	369	404	428	451	470	490	511	536	581
Aragón	324	402	437	463	485	504	522	544	568	618
Asturias	330	405	435	460	481	499	518	538	562	609
Cantabria	325	397	428	453	475	495	514	536	564	612
Catalonia	315	393	429	456	477	498	518	541	567	614
Castilla y León	348	404	434	456	475	493	513	533	558	604
Galicia	320	396	430	458	480	500	521	542	570	621
La Rioja	348	415	447	471	493	512	532	552	577	622
Navarra	338	405	435	458	479	498	515	536	562	609
Basque Country	332	407	442	467	488	508	529	551	577	627
Rest of Spain	307	378	413	439	460	479	499	521	547	594
Spain W	**313**	**385**	**420**	**445**	**466**	**486**	**506**	**527**	**553**	**600**

TABLE 6: Means and coefficients of variation of inequality of opportunity and test scores by regions, Spain 2006

	IOpp. regional mean	IOpp. regional CV	Test scores regional mean	Test scores regional CV
Andalucía	0.0020	65.00	453.602	17.454
Aragón	0.0009	27.28	486.606	16.611
Asturias	0.0008	44.50	483.564	15.873
Cantabria	0.0007	31.58	480.027	16.588
Catalonia	0.0014	43.54	480.774	17.275
Castilla y León	0.0005	65.53	481.863	14.882
Galicia	0.0007	79.15	483.842	17.219
La Rioja	0.0007	42.76	496.905	15.408
Navarra	0.0006	39.84	483.610	15.509
Basque Country	0.0009	32.43	492.708	16.550
Rest of Spain	0.0014	49.85	463.696	17.222
Spain W	**0.0013**	**52.04**	**470.114**	**16.965**

Figures 8 and 9 summarize the overall performance of those areas with respect to quality (test scores) and inequality of opportunity. The message is quite clear. The average values show that the Northern Area dominates the Central-Eastern Area in both dimensions (higher scores and lower inequality). The Central-Eastern Area, that behaves very much as the whole country, dominates in turn the Southern area in quality and inequality. The South presents lower values in both dimensions.

Figures 10 and 11 qualify the results above and illustrate that this type of relationship is systematic and holds for all effort levels. Those figures show that the three areas can be ordered according to the Lorenz criterion (first order stochastic dominance) with respect to mean scores and inequality of opportunity, at all levels. That is, for each level of effort the outcome of the Northern Area is better than that of the Central-Eastern Area which in turn is better than the Southern Area.

FIGURE 8: **Overall average test scores by areas, Spain 2006**

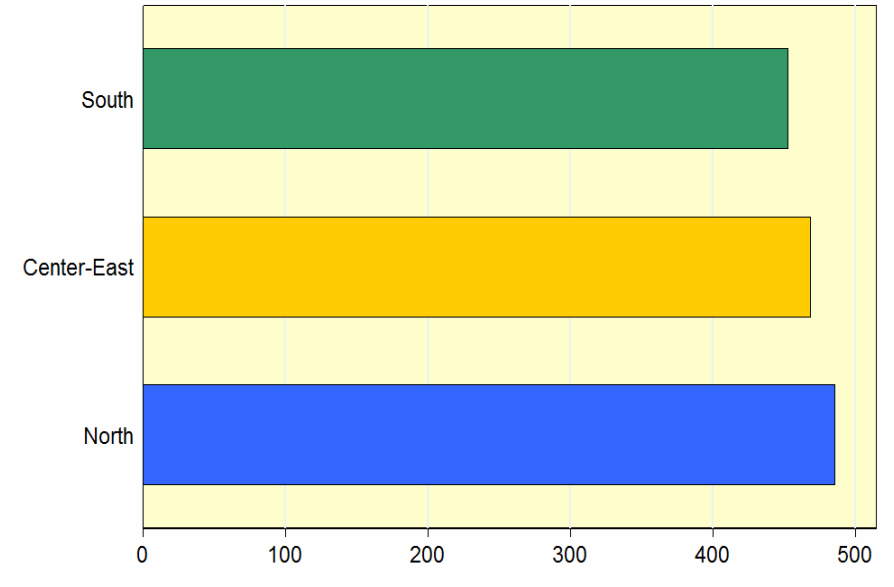


FIGURE 9: **Inequality of opportunity by areas, Spain 2006**

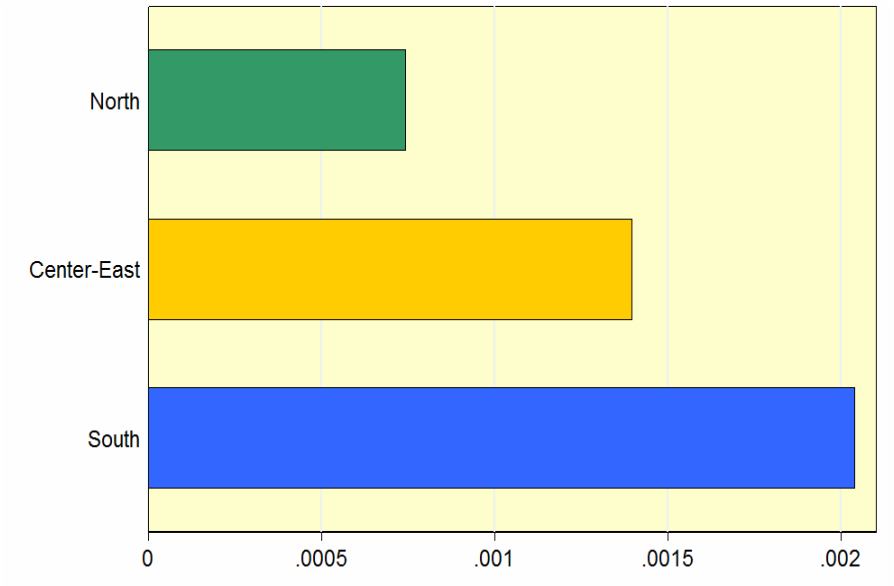


FIGURE 10: **Mean scores by areas and effort groups, Spain 2006**

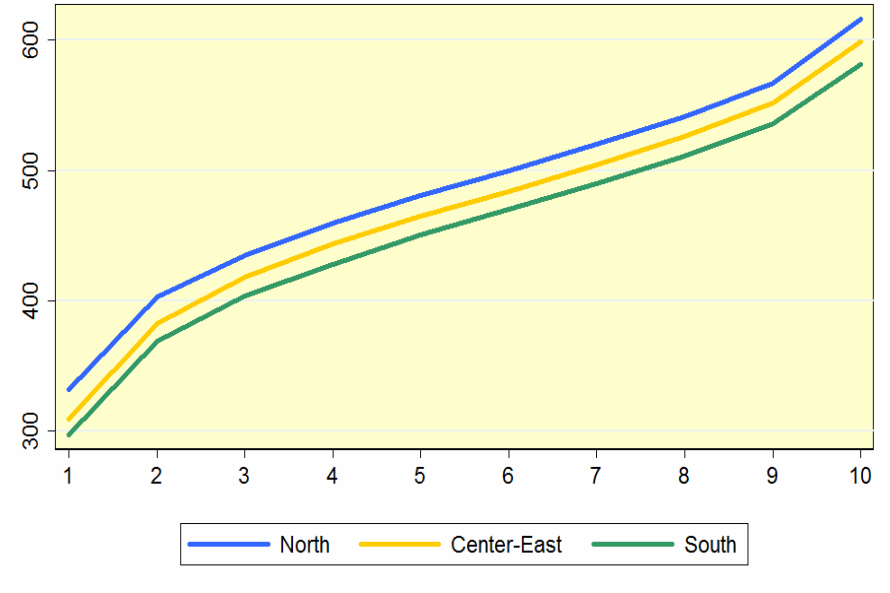
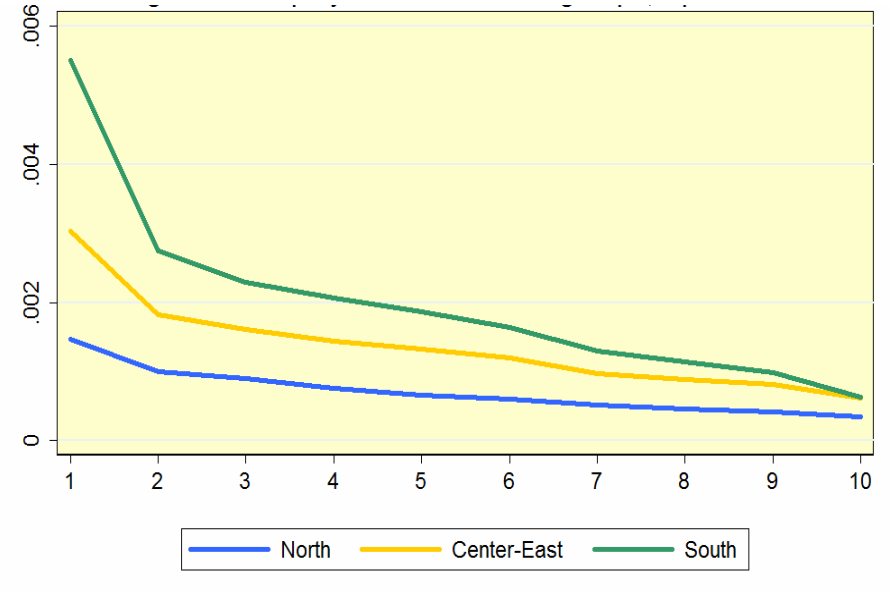


FIGURE 11: **IOp by areas and effort groups, Spain 2006**



Concerning the inequality of opportunity, note that:

a) There is a monotonic relationship between effort and opportunity: the higher the level of effort, the lower the level of inequality. That is, the influence of parental status is important for those students who exert a lower level of effort, whereas it is a minor explanation of the outcomes of the best students. This suggests that high effort can substitute less favourable external circumstances.

b) The deviations with respect to the Spanish average decreases monotonically with the degree of effort. That means that the "discrimination" among good students is similar all over Spain, whereas the geographical aspect is much more important for bad students.

5.2. Regional differences

The situation of the Spanish educational system is therefore characterized by a notorious asymmetry: Those areas with less equality of opportunity are, precisely, the areas with worse results in the test scores. One naturally wonders about the origin of such differences in a unified educational system. A first line of analysis is that corresponding to the regional distribution of the education of the parents of those students in the sample.

Table 7 below shows those data. There are substantial differences in the distribution of the students' cultural background across the regions. The range of families with no formal education goes from less than 7% (Basque Country) to more than 26% (Andalucía). The same regions define the range of the families with the higher level of education: 44% in Basque Country and 28% in Andalucía. Figure 12 illustrates further the situation by plotting the percentage of families with non-compulsory education.

We have already pointed out that the convergence in educational levels between Spain and Europe does not ensure the convergence in the corresponding PISA scores. We extend here that analysis to the case of the Spanish regions, trying to quantify the size of the "composition effect" with respect to the "type productivity effect". By composition effect we refer to the impact of the differences in the human capital structure on the students' average

performance. By type-productivity effect we refer to the differences in the idiosyncratic performance of the students' per type.

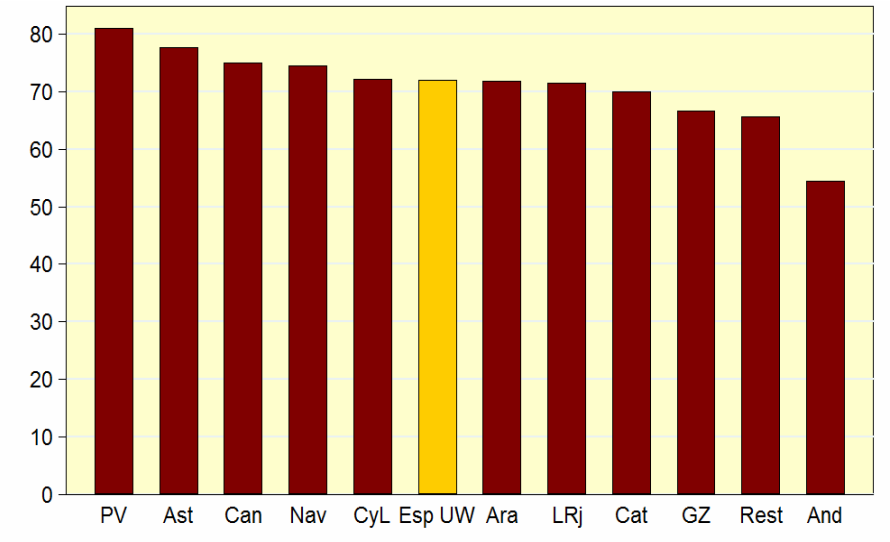
TABLE 7: Percentage of students per level of education of their parents, PISA 2006

	Level I	Level II	Level III	Level IV
And	26.16	19.38	26.51	27.96
Ara	9.05	19.10	30.27	41.58
Ast	6.69	15.63	35.88	41.80
Can	6.62	18.42	35.27	39.70
Cat	12.34	17.75	27.08	42.83
CyL	8.63	19.20	32.14	40.03
Gz	12.02	21.42	33.25	33.31
LRj	7.46	21.10	30.54	40.90
Nav	8.39	17.17	30.54	43.90
PV	6.81	12.19	30.47	50.52
Rest	13.79	20.54	29.88	35.79
Spain	10.32	17.63	30.99	41.06

Remark 1: Rows in 6 do not add up to 100 because there are some 2% of missing data in all regions.

Remark 2: Spain data are un-weighted data.

FIGURE 12: Percentage of parents with non-compulsory education, PISA 2006 (types iii and iv)



In order to decompose the differential performance of the students into composition and type-productivity effects, we apply the following technique (a form of shift-share): Let μ^j denote the overall average score of region *j*, μ_i^j the average score of students in region *j* with families with education level *i*, and let p_i^j stand for the fraction of families with education level *i* in region *j*. We can write:

$$\mu^j = \sum_{i=1}^{n} \mu_i^j p_i^j \qquad [5]$$

Let us write now those values in terms of the deviations of the national means of each type, μ_i and p_i respectively. That is,

$$\mu_i^j = \mu_i + a_i^j$$
$$p_i^j = p_i + c_i^j$$

Inserting this into equation [4] we get:

$$\mu^j = \mu + \sum_{i=1}^{n} \mu_i c_i^j + \sum_{i=1}^{n} p_i a_i^j + \sum_{i=1}^{n} c_i^j a_i^j$$

Therefore, we can write:

$$\mu^j - \mu = \sum_{i=1}^{n} \mu_i c_i^j + \sum_{i=1}^{n} p_i a_i^j + R$$

The term $\sum_{i=1}^{n} \mu_i c_i^j$ tells us the part of the mean difference that is due to the different composition of the population concerning education levels. It assigns to each region the national score of each type, weighted by the differences in the composition of the population

concerning education levels. The term $\Sigma_{i=1}^{n} p_i \alpha_i^j$ tells us the part of the mean difference corresponding to the differences in average productivity per type. That is, we keep constant the composition of the education levels (equal to the national distribution) and weight those values with the differences in the average scores of the students' types. Finally, *R* is a residual that captures the cross effects of both variables in a multiplicative way.

The results we obtain when applying this decomposition to the Spanish data are summarized in table 8. The first column tells us the difference between the average score of Spain and the corresponding region. The second and third columns provide estimates of the composition and type-productivity effects (the relative size being indicated in parenthesis below the corresponding absolute number)[15].

Those data suggest that the situation is not uniform and, in particular, that behind the differences in the regional PISA scores there is much more than the differences in the educational levels of the population. In Andalucía, for instance, slightly more than one third of the differences can be related to the distribution of education levels in the population. That is even a much smaller factor in the Rest of Spain (the other "region" with scores substantially below the Spanish average). Similarly, we find that most of the positive deviation in the case of La Rioja, Aragón or Galicia, is explained by the type productivity effect rather than by the educational levels of the population. Navarra and Basque Country exhibit a more balanced decomposition, whereas Asturias seems to be the only regions where the composition of the population really explains the better than average performance.

That means, as already pointed out, that the catching up process with respect to the Spanish levels of those regions with poor performances will not cancel the differences in the scores: some other actions are required in order to change the low performance of the Spanish compulsory educational system.

[15] Note that those percentages need not add up to 100 due to the existence of a third component in the decomposition that collects the cross effects.

TABLE 8: Decomposition of mean differences in the Spanish regions

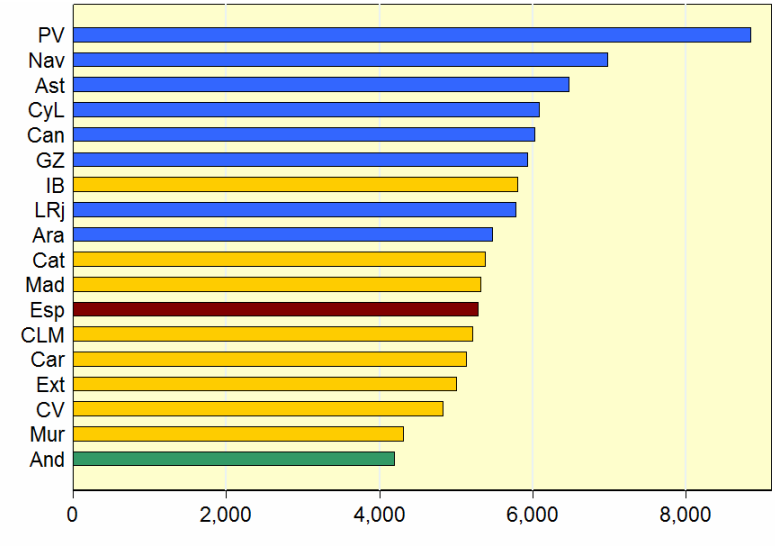
	Mean difference	Composition effect	Type Productivity effect
And	-28.00	-10.16 (36.29)	-17.79 (63.54)
Ara	4.97	0.38 (7.68)	4.59 (92.29)
Ast	1.95	2.08 (106.77)	-0.13 (-6.82)
Can	-1.62	0.95 (-58.75)	-2.52 (155.88)
Cat	-0.90	-1.49 (166.89)	0.60 (-66.87)
CyL	0.32	0.36 (111.54)	-0.04 (-11.73)
Gz	2.26	-2.27 (-100.55)	4.53 (200.54)
LRj	15.20	1.42 (9.37)	13.77 (90.65)
Nav	2.16	1.18 (54.59)	0.98 (45.47)
PV	11.22	4.22 (37.57)	6.96 (62.02)
Rest	-17.87	-2.87 (16.06)	-15.00 (83.94)

Note: Percentage in parenthesis.

Looking for other aspects that may affect the observed differential performance of the regions, it is worth analyzing the financial effort of the different regions. Figure 13 describes the public expenditure per student for all regions in Spain. A simple inspection shows that the regions that obtain the best results are those that expend more in education. For instance, our eight Northern regions are among the nine regions that expend more on education within the country. On the contrary, Andalucía is, precisely, the region with a smaller expenditure per student.

FIGURE 13: **Public expenditure on education by student, 2005**

(euros)



6. Final Comments

THERE is a well established agreement concerning the key role of education in determining future achievements of individuals. Higher education levels provide better chances in the labour market and translate into a higher aggregate productivity. Reading literacy at the end of compulsory school is a sensible proxy of the capabilities of the youth. A fair educational system should allow students to achieve competence independently on their parental background (merit instead of origin)[16]. This principle is captured by the notion of equality of opportunity used here. Note that equality of opportunity is more relevant at compulsory education than at higher levels of schooling: students at that age, besides acquiring the basic knowledge, are developing the patterns of behaviour for the future. Fifteen years old students

[16] Peragine and Serlenga (2007) point out that "if the school system fails to be fully meritocratic and selects according to abilities, then it is easier that other (negative) allocation mechanisms might prevail also in the labour market."

are still in their maturing process, can be easily influenced, and are much more dependent on the external circumstances (see Lefranc et al. (2007).

We have analyzed in this paper the performance of the Spanish educational system out of the data provided by the 2006 PISA report, with a special concern for the equality of opportunity. After an overall picture of the country, we have focussed on the differences between the Spanish autonomous regions. In order to facilitate the discussion (and also due to the lack of data for all regions), we have followed the strategy of Checchi and Peragine (2009), (2005) and have analyzed the behaviour of three different areas: North, Central-East and South.

Our results show that Spain is doing better than the EU15 in terms of equality of opportunity and worse in terms of quality (mean test scores). The differences vary quite monotonically with the effort level, in an opposite sense: the higher the effort the smaller the difference in equality of opportunity and the larger the difference in mean scores. From an internal perspective the results picture a country with noticeable differences across regions. Northern regions perform much better than the national average in terms of both quality and equality. The situation of the South is rather worrying as the low level of equality of opportunity is matched by poor results in the test scores. The data give us a picture of the Southern students as worse educated than the rest of the country and the most dependent on their family background. Central-Eastern regions exhibit an intermediate performance.

There is some evidence that those results reflect different social structures and regional policies (in particular the expenditure per student). The combination of low expenditure in education together with a low level of education of the families partly explain the observed results. Such a combination makes it more difficult to substitute learning within schools by learning within families. Be as it may, the differences in average scores, both between the Spanish regions and between Spain and the European Union, cannot be fully explained by the level of education of former generations. This implies that we cannot expect to solve the poor average performance of the students by waiting until the regional differences in human capital disappear.

The main conclusions of this analysis are the following. First, the improvement in the reading area must become a fundamental aim for the Spanish educational system. Second, some definite action must be taken in order to attain that goal, as the convergence in

education levels will not do the job. Third, the Southern regions have to make an extra effort in the improvement of the compulsory education in order to get better chances to keep the opportunities of the young. The analysis of composition and type-productivity effects suggests that there are some relevant differences in the effectiveness of the regional educational systems.

Finally, let us recall an obvious aspect of the problem on which most experts agree: no educational system can endure a national reform in every term of office, something that has taken place in Spain in the last thirty years. Some kind of national agreement is required to face the necessary improvements.

7. Appendix

TABLE A.1 reports for each region the decomposition of the overall degree of inequality between what Checchi and Peragine (2005) define as an "ethically offensive" part and an "ethically acceptable" part. We find that in those regions in which the inequality of opportunity is higher; the incidence of that portion of the decomposition on total inequality is also much higher than in the rest of the areas. More precisely, the inequality of opportunity is around the double both in the Southern and in the Center-Eastern regions than in the Northern ones.

TABLE A.1: **Inequality decomposition by regions**

Theil_2	Effort inequality	Opportunity ineaquality	Incidence % opportunity inequality	Total inequality
Rest	0.01744	0.001365	7.26	0.01881048
And	0.01820	0.002016	9.97	0.02021870
Ara	0.01718	0.000870	4.82	0.01804672
Ast	0.01514	0.000816	5.12	0.01595954
Can	0.01721	0.000689	3.85	0.01789480
CyL	0.01231	0.000472	3.69	0.01278706
Cat	0.01853	0.001395	7.00	0.01992532
Gz	0.02125	0.000736	3.35	0.02198994
Nav	0.01369	0.000597	4.18	0.01428208
LRj	0.01395	0.000755	5.13	0.01470876
PV	0.01649	0.000856	4.94	0.01734890
ESP	0.01751	0.001322	7.02	0.01883555

8. References

BELLORADO (1986): "Making literacy programs work: A practical guide for correctional educators"; U.S. Department of Justice, National Institute for Corrections, Accession no. NIC-006253.

CICCONE, A. and W. GARCÍA-FONTES (2008): "The quality of the Catalan and Spanish education systems: a perspective from PISA", Mimeo.

CHECCHI, D. and V. PERAGINE (2009): "Inequality of opportunity in Italy"; *Journal of Economic Inequality*.

CHECCHI, D. and V. PERAGINE (2005): "Regional disparities and inequality of opportunity: The case of Italy"; IZA discussion paper series Working Paper No. 1874/2005.

CICCONE, A. and W. GARCÍA FONTES (2008): "The Quality of the Catalan and Spanish Education Systems: A Perspective form PISA", Universitàt Pompeu Fabra, mimeo.

FOSTER, J.E. and A.A. SHNEYEROV (2000): "Path independent inequality measure"; *Journal of Economic Theory* 91, 199-222.

GOERLICH, F. and A. VILLAR (2008): *Distribución de la renta y bienestar social: de la teoría a la práctica*, Bilbao: Fundación BBVA, 2008.

HANUSHEK, Eric A. (2002): "Publicly provided education" in A.J. Auerbach and M. Feldstein, ed. *Handbook of Public Economics*, Amsterdan: North-Holland, 2045-2141.

LEFRANC, A., N. PISTOLESI and A. TRANNOY (2006): "Quality of opportunity: Definitions and testable conditions with an application to France"; Working Papers no. 53, ECINEQ society.

LEWIS (2002): "Guide Picks-Top 5 Professional Books about Reading"; http://k-6educators.about.com/library/products/aatp111201.htm?PM=ss03_k-6educators, About, Inc.

MOFFET, J. and WAGNER (1983): *Student Centered-Language Arts and Reading k-13: A Handbook for Teachers*; Boston: Houghton Mifflin.

PERAGINE, V. (2002): "Opportunity egalitarianism and income inequality"; *Mathematical Social Sciences* 44, 45-64.

____ (2004a): "Measuring and implementing equality of opportunity for income"; *Social Choice and welfare* 22, 187-210.

____ (2004b): "Ranking income distributions according to equality of opportunity"; *Journal of Economic Inequality* 2, .

PERAGINE, V. and L. SERLENGA (2007): "Equality of opportunity for higher education in Italy" in J. Bishop and B. Zheng, eds. *Research in Economic Inequality*, Vol 12.

ROEMER, J. (1993): "A pragmatic theory of responsibility for the egalitarian planner"; *Philosophy & Public Affairs* 22, 146-166.

ROEMER, J. (1998): *Equality of opportunity*, Harvard University Press.

RUIZ-CASTILLO, J. (2003): "The measurement of inequality of opportunities" in J. Bishop and Y. Amiel, eds. *Research in Economic Inequality*, Volume 9.

SHORROCKS, A.F. (1980): "The class of additively decomposable inequality measures"; *Econometrica* 48, 613-625.

SILBER, J. and A. SPADARO (2007): "Inequality of life chances and the measurement of social immobility"; Working paper no. 513, The Levy Economics Institute.

THEIL (1967): *Economics and information*, Amsterdam: North Holland.

VILLAR, A. (2005): "On the welfare evaluation of income and opportunity"; *Contributions to Theoretical Economics* 5 (1), Article 3.

NOTA SOBRE LOS AUTORES - *ABOUT THE AUTHORS**

AITOR CALO-BLANCO graduated in economics from the University of A Coruña and holds a PhD from the University of Alicante. He is currently a visiting professor at the Pablo de Olavide University, Seville. He focuses his research on the theory of justice and redistribution. He has specialized in the fields of equality of opportunity, economics of education, and public economics.
E-mail: aitorcalo@gmail.com.

ANTONIO VILLAR NOTARIO holds a bachelor's degree in economic sciences from the University of Valencia, and PhDs from the University of Alicante and the University of Oxford. At the present time, he is university professor at the Pablo de Olavide University, Seville. His fields of research are General Equilibrium and Welfare Economics. He is the author of six books and about forty articles, published in journals such as *Economic Theory, Economics Letters, Journal of Economics, Journal of Public Economics, Linear Algebra and Its Applications, Mathematical Social Sciences, Metroeconomica, Scandinavian Journal of Economics, The Manchester School*, and in specialized Spanish journals. He has been visiting lecturer at the Centre for Operation Research and Econometrics (Louvain-la-Neuve), at Stanford University and at the European University Institute of Florence. He has been coordinator in the Area of Economy and Law of the Spanish Evaluation and Prospective Agency (1989-1991), member of the Editorial Board of the journal *Investigaciones Económicas* and the Spanish representative of a European Network of Research (within the Human Capital and Mobility Program).
E-mail: avillar@upo.es.

Any comments on the contents of this paper can be addressed to Aitor Calo at aitorcalo@gmail.com.

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Fundación BBVA

Plaza de San Nicolás, 4
48005 Bilbao
España
Tel.: +34 94 487 52 52
Fax: +34 94 424 46 21

Paseo de Recoletos, 10
28001 Madrid
España
Tel.: +34 91 374 54 00
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