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**Evaluating the effects of decentralization on educational  
outcomes in Spain<sup>1</sup>**

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**Abstract:** Several arguments derived from fiscal federalism theory suggest that decentralization may lead to improved levels of efficiency in the provision of public goods and services. The aim of this study is to examine this hypothesis by evaluating the effects of decentralization on educational outcomes in Spain. These are measured using a *survival rate*, defined as the ratio between the number of students who enrolled in upper-secondary (non-compulsory) education and the number of students enrolled in the final year of lower-secondary (compulsory) education during the previous academic year. We use a panel data set comprising the 50 provinces of Spain for the years 1978 to 2005, a period that covers the entire process of decentralization. Since education competences were devolved to the regions at different points in time, we can estimate the effects of these reforms by applying the *differences-in-differences* method and by using the non-decentralized autonomous regions as the comparison group. We find that decentralization in Spain had a positive impact on educational outcomes when pupils on vocational training programmes are not taken into account, and that the richer the region is the more marked the effect becomes. However, this improvement in educational outcomes is achieved at the expense of enrolment in vocational training programmes. These effects might reflect a better match between population preferences and educational policies consequent upon decentralization.

**Resum:** Diversos arguments derivats de la teoria del federalisme fiscal suggereixen que la descentralització pot portar a majors nivells d'eficiència en la provisió de béns i serveis públics. L'objectiu d'aquest estudi és contrastar aquesta hipòtesi mitjançant l'avaluació dels efectes de la descentralització sobre els resultats educatius a Espanya. Els resultats educatius es mesuren d'acord amb la *taxa de supervivència*, que es defineix com el nombre d'estudiants que es matricula en educació secundària no obligatòria en relació als alumnes matriculats a l'últim curs d'educació obligatòria durant l'any acadèmic anterior. Per dur a terme aquest anàlisi utilitzem un panell de dades format per les 50 províncies d'Espanya i els anys 1978 a 2005, període que cobreix tot el procés de descentralització. Donat que les competències educatives varen ser descentralitzades cap a les comunitats autònomes en diferents moments del temps, podem estimar els efectes d'aquestes reformes fent servir el mètode de diferències en diferències, utilitzant les regions no descentralitzades en cada moment del temps com a grup de control. Els resultats de l'estudi indiquen que la descentralització a Espanya va tenir un impacte positiu sobre els resultats educatius quan els alumnes que es matriculen en programes de formació professional no es tenen en compte, i que com més rica es la regió més accentuat és aquest efecte. No obstant, aquesta millora dels resultats educatius s'aconsegueix en detriment de la matriculació en programes de formació professional. Aquests resultats poden estar reflectint un millor ajust entre les preferències de la població i les polítiques educatives com a conseqüència de la descentralització.

**JEL codes:** H11, H43, H52, I28.

**Keywords:** Decentralization, Policy Evaluation, Education.

## 1. Introduction

Fiscal federalism theory identifies a number of mechanisms via which decentralization may lead to improved levels of efficiency in the provision of public goods and services, both in terms of allocative and productive efficiency<sup>1</sup>. Thus, it has been claimed that local governments have a better knowledge of their population's preferences and needs (Oates, 1972) so that, under certain circumstances, decentralization can ensure a better match between political decisions and local preferences (*preference-matching argument*). Moreover, it is believed that decentralization can increase political participation, which in turn should ensure that local governments are more responsive to citizen demands than the central government tends to be (Shah, 1998). Closely related to this, decentralization is thought to increase the degree of political accountability of the government, which should serve as an incentive for a government to act in the best interests of its citizens (Seabright, 1996).

Given these arguments, in recent years several countries have initiated processes of decentralization with the aim of improving accountability and efficiency in their provision of public goods and services (Stegarescu, 2005). Other factors, such as separatist forces, have also promoted decentralization in various countries, including Indonesia and Russia. However, the benefits of decentralization need to be contrasted with any potential drawbacks before the system can be deemed superior in terms of social welfare and efficiency. Fiscal federalism theory has typically identified spillover effects and economies of scale as the main disadvantages of decentralization, since they can reduce the efficiency with which public goods and services are provided. More recently, Prud'homme (1995) claimed that decentralization may lead to higher levels of corruption since local authorities are more prone to being captured by local elites than central governments are. However, a number of analyses that have analysed the relationship between decentralization and lobbying conclude that the effects of decentralization on corruption are ambiguous and context-specific, indicating the need for empirical studies (Redoano, 2007; Bardhan and Mookherjee, 2000; Bardhan and Mookherjee, 2005). Thus, the theory remains inconclusive regarding the effects of decentralization, and empirical analyses are required.

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<sup>1</sup> Productive efficiency is interpreted here in a broad sense to include inefficiencies such as corruption, waste and poor governance.

Yet despite this need, empirical studies on this issue have, until recently, been virtually non-existent. Specifically, the relationship between decentralization and allocative efficiency has only been studied in Faguet (2004) and Solé-Ollé and Esteller-Moré (2005). Similarly, the literature examining the relationship between decentralization and productive efficiency remains limited and, more often than not, reports contradictory conclusions. One such example is provided by Barankay and Lockwood (2007), who analyse the effects of decentralization on the productive efficiency of government in education policy.

Thus, at a time when decentralization policies are gaining in popularity, we believe it timely to undertake additional studies of their effects. Specifically, the aim of this paper is to evaluate the effects of decentralization on educational outcomes in Spain. As we see below, in the last two decades Spain has been involved in a far-reaching process of decentralization to the extent that today it is one of the most decentralized economies in Europe. As in many other countries, its education policy has been one of the areas most affected by decentralization. And, because of the way in which the process has evolved in Spain, we are able to apply the *differences-in-differences* methodology to estimate its effects. As the country's regions received their educational powers at different points in time, we can use the autonomous regions that did not undergo decentralization in each time period as the comparison group for the decentralized regions. To do so, we constructed a panel data set containing information on the 50 provinces of Spain for the period 1978-2005, a period that covers the entire process of decentralization.

Educational outcomes, here, are measured using the *survival rate*, defined as the proportion of pupils in the final year of lower-secondary (compulsory) education who successfully complete the grade and enrol in upper-secondary (non-compulsory) education. There are at least two reasons for our interest in the proportion of students who choose to remain in full-time education after finishing compulsory education. First, in a country where enrolment rates in compulsory education are close to 100%, as is the case in Spain, it seems appropriate to use a variable that measures the proportion of students that stay on at school after this period to measure educational attainment. Second, and most importantly, recent evidence shows that each year a large number of young people in Spain fail to obtain the basic school diploma that certifies completion of lower-secondary education, and so are unable to proceed to upper-secondary education (Fuentes, 2009). As a consequence, upper-secondary graduation rates in

Spain remain low in international comparisons and, thus, raising both lower- and upper-secondary education graduation rates should be now one of the main objectives facing educational policy in Spain.

Our results show that decentralization in Spain has increased the proportion of students that enrol in upper-secondary education (*Bachillerato*) upon completion of lower-secondary education (*ESO*). We also find that the richer the Autonomous Community is, the greater the positive effects of this decentralization process have been. However, when we include the students that chose to enrol on vocational training programmes upon completion of *ESO* in our *survival rate* measure, the effects of decentralization are negative or non-significant. Given that *Bachillerato* (a general academic programme) is the chosen avenue into upper-secondary education for most *ESO* graduates, and that the attractiveness of vocational education is much lower than that of this general programme, these negative effects might reflect a better match between population preferences and educational policies consequent upon decentralization. The effects of decentralization on the educational sector in Spain have only previously been studied in Solé-Ollé and Esteller-Moré (2005), where the focus was specifically on the allocative efficiency of decentralization. The authors concluded that Spanish decentralization has improved allocative efficiency, in both education and road investment, a finding that is line with our results here.

The rest of this paper is organized as follows. Section 2 offers a review of the literature that has examined the effects of decentralization. Here, fiscal federalism theory has advanced a number of arguments in favour and against decentralization, and these serve as the theoretical framework for the empirical studies that have sought to verify these arguments. Section 3 describes the main features of the educational sector in Spain, with particular reference to the decentralization of the system. Section 4 describes the methodology we use in the empirical analysis. Section 5 discusses some empirical issues, principally the variables that are included in the analysis and our data sources. Section 6 presents the results we obtain from the analysis. Section 7 provides further analyses to corroborate the robustness of our results. Finally, the last section reports the conclusions that can be drawn from the analysis.

## **2. Literature Review**

### **2.1 The theory**

Fiscal federalism theory has traditionally presented decentralization movements as a trade-off between potential benefits, in terms of both productive and allocative efficiency, and possible drawbacks, that stem from the existence of spillover effects and economies of scale.

The *Decentralization Theorem* (Oates, 1972) claims that, in the absence of externalities and economies of scale, the decentralized provision of public goods will always be preferable in terms of social welfare to that of a centralized provision. This is because it is assumed that regional governments are better informed about local preferences and circumstances than the central government is, and this ensures that they are more responsive to local needs and are better placed to match local preferences with the provision of public goods and services (*preference-matching argument*). Oates' conclusions are based on the assumption that while central government results in a uniform provision of public goods, local governments can differentiate between regions on the basis of heterogeneous local tastes and needs. The justification for this argument is the limited access central government has to information about local circumstances, and the various political problems that may prevent the central government from providing access to heterogeneous levels of public goods and services between the regions.

More recently, the political economy literature has relaxed this hypothesis by the modelling of legislative behaviour in central government (Lockwood, 2002; Besley and Coate, 2003). These studies seem to confirm, however, Oates' conclusion that decentralization is preferable when externalities are small and/or when there exists a high degree of heterogeneity between regions. Yet, differences can be identified between the two approaches. First, in the new political economy approach, the costs of centralization are not derived from a uniform level of provision of public goods, but rather from the inefficient spending decisions made by the central legislative body. Secondly, the arguments forwarded in support of the belief that centralization improves efficiency in the presence of externalities also differ greatly. In Oates' approach, centralization is preferable under these circumstances as the process allows spillover effects to be internalised. However, in the political economy literature, externalities influence central government incentives to allocate funds efficiently.

Thus, the general conclusion to be drawn from these theoretical studies is that, if externalities are low and districts heterogeneous, decentralization will improve

allocative efficiency. However, there is an implicit assumption to this proposition that should not be overlooked. These studies assume that governments are benevolent, in the sense that they act in the best interests of their citizens. This hypothesis, however, has been called into question by more than one author in recent years, as governments might very well prioritise their own interests or be under the sway of lobbies and rent-seeking groups, resulting in reduced productive efficiency. Seabright (1996), for example, has modelled the way in which decentralization can affect a government's incentive to act in the best interests of its citizens. This author argues that government incentives depend on the degree of *political accountability*, defined as the probability that the welfare of a given region might determine the re-election of the government. Since *political accountability* or the electoral control over incumbents is greater at the local level, decentralized governments will have more incentives than centralized authorities to act in accordance with the preferences of the population and, therefore, be less corrupt (*accountability argument*). Persson and Tabellini (2000) and Hindriks and Lockwood (2005) reach similar conclusions about the relationship between decentralization, political accountability and government behaviour.

Despite the above definition of *political accountability*, the literature usually considers this term in a broader sense as the electoral rules and other institutional mechanisms that constrain the rent-seeking activities of office holders, such as the taking bribes, favouring of particular interest groups and insufficient innovation and effort. Thus, in order to determine the impact of decentralization, Lockwood (2006) has proposed focusing on two possible aspects of accountability: the degree to which institutions allow the government to divert rents, and the degree to which institutions allow special interest groups to distort government decision-making through their lobbying activity. In fact, various studies have focused on this relationship between decentralization and lobbying, and conclude that the effects of decentralization on corruption are ambiguous and context-specific, indicating the need for empirical studies (Redoano, 2007; Bardhan and Mookherjee, 2000; Bardhan and Mookherjee, 2005).

## 2.2 Empirical work

As we have seen, theoretical analyses do not allow us to draw any definitive conclusions regarding the superiority of centralised or decentralised systems in terms of their respective economic efficiency. Improved *political accountability* resulting from

decentralization and increased *allocative efficiency* must be set against any externalities which arise from spillovers between localities. It has also been argued that the combination of the decentralization of expenditures and the centralization of tax collection means that subcentral governments have an unclear perception of hard budget constraints, which causes them to overspend and to be inefficient (Wildasin, 1997). Thus, the net benefits of decentralization are likely to vary between policies and localities, so that the choice between centralized and decentralized forms of government is highly sensitive (Seabright, 1996) and probably context specific, which makes empirical studies necessary. However, the empirical literature examining the effects of decentralization on both allocative and productive efficiency has, until recently, been virtually non-existent and, indeed, continues to be somewhat scarce.

Faguet (2004) and Solé-Ollé and Esteller-Moré (2005) examine the influence of decentralization on *allocative efficiency* by determining whether the process has had an impact on investment patterns (across Bolivian municipalities in the first instance and Spanish provinces in the second), and the extent to which these changes could be related to objective measures of needs. Both studies conclude that decentralization has led to a better adjustment between investment patterns and needs, corroborating one of the main theories of fiscal federalism. However, Akin *et al.* (2005), in their analysis of the allocation of funds between public and non-public goods in Uganda, conclude that the regional governments tend to allocate fewer resources than the central government to public good activities, implying that social welfare is weakened with decentralization.

Most of the empirical literature analysing the impact of decentralization on *productive efficiency* has not attempted to identify with any degree of precision the particular channels discussed above. Rather, as discussed by Barankay and Lockwood (2007), the general approach has involved examining the relationship between fiscal decentralization and certain key observable factors of governance, such as measures of outcomes in a given policy area or political, economic or social indicators. In the education sector, which is the focus of the present study, Habibi *et al.* (2001) report a positive impact of decentralization on educational outcomes in Argentina when using the ratio of students enrolled in secondary school per thousand primary students as their dependent variable. Likewise, Galiani and Schargrodsy (2001) and Galiani, Gertler and Schargrodsy (2008) find a positive impact of decentralization in the same country on educational outcomes (measured using the standardized test scores of Argentine students), but only in provinces that do not report a very large fiscal deficit. Similar



results are reported in Barankay and Lockwood (2007) in their analysis of the effects of decentralization on educational attainment (measured according to the *maturité rate*, i.e., the ratio between the number of students obtaining the university entrance qualification and the number of 19 year olds in the population) in the Swiss cantons. Faguet and Sanchez (2008) also present evidence of improved educational outcomes in Colombia (measured as the year-on-year increase in student enrolment) as a result of decentralization. However, the literature also reports instances in which decentralization has no impact on educational outcomes. This is the case of Mahal *et al.* (2000), who even report negative effects of decentralization on primary health care and education in India, and Treisman (2002), who analyses the effects of decentralization on youth illiteracy rates, as a measure of the quality of public services in basic education, for a cross-section of 91 countries.

Finally, the several studies that have examined the relationship between decentralization and corruption also report contradictory findings. While Treisman (2002) presents quite convincing evidence to suggest that decentralization leads to higher levels of perceived corruption, Fisman and Gatti (2001) and Huther and Shah (1998) conclude just the opposite.

Thus, reports regarding the effects of decentralization on government quality and educational outcomes are somewhat contradictory. Given these contradictions, and the fact that the case of Spain has only been analysed in Solé-Ollé and Esteller-Moré (2005), and then solely in terms of allocative efficiency, we consider an empirical analysis of the effects of decentralization on educational outcomes in Spain to be of great interest.

### **3. The main features of the education sector in Spain**

#### **3.1 Spain's education system**

The education system in Spain has undergone several reforms during the last thirty years, in response to the changing needs of an economy that has developed greatly during this period. In 1970, the *Ley General de Educación* (LGE) made education free and compulsory until the age of 14. In addition, the law introduced vocational training into the education system as an alternative pathway to academic study upon completion of compulsory education and to facilitate young people's entry into the labour market.

In 1985, the *Ley Orgánica Reguladora del Derecho a la Educación* created the state-assisted schools, which combined free education (in private schools) with parental discretion regarding the school to which they could send their children. However, the basic structure of the education system was not altered until 1990, when the *Ley Orgánica de Ordenación General del Sistema Educativo* (LOGSE) extended compulsory education to the age of 16, and created advanced vocational training schools.

Despite this reform, and the compulsory extension of school attendance to the age of 16, each year a large number of youths fail to obtain the basic school diploma certifying successful completion of *ESO*. Given that these pupils cannot therefore proceed to upper-secondary education, a large number of unskilled workers enter the Spanish labour market. Further, the net enrolment rates in upper-secondary education in Spain are lower than those in most other European countries as are Spain's graduation rates when compared internationally (Fuentes, 2009). Only Luxemburg, Portugal and the United Kingdom figured below Spain in 2004 in terms of their net enrolment rates at the age of 18, while there was a gap of more than twenty percent with Finland and Sweden, which had net enrolment rates above 90 percent. However, marked differences can be observed between the regions of Spain. Thus, in 2004, while the net enrolment rate at the age of 17 was 92.6 percent in País Vasco, in line with Europe's best performing countries, it was only 61.1 percent in Baleares.

Enrolment on vocational training programmes is lower than that on general academic programmes in all the regions of Spain. This is mainly because the educational pathway *Bachillerato* is the favoured route for admission into university, but it may also reflect the high failure rate of pupils in lower-secondary education, which is likely to depress participation of vocationally interested pupils in upper-secondary education. As a consequence, graduation rates for vocationally-oriented degrees are also very low when compared internationally.

Thus, one of the main challenges that the Spanish education system currently faces is how to raise its number of upper-secondary education graduates. As signalled in several studies, this first requires reducing the number of youths who are unable to proceed to upper-secondary education because they fail to obtain the basic school diploma that certifies completion of lower-secondary education. Although we do not have data on early school leavers, we can compute the proportion of students enrolled in the final year of lower-secondary education (i.e., compulsory education) who choose to

remain at school to study upper-secondary education as full-time students. A similar measure has been used in Pissarides (1981) to analyse the demand for post-compulsory education in England and Wales. Likewise, the OECD used a similar measure in *Education at a Glance 1992*, to analyse higher education survival (OECD, 1992).

### 3.2 Decentralization process

We can trace the process of decentralization in Spain back to 1978, when the Spanish Constitution was enacted. The 1978 Constitution clearly laid down the foundations that would enable Spain to become one of the most decentralized economies in Europe. Thus, it established the right of Spanish provinces to unite to form autonomous regions (17 Self-governing Communities were formed from the 50 provinces) and specified the division of powers between the central government and the new autonomous or regional governments. In the education sector, the Constitution upheld the central government's power to define the structure of the state's education system, to regulate the requirements for the obtaining, issue and standardization of academic degrees and professional qualifications and to establish the basic rules to guarantee the unity of the Spanish education system. All other responsibilities in the sector, however, were devolved to the regional governments.

One of the main features of Spain's process of decentralization has been the asymmetrical manner in which it has been conducted (García-Milà and McGuire, 2002). While provinces with common historic, cultural and economic characteristics, islands and provinces with a historic regional status were able to accede to all the powers not specifically assigned to the central government in the Constitution (section 149) following the approval of their Devolution Statutes (that is, Cataluña, País Vasco, Galicia, Andalucía, Comunidad Valenciana and Canarias), the other autonomous regions had to wait five years following the approval of their Devolution Statutes to be assigned the same powers. In practice, however, these non historic autonomous regions were not able to receive these educational powers until the approval of the *Acuerdos Autonómicos de ampliación de competencias* in 1992, and the transfers were not made effective until the final years of the nineties. As a result, the decentralization process has taken place over almost two decades, but today all the autonomous regions enjoy the same powers in the education sector. Table 1 shows the year in which the individual Statutes of Autonomy were introduced in each Autonomous Community and the year in

which educational powers were transferred to them. The fact that the different regions received these educational powers at different points in time allows us to estimate the effect of decentralization on educational outcomes by using the autonomous communities that are not decentralized as a comparison group for the regions that are decentralized in each time period.

#### 4. Methodology

The aim of this study is to evaluate the effects of decentralization in Spain on the country's educational outcomes. As in the evaluation of any policy area, the effect of decentralization in any region  $i$  is given by the difference between the outcomes in this region at time  $t$  after decentralization and the outcomes in this region had it not been decentralized:

$$\alpha_{it} = Y_{it}^D - Y_{it}^{ND} \quad (1)$$

where  $\alpha_{it}$  denotes the individual-specific treatment effect,  $Y_{it}^D$  denotes the outcomes in the treated group of regions if decentralized, and  $Y_{it}^{ND}$  the outcomes in the treated group of regions had they not received educational powers (Blundell and Costa Dias, 2002). However, as it is impossible to observe what would have happened had decentralization not taken place in a particular region,  $Y_{it}^{ND}$  is non-observable and has to be estimated. When experimental data are available, the outcomes in the non-treated regions can be used to approximate  $Y_{it}^{ND}$ . In our study, although we do not have any experimental data, we are fortunate that educational powers were devolved to the regions at different points in time. Thus, we can use the outcomes in the non-decentralized regions to estimate what would have happened in the decentralized regions had they not been decentralized. Although the decision to decentralize was made on historical grounds, so that should not have been affected by any specific regional characteristics with an influence also on the educational outcomes, we apply the *differences-in-differences* methodology to estimate its effects. In this way, we are able to control for differences between regions in terms of the non-observable characteristics that might determine both student outcomes and the desire of regional

governments to be granted powers in the field of education. For example, the importance attached to education in a given society. If such differences were to exist and we did not control for them, a non-zero correlation between the decentralization variable and the error term in the outcome equation would appear, and our estimates of the impact of decentralization would be affected by a selection bias (Heckman and Hotz, 1989).

The *differences-in-differences* method enables us to control for such differences by decomposing the error term in the outcomes equation on a region-specific fixed effect,  $\Phi_i$ , a common macro-economic effect,  $\theta_t$ , and a temporary individual-specific effect,  $\varepsilon_{it}$  (Blundell and Costa Dias, 2002), as we can see in equation (2):

$$Y_{it} = d_{it}\alpha + (\Phi_i + \theta_t + \varepsilon_{it}) \quad (2)$$

where  $\Phi_i$  includes the unobservable or non-measurable characteristics of provinces that may have an influence both on educational outcomes and on the decision whether to decentralize or not;  $\theta_t$  allows us to control also for the temporary shocks that affect the outcomes of all provinces equally (for example, a central government reform); and  $d_{it}$  is the decentralization variable, which is defined with a dummy that takes the values 1 if the province  $i$  is in a decentralized Autonomous Community in year  $t$ , and 0 otherwise. We consider this variable to be appropriate in the case of Spain, where the decentralization of spending in education has also meant devolution in decision-making powers to the Autonomous Communities. Under these circumstances, the only assumption that we need so as to identify the effect of decentralization on educational outcomes,  $\alpha$ , is that selection into treatment is independent of the temporary individual-specific effect. This ensures that the evolution of the outcomes in non-decentralized regions is the same as they would have been in decentralized regions had the latter not been decentralized:

$$\left( Y_{t_1}^D - Y_{t_0}^D \right), \left( Y_{t_1}^{ND} - Y_{t_0}^{ND} \right) \perp D \quad (3)$$

If this assumption is valid, the estimation of equation (2) for the pooled sample of decentralized and non-decentralized autonomous regions leads to the Average Treatment Effect on the Treated (ATET), which can be represented as follows:

$$\alpha = (Y_{t_1}^D - Y_{t_0}^D) - (Y_{t_1}^{ND} - Y_{t_0}^{ND}) \quad (4)$$

where  $\alpha$  denotes the ATET,  $(Y_{t_0}^D, Y_{t_1}^D)$  denote the outcomes for the treated group of regions before and after the reform, respectively, and  $(Y_{t_0}^{ND}, Y_{t_1}^{ND})$  the outcomes of the control group of regions also before and after the reform. Thus, the *differences-in-differences* estimator measures the excess outcome growth for the treated compared to the non-treated regions (Blundell and Costa Dias, 2000).

Given that in Spain the devolution of powers was decided on historical grounds, we do not expect the selection process to have been affected by the observable characteristics of the regions. However, differences between the two groups of regions could appear simply because of the fact we are dealing with only 17 Autonomous Regions in Spain. We can assess the importance of this non-random selection in base to the observable characteristics of the regions by simple comparison of these characteristics in the two groups of regions before decentralization was initiated. Should it be the case that before treatment decentralized and non-decentralized regions presented systematic differences in their observable characteristics that might be considered as being associated with the dynamics of the outcome variable, these then ought to be included in the regression to solve the selection problem (Abadie, 2005). When these control variables are included in equation (2) we obtain the so-called *linear matching with differences-in-differences* estimator, which was first proposed by Heckman, Ichimura, Smith and Todd (1998). By including these control variables in the regression we ensure that we are comparing the outcomes of decentralized regions with the outcomes in non-decentralized regions that have similar observable characteristics, and thus, which would respond in the same way to the decentralization policy. In that case, assumption (3) above continues to be valid, but only conditional on the observable characteristics of the regions included in the regression function,  $X$  :

$$(Y_{t_1}^D - Y_{t_0}^D), (Y_{t_1}^{ND} - Y_{t_0}^{ND}) \perp D | X \quad (5)$$

This is the Conditional Independence Assumption (CIA) needed for the matching estimator to be consistent, on a redefined outcome variable, namely the growth in the outcomes. However, this is a weaker assumption than CIA, in that there is scope for selection both on observables and non-observable characteristics, as long as these are fixed over time and additively separable. As we have seen, this model allows any kind of dependence between selection for treatment,  $d_{it}$ , and the region-specific component,  $\Phi_i$ , i.e., it allows for fixed effects. Thus, we first need to take first differences to get rid of the regional fixed effects in order to identify the rest of the parameters, and then to apply pooled OLS to the differences equation (Wooldridge, 2002). We compute robust variance estimates and conduct our estimations by clustering the error term by autonomous communities, in order to adjust the standard errors for intragroup correlation (between provinces in the same autonomous community) and to obtain a variance covariance matrix which is consistent in the presence of any correlation pattern within regions over time (Bertrand et al., 2004).

By employing this method, we obtain consistent estimators under the assumption of strict exogeneity of the regressors. As we have seen, when selection depends only on the non-observable characteristics of the regions that are constant over time, the decomposition of the error term implied by the *differences-in-differences* approach implies the strict exogeneity of the decentralization variable, and our estimations will be consistent. If other control variables must be included in the regression, these variables must also accomplish the strict exogeneity assumption for their coefficients to be consistently estimated. Since the educational process is cumulative, we need to include the first lag of the outcomes variable in order to control for past educational inputs (Todd and Wolpin, 2003) and to avoid any kind of correlation between the error term and the past, present and future values of the explanatory variables.

## **5. Empirical issues**

### **5.1. Variables**

The main objective of this empirical study is to analyse the effects of the decentralization of education in Spain on educational attainment. Several variables have

been proposed in the literature to measure educational attainment, including: the net enrolment rate (Mahal *et al.*, 2000), average test scores in Language and Maths (Galiani and Schargrodsky, 2001) and the ratio between the number of students obtaining the university entrance qualification and the number of 19 year olds in the population (Barankay and Lockwood, 2007). Here, we measure educational attainment by using the *survival rate*, defined as the ratio between the number of students that choose to stay on at school to study *Bachillerato* (non-compulsory) and the number of students enrolled in the final year of lower-secondary (compulsory) education in each province (in the previous year). As an alternative measure of educational outcomes, we also define a *survival rate* that not only includes pupils who enrol for *Bachillerato* upon completion of their compulsory education, but also those that enrol on vocational training programmes. Habibi *et al.* (2001) used a similar measure, defined as the ratio of students enrolled in secondary school per thousand primary school students. Similarly, Pissarides (1981) defines a similar measure to analyse the demand for post-compulsory education in England and Wales. In a country where enrolment rates in compulsory education are close to 100%, as is the case in Spain, it seems appropriate to use a variable that measures the proportion of students that stay on at school after this period to measure educational attainment.

The literature contains a wide-ranging debate regarding the best determinants of educational attainment, but its conclusions are not always clear. According to Hanusheck's meta-analyses (1986; 2003) school inputs are not significant in explaining educational attainment, at least insofar as they are typically measured in the literature. Rather, family characteristics – including income, parental education or family structure, have been found to be of greater importance in accounting for educational outcomes. However, recent empirical studies of the effects of class size on educational attainment, based on experimental data (Krueger, 1999), instrumental variables methods (Angrist and Lavy, 1999) and on a very rich data set that allowed the main potential endogeneity problems affecting the education production functions to be eliminated (Rivkin *et al.*, 2005), suggest that class size reductions have a positive and significant effect on educational attainment. The most likely reason why these studies reach such different conclusions is that the statistical models used in estimating these relationships are misspecified and fail to account for the major determinants of achievement. When analysing the cognitive achievement of children, it is essential to have access to data regarding all past and present family and school inputs. Since the researcher typically



does not enjoy access to such data, highly restrictive assumptions are needed to justify some of the specifications that are commonly used in the literature, mainly the contemporaneous specification and the value added specification. The main problem of the contemporaneous specification is that all past school and family inputs are omitted in the regression, which probably results in biased and inconsistent estimates unless highly restrictive and non reasonable assumptions are fulfilled. By contrast, the value-added specification can lead to consistent estimates under the assumption that a lagged outcome variable provides a sufficient statistic for all historical inputs, but only when contemporaneous inputs have not been omitted (Todd and Wolpin, 2003).

As we have seen, to obtain consistent estimates of the effects of decentralization we only need to include the determinants of educational outcomes if there were pre-treatment differences in the decentralized and non decentralized regions. Thus, we first need to determine whether in Spain in 1980 there were any differences in these variables between the regions that would be decentralized in the eighties and those that would be decentralized at a later date in the following decade. In line with previous discussions of education production functions, we consider the potential determinants of educational attainment in Spain to be the *pupil/teacher ratio*, as a measure of school inputs; *per capita income* and the *schooling* of the active population, as measures of family inputs or characteristics; the *unemployment rate* as being representative of the broader context of the educational sector; and the first lag of the *survival rate*, as a measure of past school and family inputs. If we were to include these variables in the regression, we would expect the coefficient of the *pupil/teacher ratio* to be negative, whereby the lower the pupil/teacher ratio is, the better the educational outcomes are. Family characteristics, measured by *per capita income* and *schooling* variables, are expected to have a positive influence on educational outcomes. First, we suppose that low income families are not able to spend as much as high income families are on their children's education (for example, paying for private lessons), and that this will negatively affect a child's educational attainment as defined above. In addition, school pupils from low income families may have to spend more time working than their higher income counterparts, and this might also have an impact on their educational attainment. Second, family background has also been demonstrated to have a positive influence on a child's school performance, as it would seem that more highly educated parents attach greater importance to education than less educated parents tend to do. The *unemployment rate* can influence pupils' decision making, in the sense that a high

unemployment rate will encourage them to stay on at school after finishing compulsory education. Although the omission of contemporaneous inputs could affect the coefficient of the input variables, we would expect the coefficient of the decentralization variable not to be affected by this problem, since it should not be correlated with the omitted variables.

## 5.2. Data sources and definition of variables

The data consist of a panel data set incorporating the 50 provinces of Spain. Given that the decentralization process in Spain was set in motion at the beginning of the eighties and finished at the end of the nineties, we analyse the period 1978-2005. In this way, we have observations both before and after the decentralization process, as is required in order to apply the *differences-in-differences* estimation method.

The *survival rate* is defined as the ratio between the number of students in each province that are enrolled in upper-secondary education and the number of students who were enrolled in the final year of lower-secondary education (one year before). This variable seeks, therefore, to measure the proportion of final-year *ESO* students who stay on at school and study the *Bachillerato*. We also consider a *survival rate* which includes both those pupils that enrol in *Bachillerato* and those that enrol on Vocational Training Cycles upon completion of *ESO*. Both measures of the *survival rate* include pupils in public and private schools. This is done for two reasons: first, because we can expect decentralization to affect education outcomes in private schools too, since state-assisted schools are also included in this group<sup>2</sup>. Second, if we restrict the measurement of the *survival rate* to public schools, the variable will be affected by pupils transferring from private schools on completing compulsory education. Indeed, compulsory education is subsidised in most private schools (with the state paying a large part of the costs); however, this is not the case for non-compulsory education, and so some parents choose to transfer their children from the private to the public sector at this juncture. These circumstances will tend to lead to an overstating of the proportion of students who enrol in upper-secondary education after finishing compulsory education in public schools. However, we can also assume that the greater the number of pupils transferring from private schools, the better the quality of public education must be, as otherwise these

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<sup>2</sup> We verify this by estimating the effects of decentralization for public and private schools separately.

students would have preferred to stay in the private sector. Thus, an increase in the *survival rate* caused by this flux of students from the private to the public sector may be interpreted as an indication of an improvement in the quality of education in public schools.

The data describing the number of pupils enrolled in each course were obtained from the Education Annuals published by the *National Statistics Institute* until 1985 and by the *Ministry of Education and Science* for all years after that date. The same annuals provide information on the number of teachers in secondary education, which is used to compute the *pupil/teacher ratio*. Thus, the *pupil/teacher ratio* variable is an average of the number of pupils per teacher in lower-secondary education, upper-secondary education and vocational training programmes, since it is not possible to obtain more disaggregated data.

The *per capita income* series, measured in thousands of euros at 1990, is constructed from data published by the *Fundación BBVA* (period 1978-1986) and from the *Regional Accounts* published by the *National Statistics Institute* (period 1986-2005). The *schooling* variable, defined as the percentage of the working population holding a university degree, was calculated from the human capital series published by the *Instituto Valenciano de Investigaciones Económicas* (IVIE) and the *Fundación BBVA*. The *unemployment rate* that we use to obtain the results presented in this paper is the overall unemployment rate, although we obtain similar results with alternative measures of this statistic. These data are also obtained from the human capital series published by the *Instituto Valenciano de Investigaciones Económicas* (IVIE) and the *Fundación BBVA*.

Finally, the *decentralization dummy* was constructed from the legislative acts providing for the transfer of educational powers from the central to the regional governments, and published in the *Boletín Oficial del Estado* (BOE). It takes a value of 1 if province  $i$  lies in a decentralized Autonomous Community in year  $t$ , and 0 otherwise. Alternatively, we define a series of program indicators  $d_{ji}$ , which take a value of 1 if province  $i$  in time  $t$  has been in the program exactly  $j$  years (and zero otherwise) when  $j = 1, 2, \dots, (J-1)$ , and a value of 1 if province  $i$  in time  $t$  has been in the program  $j$  or more years (and zero otherwise) when  $j = J$ . In this way, we obtain a more flexible specification, which allows us to consider the possibility that the effects of decentralization on the *survival rate* depend on the number of years since

decentralization of competences took place. Finally, we also define separate indicators for the regions that were decentralized during the eighties and the regions that were decentralized during the nineties. Given the different context in which educational powers were devolved to these two groups of regions, and the differing levels of experience of the governments on receiving them, we can expect the effects of the decentralization policy to be different.

## **6. Results**

### **6.1. Analysis of differences between regions before decentralization**

One of the main features of the Spanish process of decentralization has been the asymmetrical manner in which it has been conducted. While provinces with common historic, cultural and economic characteristics, islands and provinces with a historic regional status were able to accede to all the educational powers not specifically assigned to the central government in the Constitution at the beginning of the eighties, the other autonomous regions had to wait until the end of the nineties to receive the same powers. This feature of the decentralization process allows us to estimate the effect of decentralization on educational attainment by using the autonomous communities that are not decentralized as a comparison group for the regions that are decentralized in each time period. However, in order to ensure the consistent estimation, we need to control for any observable or non-observable variables that might have differed between the treated and the comparison group before decentralization, and which might also influence the evolution in educational outcomes. Although we do not expect such differences to exist in Spain, since the pathway taken by the decentralization process was decided on the basis of historical characteristics of the regions, we use the *differences-in-differences* estimation method, which accounts for any unobservable characteristics of the regions which may determine both student outcomes and the desire of regional governments to be granted powers in the field of education. Thus, we only need to analyse if, before the decentralization process started, there existed differences in the observable characteristics of the regions which may determine their educational attainment. If there are no differences, as we would expect, the group of regions that were decentralized in the eighties will be statistically

equivalent to the group of regions decentralized in the nineties in all dimensions except their treatment status, and we can use the *differences-in-differences* method to estimate the effect of decentralization. If there are differences in the observable characteristics of the regions, we only need to include them in the regression in order to identify the parameter of interest, thus obtaining the *generalized differences-in-differences* or *linear-matching differences-in-differences* estimator.

In Table 2 we compare the characteristics of the two groups of regions that might influence the evolution in their educational outcomes, before the decentralization process was set in motion, i.e. for the year 1980. As expected, no statistically significant differences can be appreciated for any of the variables being compared. Thus, we can conclude that the determinants of educational attainment did not influence inclusion in the decentralization process in Spain. As a consequence, we can consistently estimate the effects of decentralization without including any control variables in the regression, that is, by using the *differences-in-differences* estimation method.

## 6.2. Regression analysis

In what follows we present the *differences-in-differences* estimator of the effects of decentralization on educational attainment in Spain. Since the decentralization process in Spain began at the start of the eighties and terminated at the end of the nineties, we use a panel data set comprising the 50 provinces of Spain for the period 1978-2005. In this way, we include observations both before and after decentralization, as is required when applying the *differences-in-differences* estimation method. Educational attainment is measured using two alternative variables. Both variables are measures of the *survival rate*, defined as the ratio between the number of pupils that enrol in upper-secondary (non-compulsory) education and those that were enrolled in the final year of lower-secondary (compulsory) education one year before. The only difference in the two variables is that one does not include those pupils that enrolled on vocational training programmes upon completion of their compulsory education (labelled in the tables of results as “Without VT”), while the other variable does (labelled as “With VT”). Decentralization is measured with the *decentralization dummy* variable as defined above, which takes the value of 1 when the province  $i$  is in a decentralized autonomous region at time  $t$  and 0 otherwise.

Table 3 shows the results we obtained from this analysis. As can be seen in column 1, the effect of decentralization on the *survival rate* “without VT” is positive and significant. Thus, according to these results, the decentralization process increased the *survival rate* in a province by an average of more than 1.6 percent. However, when the *survival rate* measure includes pupils that enrolled on vocational training programmes after finishing compulsory education (column 2), decentralization appears as a non significant factor in explaining educational attainment.

However, we should bear in mind that this is an average impact across regions, while decentralization would have had heterogeneous effects. Since the regions of Spain are highly heterogeneous in terms of some of their characteristics, a reform that has a positive effect in one region might well have the opposite effect in another region. Although we cannot identify the effects of the treatment on every region  $i$ , in columns 3 and 4 we do analyse whether the effects of decentralization depend on the *per capita income* and the *per capita public revenues* of the regions<sup>3</sup>, by including interaction terms between the decentralization dummy and these two variables. Given the previous evidence reported on this issue (Galiani and Schargrodsky, 2001; Galiani, Gertler and Schargrodsky, 2008; Barankay and Lockwood, 2007), we would expect the effects of decentralization to be greater in the richer regions. Effectively, when vocational training pupils are not included in the *survival rate* (column 3), the coefficient on the interaction term between the *decentralization* and the *per capita income* variables is positive and significant, although the *decentralization dummy* coefficient is no longer significant. Thus, if we suppose that the *per capita income* in a region is 12.83 thousands of euros (as in Madrid in 2000, when it received its educational powers), the effect of decentralization would be to increase the *survival rate* by 3.32 percent. However, if the per capita income in a region is 7.48 thousands of euros (as in Extremadura in 2000, when it received its education powers), the effect of decentralizing the education policy would be to increase the *survival rate* by 1.93 percent. By contrast, in column 4, where the *survival rate* measure also includes vocational training pupils, the interaction term between per capita income and decentralization does not show a significant effect. Rather, the decentralization variable coefficient now presents a negative sign and it is

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<sup>3</sup> The amount of *public revenues* at the disposal of the regional governments includes tax revenues and central government transfers (excepting transfers for specific services others than education). In the case of Pais Vasco and Navarra, which have a different funding system, public revenues are obtained as the difference between tax revenues and the transfers to the central government (data from BADESPE).

significant. As discussed above, vocational training programmes are not as attractive to the population as the general programmes are. Thus, these results appear to show how regional governments respond to public preferences, by trying to increase enrolment rates on general programmes, while in all probability neglecting vocational training programmes. Finally, our results show that the effects of decentralization do not vary with the level of a region's public revenues.

### 6.3. Alternative measures of decentralization

Although by using the decentralization dummy variable we can consistently estimate the ATET, a more flexible specification can be obtained by replacing the dummy variable with a series of indicators  $d_{jit}$ , which take a value of 1 if province  $i$  in time  $t$  has been in the program exactly  $j$  years (and zero otherwise) when  $j = 1, 2, \dots, (J - 1)$ , and a value of 1 if province  $i$  in time  $t$  has been in the program  $j$  or more years (and zero otherwise) when  $j = J$ . In this way, we allow the effects of decentralization to depend on the number of years that have passed since measures of decentralization were introduced in each region. Table 4 presents our results when we estimate this specification in columns 1 and 2. In column 1 we can observe that in the first year in which decentralization is initiated (*year of decentralization*), there is an increase in the *survival rate without VT* of more than 1.6 percent, an effect that is also captured by the single dummy variable (Table 3). However, it is also observed that decentralization now has an increasing positive impact on the *survival rate* measure in the years that follow. This means that, although decentralization has a positive impact on the *survival rate without VT* from the first year in which it is set in motion, the effect increases as the regional governments have time to implement various measures that can improve educational attainment or as the impact of these measures makes itself felt on the *survival rate*.

A further result of interest, and one that is captured by this table, is the fact that when using this more flexible specification we also appreciate a negative impact of decentralization on the *survival rate* that includes pupils who enrol on vocational training programmes upon completion of compulsory education. Since these negative effects appear after the first year of decentralization, they are not captured by the single dummy variable. However, we can see that the negative coefficients of the

decentralization indicators diminish in absolute value with the passing of the years, and are only significant in the two years immediately following decentralization.

Given these results, we can conclude again that the decentralization policy has had a positive effect on the proportion of pupils that enrol in *Bachillerato* upon completion of lower-secondary education. As we have seen, incrementing this rate is one of the main challenges currently facing the Spanish education system, so that it might in turn increment its upper-secondary graduation rates, which remain relatively low when compared internationally. However, the negative impact of decentralization on the *survival rate* that includes pupils on vocational training programmes (at least during the first few years) is not so encouraging. This result would seem to reflect two factors. On the one hand, it might be the case that following decentralization regional governments decided to introduce stricter rules within the educational system. Although such measures seem to have achieved the objective of increasing the proportion of pupils that enrol in *Bachillerato* upon completion of compulsory education, it is possible that, at the same time, pupils that otherwise would have enrolled on vocational training programmes have been unable to obtain the lower-secondary education certificate. On the other hand, these results might reflect a better match between public preferences and education policy. Since vocational training programmes are generally less attractive to pupils than the general educational programmes, regional governments might have concentrated their efforts and resources on improving the latter programmes, which at the same time could have had a negative impact on enrolment in vocational training programmes during the first few years of decentralization.

Up to this juncture, we have analysed the combined effects of decentralization in those regions that received decentralized powers at the beginning of the eighties and those that received these competences at the end of the nineties. A more detailed insight of the effects of decentralization can be obtained by analysing the effects on the two groups of regions separately, since they are not necessarily the same: first, because at the beginning of the eighties the autonomous regions had just been created, while at the end of the nineties the regional governments had acquired almost twenty years of operational experience; and second, because the social, economic and financial contexts were very different in the two periods. To do this, we created two new sets of indicators,  $Treated_{80_{jii}}$  and  $Treated_{90_{jii}}$ , which identify decentralization in the two groups of regions separately. We present the results of using separate indicators for each group in



columns 3 to 6 of Table 4. As expected, the estimated effects of decentralization differed between the two groups of regions. First, while in regions that were decentralized at the beginning of the eighties the process recorded its full impact on the *survival rate without VT* during the year of decentralization, in regions that were decentralized at the end of the nineties the effects of decentralization were not significant until three years after decentralization. However, from this moment the impact of decentralization was increasingly positive. A possible explanation for this difference is that, when at the beginning of the eighties the regions received their educational competences reform was urgently needed, such reforms were not so obvious at the end of the nineties. Thus, changes were only introduced later or, it might be the case that their effects took longer to be noticed. Whatever the explanation, the effects appear to be more significant at the end of the nineties, perhaps reflecting the greater experience acquired by regional governments in the intervening decade. Second, the negative impact of decentralisation on the *survival rate with VT* students was recorded only at the end of the nineties, and was not significant at the beginning of the eighties. This negative effect, however, only remained significant in the three years following decentralization, and disappeared in the fourth year.

Thus, what can be concluded from these results is that, at the beginning of the eighties, decentralization only had a positive effect on the *survival rate without VT*, and that this was felt immediately during the first year of decentralization. By contrast, at the end of the nineties, decentralization had a negative impact on the proportion of pupils that enrolled in vocational training programmes. However, three years after decentralization this negative impact started to be offset by the positive impact on the proportion of pupils that were enrolling in *Bachillerato*, and after four years the impact had been fully countered, so that the overall effect was not significant.

#### 6.4. Regression analysis by sex and by type of institution

Up to this juncture, we have analysed public and private schools together, and we have not distinguished between male and female students. One reason for this analysis is that private schools include Spain's state-assisted schools, which as such are also affected by government education policies. A second reason was to avoid the measurement problem that the transfer of pupils between public and private schools could cause for our outcome variable. However, it is interesting to analyse the effects of

decentralization separately for both public and private schools and for male and female students. In this way, we should be able to determine whether decentralization has had any impact on the *survival rate* in private schools. Likewise, as we can interpret any increase in the *survival rate* in public schools (because of pupils transferring from private schools) as a sign of an improvement in the quality of public education quality, it is also interesting to conduct the analysis for public schools separately. Similarly, it is interesting to see if male and female students respond distinctly to a policy change such as those ushered in by decentralization. These results are summarised in Table 5. Panel A shows the results when the dependent variable is the *male survival rate*, and Panel B the results when the dependent variable is the *female survival rate*. In columns 1 and 2 we include all schools (public and private), while in columns 3 and 4 only public schools are included. The effect of decentralization on the *survival rate* in private schools is not shown because it is always non significant. Thus, despite the fact that most private schools are publicly funded, the decentralization process in Spain had no effect on their survival rate. However, this is not the same as saying that it had no effect on educational attainment in private schools, just that the proportion of students who stayed on at private schools to study upper-secondary education did not change. However, it is still possible that decentralization increased the proportion of pupils that enrolled in upper secondary education in public schools after completing their compulsory education in private schools.

The main result of note contained in this table is that decentralization had a positive impact both on male and female survival rates not including VT pupils, although the speed with which this impact was felt varied. However, when vocational training pupils are included in the survival rate measure, we see that decentralization only affected the male survival rate.

## **7. Robustness analysis**

In this section we run a number of additional regressions in order to show the robustness of the results presented above. First, we estimate the *linear matching differences-in-differences* specification of the outcomes equation, i.e., we include in our regression function the control variables considered above as possible determinants of educational attainment:

$$Y_{it} = \Phi_i + \theta_t + d_{it}\alpha + X_{it}\beta + \varepsilon_{it} \quad (6)$$

where  $X_{it}$  is the matrix of control variables, which also includes the lagged dependent variable. In this way, we can corroborate that the inclusion or otherwise of these variables does not affect the estimated impact of decentralization on the *survival rate*. As explained in greater detail above, this is because inclusion within the decentralization process did not depend on these variables, so that their omission in the outcomes equation does not affect the estimated decentralization parameter. However, we do need to take into account that the inclusion of the lagged dependent variable in the regression analysis introduces a source of endogeneity into our equation. In order to solve this problem, we instrument the lagged dependent variable after differencing equation (6), using as an instrument the second lag of the dependent variable, as suggested by Anderson and Hsiao (1982). As before, we compute robust variance estimates and conduct our estimations by clustering the error term by autonomous communities.

Finally, we estimate the so called *random trend model* specification. The main advantage of this alternative specification is that each region is allowed to have its own time trend, which allows us to relax the more restrictive assumption of the *differences-in-differences* model of common macroeconomic effects. Thus, the outcome equation to be estimated in this case is:

$$Y_{it} = \Phi_i + \theta_t + \psi_i t + d_{it}\alpha + \varepsilon_{it} \quad (7)$$

The results of these analyses are presented in Table 6. If we look at columns 1, 3 and 5, we can see that our results for the effects of decentralization on the *survival rate without VT* are robust. We find that decentralization had a positive and significant effect on the *survival rate without VT* independently of the specification that we use. In column 5, where we also included the interaction terms, we observe that the richer the region is, the greater the effects of decentralization are. We can see that both the *differences-in-differences* specification (Table 3) and the *linear matching with differences-in-differences* specification (Table 6, column 1) present exactly the same value of the parameter of the decentralization variable. Rather, the specification that allows for specific regional time trends provides us with a slightly higher parameter

value. However, as pointed out by Heckman and Hotz (1989), we should not expect exactly the same estimated parameter from alternative non-experimental methods, since they are based on different assumptions regarding the distribution of the differences between regions. Thus, the key point here is that alternative methods lead us to the same conclusions regarding the benefits of decentralization.

Similarly, the effects of decentralization on the *survival rate with VT* that we obtain with these alternative specifications are the same as those recorded before. In columns 2, 4 and 6 of Table 6 we see that, while the single dummy variable is unable to capture the negative impact of decentralization in either the *random trend model* or the *linear matching with differences-in-differences*, it does do so when the interaction terms are included in the regression. Thus, although we do not obtain significant effects in some specifications, the results seem to point to the conclusion that decentralization had a negative impact on the *survival rate* measure which includes vocational training pupils. However, the results are not as clear in the case of the *survival rate* measure which does not include VT pupils.

We can observe the impact of school inputs on the *survival rate* in columns 1 and 2. As we can see, the coefficient of the *per capita income* variable is positive and significant, as we would expect if we take into account the previous evidence reported in this field. However, the *pupil/teacher ratio*, the *schooling* variable, the *unemployment rate* and the first lag of the dependent variable are not significant. Although these results seem to confirm previous evidence as to which inputs matter when explaining educational outcomes, caution should be exercised before drawing any definitive conclusions. It should be borne in mind that the coefficients of the input variables would be biased if other inputs, correlated with those that were included, had been omitted. Given the difficulty of specifying an outcome equation which includes all relevant family and school inputs, we should not rule out the possible existence of omitted variables. Further, other endogeneity problems might serve to bias the coefficients of these variables. However, we are confident that the omission of input variables or their endogeneity does not affect the estimator of the effect of decentralization, i.e., the one which concerns us here.

## 8. Conclusions

The effects of decentralization on the productive efficiency of government remain unclear in the theoretical literature, which tends to emphasise the trade-offs between potential benefits and drawbacks. However, until recently, very few empirical studies had attempted to examine these trade-offs. At a time when decentralization policies are on the agenda of many countries and figure among the main recommendations emanating from international organizations, we considered it timely to offer some insights into this problem. Specifically, we have focused on the impact of decentralization on educational outcomes in Spain, although a similar analysis could be extended to other areas of public policy.

As we have seen, the decentralization process in education started at the beginning of the eighties, when educational powers were devolved to Cataluña, País Vasco, Galicia, Andalucía, Comunidad Valenciana and Canarias. The fact that the other autonomous regions had to wait until the end of the nineties to receive the same powers enables us to use these non-decentralized regions as the control group and so estimate the effects of decentralization. Although it is our belief that the selection process was not influenced by regional characteristics, which in turn might also have influenced the evolution of educational outcomes, we use the *differences-in-differences* method to estimate the effects of decentralization. In this way, we are able to control not only for the temporary shocks that affect the outcomes of all regions equally (such as central government reform), but also for the non-observable characteristics of the regions that may influence the evolution of their educational outcomes and which could result in differences between the treatment and comparison group before decentralization.

According to our analysis, decentralization in Spain increased the *survival rate* (when pupils enrolled on vocational training programmes are not included) by more than 1.6 percent on average. When we allow the effects to differ in accordance with the observable characteristics of the regions, we see that this effect increases with the per capita income of the region - the difference in the effect on rich and poor regions being more than one percent. However, decentralization had a negative or non-significant impact on the *survival rate* when vocational training pupils were included. This result appears to be attributable to the fact that less attention has traditionally been dedicated to vocational training programmes in Spain. While it is true that in recent years politicians have shown more concern for vocational training programmes, in response to

increasing evidence regarding the shortfall in the number of skilled workers in the Spanish labour market, this was not the case during the period analysed. These results might be interpreted as evidence of the better match between the preferences of the public and educational policies under a decentralized system, since vocational training programmes in Spain remain comparatively unattractive.

When the effects of decentralisation are allowed to depend on the number of years that have transpired since the devolution of powers to region and on the specific wave of decentralization, we obtain a broader view of how these effects worked. The main conclusion we draw is that the effects of decentralization were greater at the end of the nineties than at the beginning of the eighties, which may in part reflect the experience acquired by autonomous governments in the implementation of their educational competences. Moreover, although the effects take longer to be noticed at the end of the nineties, they are increasing over time. We also observe that the negative impact of decentralization on the survival rate when VT students were included only occurred at the end of the nineties, and was seen to disappear after three years under a decentralised system.

Our analysis of the effects of decentralization by institutional type showed that educational outcomes were only affected in the case of public schools, despite the fact that most private schools in Spain are publicly funded. However, this does not mean that the decentralization process had no effect on educational attainment in private schools, just that the proportion of students who remained in these institutions to study upper secondary education did not alter. Thus, it would be interesting to analyze whether decentralization had an impact on other measures of educational attainment in lower secondary education in private schools.

When analysing the effects of decentralization by sex, we found that devolution had a positive impact both on male and on female survival rates when vocational training pupils were not included. However, when vocational training pupils were included in the survival rate measure, we found that decentralization only affected the *male survival rate*.

Finally, in the last section we were able to corroborate the robustness of our results by using two alternative models that enabled us to relax some of the assumptions needed for the *differences-in-differences* estimator to be consistent. We first estimated the *linear matching with differences-in-differences* model, which involved adding the variables that are considered as being the determinants of educational attainment to our

previous specification. Second, we specified a *random trend model* thereby relaxing the hypothesis that the regions respond in the same way to a macroeconomic shock. Both specifications allow us to corroborate the conclusions outlined above, namely, that the decentralization process in Spain has had a positive impact on the *survival rate without VT*, and that the richer the region, the more marked this effect was.

## 9. References

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Table 1. Statutes of Autonomy and educational transfer decrees

Autonomous Community	Statutes of Autonomy Constitutional Laws	Educational transfers decrees
Andalucía	6/1981	3936/1982
Aragón	8/1982	1982/1998
Asturias	7/1981	2081/1999
Baleares	2/1983	1876/1997
Canarias	10/1982	2091/1983
Cantabria	8/1981	2671/1998
Castilla y León	4/1983	1340/1999
Castilla La Mancha	9/1982	1844/1999
Cataluña	4/1979	2809/1980
Extremadura	1/1983	1801/1999
Galicia	1/1981	1763/1982
Madrid	3/1983	926/1999
Murcia	4/1982	938/1999
Navarra	13/1982	1070/1990
País Vasco	3/1979	2808/1980
La Rioja	3/1982	1826/1998
C. Valenciana	5/1982	2093/1983

Source: *Boletín Oficial del Estado (BOE)*

Table 2. Analysis of differences between treated and comparison regions in 1980.

Variables	<i>Treated Group</i>		<i>Comparison Group</i>		<i>Difference</i>
	Mean	Std. Dev.	Mean	Std. Dev.	
<i>Survival rate without VT (Public schools)</i>	74.79	5.41	74.45	5.86	-0.33
<i>Survival rate without VT (Private schools)</i>	76.63	5.55	77.01	8.58	0.37
<i>Survival rate without VT (All schools)</i>	75.48	4.01	75.51	4.45	0.02
<i>Survival rate with VT (Public schools)</i>	72.36	5.64	73.84	9.93	1.48
<i>Survival rate with VT (Private schools)</i>	52.04	12.53	55.91	11.11	3.86
<i>Survival rate with VT (All schools)</i>	64.88	2.82	66.62	5.02	1.74
<i>Pupil-teacher ratio (Public schools)</i>	16.91	1.16	16.88	1.14	-0.04
<i>Pupil-teacher ratio (Private schools)</i>	14.99	2.82	14.34	1.81	-0.65
<i>Pupil-teacher ratio (All schools)</i>	16.29	1.23	15.93	0.97	-0.36
<i>Per capita income</i>	4.58	0.76	4.46	0.80	-0.12
<i>Schooling</i>	6.36	1.57	6.91	1.72	0.55
<i>Unemployment rate</i>	11.04	5.48	9.04	3.18	-1.99

Note: In the treated group we include Cataluña, País Vasco, Galicia, Andalucía, Valencia and Canarias, while the remaining communities are included in the comparison group. The column labelled 'difference' records the difference in mean between the treated and the comparison group for each variable. We conducted a t-test on the equality of means; \*, \*\* and \*\*\* indicate that the difference is significant at the 90, 95 and 99% levels, respectively.

Table 3. Regression analysis

	<i>Differences-in-differences</i>		<i>Differences-in-differences with interaction terms</i>	
	<i>Without VT</i>	<i>With VT</i>	<i>Without VT</i>	<i>With VT</i>
	(1)	(2)	(3)	(4)
Decentralization dummy	1.652 (0.60)**	-0.850 (0.72)	0.109 (0.99)	-1.959 (0.96)*
Decent. x income			0.373 (0.18)*	0.336 (0.23)
Decent. x public revenues			-0.845 (0.72)	-1.203 (1.76)
Temporal Fixed Effects	Yes	Yes	Yes	Yes
R-squared	0.227	0.258	0.228	0.259
Number of observations	1350	1350	1350	1350

Note: \*, \*\* and \*\*\* indicate that the coefficient is significant at the 90, 95 and 99% levels, respectively. We estimate equation (2) in first differences, by pooled OLS. Our data base is a panel data set which includes the 50 provinces of Spain for the period 1978-2005. The dependent variable is the *survival rate*, “without VT” when it does not includes pupils that enrol on vocational training programmes upon completion of their compulsory education, and “with VT” when these pupils are included. The decentralization variable is defined with a dummy which takes the values 1, when the province  $i$  is in a decentralized autonomous region at time  $t$ , and 0 otherwise. Control variables are not included in the regression, so that the estimated effect corresponds to the *differences-in-differences* estimator of the Average Treatment Effect on the Treated (ATET). Temporal Fixed Effects are included in all the specifications; “Yes” means that they are jointly significant, and “No” means that they are not significant. The error terms are clustered at the Autonomous Community level and the variance covariance matrix estimate is robust.

Table 4. Alternative measures of decentralization

	<i>1 set of indicators</i>		<i>2 set of indicators</i>			
	$d_{jit}$		$Treated_{80_{jit}}$		$Treated_{90_{jit}}$	
	<i>Without VT</i>	<i>With VT</i>	<i>Without VT</i>	<i>With VT</i>	<i>Without VT</i>	<i>With VT</i>
	(1)	(2)	(3)	(4)	(5)	(6)
Year of decentralization	1.643 (0.58)**	-0.958 (0.71)	2.006 (0.96)*	0.003 (0.82)	1.268 (0.83)	-2.005 (1.59)
1 year after decent.	1.320 (0.62)**	-2.156 (0.89)**	1.190 (1.29)	-0.296 (1.09)	1.326 (1.23)	-4.312 (1.57)**
2 years after decent.	1.603 (0.80)*	-2.354 (1.06)**	1.758 (1.16)	0.068 (1.19)	1.373 (1.24)	-5.162 (2.00)**
3 years after decent.	1.906 (1.32)	-1.773 (1.15)	1.199 (2.20)	0.630 (1.54)	2.673 (0.92)**	-4.324 (2.38)*
4 years after decent.	2.347 (0.91)**	-1.571 (1.05)	0.536 (1.22)	-0.876 (1.84)	4.290 (1.19)***	-2.277 (2.75)
5 years after decent.	2.965 (1.09)**	-0.321 (1.01)	1.963 (1.35)	1.342 (1.93)	4.086 (1.42)**	-1.902 (2.78)
Temporal Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.228	0.262	0.233	0.271	0.233	0.271
Number of observations	1350	1350	1350	1350	1350	1350

Note: \*, \*\* and \*\*\* indicate that the coefficient is significant at the 90, 95 and 99% levels, respectively. We estimate equation (2) in first differences, by pooled OLS. Our data base is a panel data set which includes the 50 provinces of Spain for the period 1978-2005. The dependent variable is the *survival rate*, “without VT” when it does not include pupils that enrol on vocational training programmes upon completion of their compulsory education, and “with VT” when these pupils are included. The decentralization is measured with a set of  $J$  indicators in columns 1 and 2, which take the values 1 when a region has been decentralized exactly  $j$  years before if  $j=1,2,\dots,J-1$ , or when a region has been decentralized  $j$  or more years before if  $j=J$ ; in columns 3 to 6 decentralization is measured with two sets of dummies which distinguish between regions that were decentralized at the beginning of the eighties and the regions that were decentralized at the end of the nineties. Control variables are not included in the regression. Temporal Fixed Effects are included in all the specifications; “Yes” means that they are jointly significant, and “No” means that they are not significant. The error terms are clustered at the Autonomous Community level and the variance covariance matrix estimate is robust.

Table 5. Effects of decentralization by sex and by type of institution

	<i>All Schools</i>		<i>Public Schools</i>	
	<i>Without VT</i>	<i>With VT</i>	<i>Without VT</i>	<i>With VT</i>
	(1)	(2)	(3)	(4)
<i>Panel A. Male survival rate</i>				
Year of decentralization	1.825 (1.16)	-1.322 (1.21)	1.816 (1.04)*	-2.765 (1.41)*
1 year after decent.	1.482 (1.03)	-2.383 (1.47)	2.013 (1.14)*	-3.275 (1.35)**
2 years after decent.	1.988 (1.49)	-2.763 (1.48)*	2.924 (1.78)	-3.536 (1.49)**
3 years after decent.	1.786 (1.82)	-1.490 (1.20)	2.716 (2.45)	-2.485 (2.41)
4 years after decent.	2.946 (1.23)**	-1.511 (1.24)	4.558 (1.56)**	-2.498 (1.94)
5 years after decent.	1.773 (1.59)	-1.485 (1.44)	2.085 (1.90)	-2.794 (1.57)*
<i>Panel B. Female survival rate</i>				
Year of decentralization	1.483 (0.49)***	-0.491 (0.91)	0.914 (0.78)	-1.526 (1.56)
1 year after decent.	1.181 (0.70)	-1.918 (1.11)	1.542 (1.06)	-2.254 (1.73)
2 years after decent.	1.340 (0.67)*	-1.872 (1.37)	2.431 (1.08)**	-1.495 (2.01)
3 years after decent.	1.954 (1.27)	-1.983 (1.49)	3.216 (1.72)*	-1.363 (2.78)
4 years after decent.	1.936 (1.09)*	-1.499 (1.50)	3.347 (1.45)**	-2.381 (1.95)
5 years after decent.	4.106 (1.65)**	1.061 (1.93)	5.561 (2.14)**	1.048 (2.58)

Note: \*, \*\* and \*\*\* indicate that the coefficient is significant at the 90, 95 and 99% levels, respectively. We estimate equation (2) in first differences, by pooled OLS. Our data base is a panel data set which includes the 50 provinces of Spain for the period 1978-2005. The dependent variable is the *male survival rate* in Panel A and the *female survival rate* in Panel B. In columns 1 and 2 we compute the survival rate in all schools (public and private), “without VT” when it does not includes pupils that enrol on vocational training programmes upon completion of their compulsory education, and “with VT” when these pupils are included; and in columns 3 and 4 the survival rate in public schools, also “without VT” and “with VT”. The decentralization is measured with a set of J indicators in columns 1 and 2, which take the values 1 when a region has been decentralized exactly  $j$  years before if  $j=1,2,\dots,J-1$ , or when a region has been decentralized  $j$  or more years before if  $j=J$ ; in columns 3 to 6 decentralization is measured with two sets of dummies which distinguish between regions that were decentralized at the beginning of the eighties and the regions that were decentralized at the end of the nineties. Control variables are not included in the regression. Temporal and Regional Fixed Effects are included in all the specifications; “Yes” means that they are jointly significant, and “No” means that they are not significant. The error terms are clustered at the Autonomous Community level and the variance covariance matrix estimate is robust.

Table 6. Robustness analysis.

	<i>Linear Matching differences-in-differences</i>		<i>Random Trend Model</i>		<i>Random Trend Model with interaction terms</i>	
	<i>Without VT</i>	<i>With VT</i>	<i>Without VT</i>	<i>With VT</i>	<i>Without VT</i>	<i>With VT</i>
	(1)	(2)	(3)	(4)	(5)	(6)
Decentralization dummy	1.652 (0.58)**	-0.830 (0.72)	2.127 (0.75)**	-0.349 (0.82)	0.263 (1.26)	-2.225 (1.17)*
Decent. x income					0.499 (0.22)**	0.353 (0.38)
Decent. x public revenues					-1.433 (0.87)	-0.167 (2.20)
Survival rate (-1)	-0.060 (0.09)	-0.095 (0.11)				
Pupils per teacher ratio	0.198 (0.20)	0.253 (0.16)				
Income	0.547 (0.18)***	0.396 (0.20)*				
Schooling	0.076 (0.08)	-0.082 (0.12)				
Unemployment rate	0.001 (0.05)	-0.021 (0.04)				
Temporal Fixed Effects	Yes	Yes	-	-	-	-
Regional Time Trends	-	-	Yes	Yes	Yes	Yes
R-squared	-	-	0.162	0.153	0.164	0.154
Number of observations	1250	1250	1300	1300	1300	1300

Note: \*, \*\* and \*\*\* indicate that the coefficient is significant at the 90, 95 and 99% levels, respectively. In columns 1 and 2 we estimate equation (6). Since the control variables include the lagged dependent variable we use the instrumental variables approach to estimate the effect of decentralization on the differenced equation, using the second lag of the dependent variable in levels as instrument. In columns 3 to 6 we estimate equation (7) after differencing it two times, by pooled OLS. Our data base is a panel data set which includes the 50 provinces of Spain for the period 1978-2005. The dependent variable is the *survival rate*, “without VT” when it does not include pupils that enrol on vocational training programmes upon completion of their compulsory education, and “with VT” when these pupils are included. The decentralization variable is defined with a dummy which takes the values 1, when the province  $i$  is in a decentralized autonomous region at time  $t$ , and 0 otherwise. Temporal and Regional Fixed Effects are included in all the specifications; “Yes” means that they are jointly significant, and “No” means that they are not significant. The error terms are clustered at the Autonomous Community level and the variance covariance matrix estimate is robust.