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REVENUE DECENTRALISATION AND ECONOMIC GROWTH IN THE SPANISH AUTONOMOUS COMMUNITIES

Ramiro Gil-Serrate and Julio López-Laborda

ABSTRACT: This paper is an empirical sequel to our previous theoretical analysis of the relationship between tax decentralisation and economic growth. Taking such theoretical work as a point of departure, we ask whether the process of revenue decentralisation from central to regional governments experienced by the Spanish economy during the period 1984-1995 supports our main findings. In addition, following recent analytical considerations for fiscal decentralisation measurement three different revenue decentralisation indicators for the Spanish case are proposed. According with the results, we might conclude that revenue control decentralisation to regional levels of government in Spain has generated a positive effect on regional economic growth during the period considered.

Keywords: revenue control decentralisation; regional growth; Spanish Autonomous Communities

JEL classification: H77; O40; R11

1. INTRODUCTION

Studies of the possible relationship between fiscal decentralisation processes and economic growth opened up a new line of research in the latter half of the 1990's. This was built upon a much wider academic foundation, concerned with the relationships between fiscal decentralisation and a series of economic and political goals, and based on the seminal work of Tiebout (1956), Stigler (1957), Musgrave (1959) and Oates (1972). In addition to economic growth *per se*, these goals included public spending efficiency, horizontal fiscal equity, controlling the size of government, macroeconomic stability, creating appropriate conditions for governments and markets to operate effectively and the reduction of poverty.

The main spur to the development of this new line of research has been the process of devolution of power from central to lower tiers of government, a trend occurring mainly in transitional and developing economies, with the encouragement of various international bodies, particularly the World Bank. The intuition that these processes might not only affect the efficiency of public spending, horizontal fiscal equity and macroeconomic stability, comprising what might be called the traditional effects, but could also influence economic growth, has led researchers at this and other international institutions to analyse this possible relationship.

The emergence (or re-emergence) of debate on the subject of fiscal decentralisation in numerous developed economies in recent decades has, meanwhile, encouraged academic interest in this line of research. Consequently, the process is central to the study of such economies, with research focusing on the possible relationship to economic growth, one of the principal current academic concerns.

A detailed review of the state of research into the relationship between fiscal decentralisation and economic growth is contained in Martínez-Vázquez and McNab (2003), who draw attention to the paucity of empirical work in this area, which contrasts sharply with the profusion of informal literature on the economic consequences of fiscal decentralisation. They also draw a clear distinction between the direct and indirect relationships which fiscal decentralisation and economic growth display.

The direct relationship is clearly described in Oates (1993)¹, who transposes his basic proposition concerning the positive impact of fiscal decentralisation on economic efficiency to the dynamic sphere of economic growth (without supplying a formal analysis, however). The economic efficiency proposition was developed within a static framework in Oates' (1972) Decentralisation Theorem, and was further reinforced by the population mobility arguments propounded in Tiebout (1956); it is argued that regional and national economic growth could be increased if decisions concerning investment in different types of capital were taken by lower tiers of government, because of the greater local knowledge, political accountability and transparency existing at these levels.

With some exceptions, Oates' argument has been accepted as the starting point for the empirical and theoretical research, undertaken from the mid-1990s to date, which analyses the possible effects of fiscal decentralisation upon economic growth. Such studies include eminently empirical work aimed at quantifying these effects; some examples are Woller and Phillips (1998), Zhang and Zou (1998), Lin and Liu (2000), Yilmaz (2000), Thiessen (2000 and 2003), Akai and Sakata (2002), Desai *et al.* (2003), Rodríguez-Pose and Bwire (2004), Iimi (2005) and Jin and Zou (2005). Other papers attempt not only to quantify the such effects, but also to construct a simple analytical model reflecting the relationship existing between the two processes; see, from among the literature, Davoodi and Zou (1998), Xie *et al.* (1999), Zhang and Zou (2001), and Martínez-Vázquez and McNab (2002). Finally, the work of Zou (1996), Brueckner (1999 and 2005) and Gong and Zou (2002 and 2003), focuses exclusively, and therefore in greater detail, on the construction of the relevant analytic framework.

However, the results obtained by this series of studies are not conclusive. The various theoretical models developed regarding the relationship between fiscal decentralisation and economic growth usually offer, as their result, the existence of optimal levels of fiscal decentralisation (maximisers of economic growth) in excess of which the effects of decentralisation upon growth become negative. Such is the case of, among others, Davoodi and Zou (1998), Xie *et al.* (1999) and Zhang and Zou (2001);

¹ However, other researchers into fiscal federalism also describe its influence upon economic growth. See, for example, Bahl and Linn (1992), Rivlin (1992), Bird (1993) and Gramlich (1993).

by contrast, when this relationship is tested empirically, the result is rather less clear. In some cases, fiscal decentralisation is not significant -Woller y Phillips (1998)- while in others, when it is indeed significant and a test is performed of the potential non-linear relationship between decentralisation and growth, the coefficient estimated is not significant -Martínez-Vázquez and McNab (2002).

Furthermore, when a significant relationship is estimated between fiscal decentralisation and economic growth, highly disparate results are obtained. Thus, when analysing this relationship for a group of countries with developed or developing economies, a positive effect of the decentralisation of expenditure upon economic growth is observable -Yilmaz (2000) and Iimi (2005)-, which remains positive when the analysis is performed only for a set of economically developed countries -Thiessen (2003)-, but which becomes negative when the sample comprises developing countries -Davoodi and Zou (1998)². By contrast, research focused on one specific economy obtains a negative effect of the decentralisation of expenditure upon the economic growth of Germany in the four decades following the Second World War -Behnisch *et al.* (2002)-, and a positive effect of the decentralisation of expenditure, implemented in China from the 1980s onwards, upon economic expansion in the Chinese regions, -Jin *et al.*, (1999) and Qiao *et al.* (2002). In the case of the USA, a positive effect of expenditure decentralisation upon the economic growth of the constituent states also seems to have taken place in the first half of the 1990s -Akai and Sakata (2002). When a specific analysis is undertaken of the relationship between the decentralisation of revenue and economic growth, for groups of countries, no significant effect is obtained -Fukasaku and de Mello (1998)-, even when a distinction is made between developing economies -Woller and Phillips (1998)- and developed economies -Thiessen (2003). While for cases of individual countries a positive effect of decentralisation of revenue upon growth in Chinese regions is obtained -Lin and Liu (2000)-, in that of the Indian states -Zhang and Zou (2001)- and upon the recovery of industrial production of the Russian regions -Desai *et al.* (2003).

² This result supports the reasoning of Bahl and Linn (1992), which refers to the necessity of exceeding a certain threshold of development in order for fiscal decentralisation to provide positive effects upon economic growth.

Such diversity of results produced by research aimed at the empirical study of the relationship between fiscal decentralisation and economic growth may be due to the differing economic or time scenarios analysed in each case, but may also be affected by certain methodological problems, such as the correct specification of the equation to be estimated or the fiscal decentralisation indicators employed, according to Martínez-Vázquez and McNab (2003). Specifically, the fiscal decentralisation indicators which are normally utilised are the subcentral/total ratios of expenditure and revenue, compiled using data from the *Government Financial Statistics* (GFS) of the International Monetary Fund (IMF) or national statistical institutes. These indicators, although highly operative, in many cases do not provide adequate information regarding the degree of autonomy with respect to central control which such fiscal decentralisation represents for subcentral governments. That is to say, in line with Rodden (2004), they do not reflect the basis of the majority of the theoretical arguments which refer to the advantages produced by a process of fiscal decentralisation. This is, for example, the case of Oates (1993), when he proposes the fulfilment of his Decentralisation Theory of 1972 within the dynamic context of economic growth.

Recently, in response to this situation, several studies have been published -Ebel and Yilmaz (2002), Meloche *et al.* (2004) and Stegarescu (2005)- which, without abandoning the quantitative nature of the indicators, have proposed a more diligent employment of the data available for a series of countries. The essential idea is that it is important to take into account not only the volume of decentralised resources, but also the degree of control which subcentral governments exert over them; consequently, an important element of the theory of fiscal federalism would be captured and, as a result, the empirical analysis of decentralisation processes would become more accurate.

Moreover, as we have indicated in Gil-Serrate and López-Laborda (2005)³, within the literature concerning the relationship between fiscal decentralisation and economic growth, there can be discerned a greater interest in the analysis of that relationship with regard to the decentralisation of expenditure than with regard to the decentralisation of revenue, from not only the theoretical but also the empirical point of view. Consequently, we believe it is important to further the study of the relationship

³ A preliminary version of this study was presented to the 44th Congress of the European Regional Science Association held in Oporto, Portugal, in 2004.

between revenue decentralisation and economic growth; as a result, once we have proposed a theoretical link between a process of fiscal decentralisation taking place in a typical region and balanced per capita regional income in the long term in the study cited immediately above, we now turn to the empirical analysis of the relationship which may exist between the decentralisation of revenue and regional economic growth.

We shall perform this analysis for the case of Spanish regions and the period 1984-1995, employing the econometric approach of panel data. In order to do this we employ the theoretical model presented in Gil-Serrate and López-Laborda (2005), not in order to directly estimate it but rather to take into account the principal results obtained:

1. That for any level of decentralisation of expenditure, a greater decentralisation of revenue may positively affect economic growth.
2. That there exists, in certain circumstances, a relationship between a low productivity of public investment and a positive effect of the decentralisation of revenue upon economic growth, a relationship which would be channelled through private investment, as a consequence of the "flypaper effect".

Considering these results, in line with Martínez-Vázquez and McNab (2003), leads us to analyse not only the possible direct relationship between the decentralisation of revenue and regional economic growth, but also the indirect relationship which may exist between the two processes, via private investment. On this point, we agree with the (limited) previous studies which, analysing the indirect nature of such a relationship, have taken into account the possible effects that fiscal decentralisation may have upon those determinants of economic growth most widely recognised by the relevant literature, e.g. the work of Thiessen (2000 and 2003), with regard to investment and total factor productivity (TFP), and that of Martínez-Vázquez and McNab (2002), concerning macroeconomic stability, as represented by the rate of inflation.

In addition, on the basis of the idea (expressed above) that when constructing a fiscal decentralisation indicator it is necessary to take into account the degree of control which regional governments have over decentralised resources, we shall propose three indicators of decentralisation for the case of the decentralisation process which has

taken place in Spain since 1978. These indicators will be our variables of interest in the study of the potential relationship between the decentralisation of revenue and the economic growth of the Spanish regions.

Both the employment of revenue decentralisation indicators which reflect the differing degrees of control regional governments have upon that revenue and the demonstration of a possible indirect relationship between revenue decentralisation and economic growth, in the context of Spanish regions or Autonomous Communities (ACs), make important contributions to the scanty literature which exists regarding the empirical testing of the relationship between fiscal decentralisation and economic growth in Spanish regions. The two studies which have so far explored this relationship have estimated, firstly, direct positive and significant effects of the decentralisation of expenditure and revenue in the growth of the ACs for the period 1991-1996 (Carrión-i-Silvestre *et al.*, 2004) and, secondly, a non-significant direct relationship between the decentralisation of expenditure and revenue and the economic growth of the ACs, for a time period (1992-1999) very similar to that analysed in the previous study (Pérez and Cantarero, 2004). The use of such short time periods and the disparity of results makes it difficult to draw a conclusion regarding the existence and sign of the relationship between fiscal decentralisation and economic growth in Spanish regions.

The current study, of a slightly longer period (1984-1995), which tests the existence of a direct relationship between the decentralisation of revenue and the economic growth of Spanish regions, finds almost no evidence of such a link. It is also apparent that, if this relationship did in fact exist, the degree of control exerted by regional governments upon decentralised revenue would not play a significant role therein. Nevertheless, we do find a positive (indirect) effect of the decentralisation of revenue upon regional economic growth, through the positive influence of the former upon private (sector) investment, which in turn positively affects economic growth; with regard to this effect, the degree of control which regional governments have over their revenue is important.

Thus, the current study is structured as follows: in the first section we propose a set of indicators for the decentralisation of revenue, in the context of the process of Spanish fiscal decentralisation, which take into account the degree of control which

regional governments exert over such revenue. The following section describes both the econometric specification and the variables, which we shall use to test the relationship between the decentralisation of revenue and economic growth in Spanish ACs. The third section is concerned with econometric questions which are important for the performance of this test, and includes a discussion and interpretation of the principal results obtained; it also considers the empirical testing of the possible indirect relationship between the decentralisation of revenue and regional economic growth through private investment. The final section presents the principal conclusions reached by the study.

2. PROPOSAL OF A SERIES OF INDICATORS OF REVENUE DECENTRALISATION FOR THE CASE OF THE SPANISH AUTONOMOUS COMMUNITIES

In order to indicate the level of fiscal control which Spanish regional governments have over their revenue (rather than simply the quantity of decentralised resources), and following Ebel and Yilmaz (2002), Meloche *et al.* (2004) and Stegarescu (2005), we propose the following indicators, on the basis of the recognised revenues of such governments, according to the economic classification of Spanish public accounts:

1. Full revenue control decentralisation (FREVC DREG): revenues over which the subcentral bodies may exercise their powers without restrictions, as a proportion of total recognised non-financial revenues. Such revenues, in the case of Spanish regional governments, correspond to sections 3 (administrative fees, user charges and other revenue), 5 (income from business operations and property) and 6 (divestment of property investments).
2. Medium revenue control decentralisation (MREVC DREG): revenues over which the subcentral tiers enjoy, at least, the power to determine the sum or level of such revenues⁴, as a proportion of total recognised non-financial

⁴ In the case of taxes, and following, from among many authors, Bird (1993), the power to determine, at least, the tax rate.

revenues. Currently, in the case of Spanish regional governments, these revenues correspond to sections 3, 5 and 6 and part of sections 1 (direct taxes) and 2 (indirect taxes). However, it was not until 1997 that such governments acquired regulatory authority over direct ceded taxes⁵ and some indirect ceded taxes⁶. With the exception of Navarre and the Basque Country (to be precise, its "Foral Deputations"), which, due to the special system of financing applied to them, have possessed wide-ranging regulatory authority over the cited direct and indirect taxes since the beginning of the process of fiscal decentralisation. Thus, for the construction of this indicator, as far as the ACs with ordinary financing systems are concerned, sections 3, 5 and 6 must be included since the beginning of such process and, from 1997 onwards, so must all of section 1 and the ITP (Property Tax) and IAJD (Stamp Duty) of section 2. While for Navarre and the Basque Country, this same inclusion, referring to sections 1 and 2, must be performed from the beginning, together with sections 3, 5 and 6.

3. Low revenue control decentralisation (LREVCDREG): revenues which the regional tiers receive, at least, under the formula of participation⁷, as a proportion of total recognised non-financial rights. In the Spanish case, such revenues correspond to sections 1, 2, 3, 5 and 6. Thus, in order to construct this indicator, for all the ACs, the totality of the revenues listed in those five sections must be considered from the beginning of the process of fiscal decentralisation.

These indicators (which will be our variables of interest in the analysis we shall subsequently perform of the possible existence of a relationship between the decentralisation of revenue and the economic growth of the ACs) may be calculated using the information included in the Spanish Public Sector Database (BADESPE)⁸ from 1984 until today; information regarding their construction is described in Table 1.

⁵ Personal Income Tax (IRPF), Inheritance and Gift Tax (ISD) and Wealth Tax (IP).

⁶ Basically, the Property Transfer Tax (ITP) and Stamp Duty (IAJD).

⁷ That is to say, conditional and unconditional grants are excluded.

⁸ Compiled by the Institute of Fiscal Studies (IEF), and the only database which offers detailed budgetary information for the various levels of government which exist in Spain.

Table 1. Indicators of revenue decentralisation for the case of the Spanish Autonomous Communities

<i>S</i>	<i>REVENUE DECENTRALISATION</i>		
	<i>FULL</i>	<i>MEDIUM</i>	<i>LOW</i>
<i>DESCRIPTION</i>	<p>FCREVDREG: Revenues of the ACs, recognised in sections 3, 5 and 6, as a proportion of total recognised non-financial revenues, in accordance with the economic classification.</p>	<p>MCREVDREG: Revenues of the ACs recognised in sections 3, 5 and 6 and in sections 1 and 2 (only ITP and IAJD), from 1997 onwards, for ACs with the standard system of financing and for the complete period for those employing the special system, as a proportion of total recognised non-financial revenues, in accordance with the economic classification.</p>	<p>LCREVDREG: Revenues of the ACs recognised in sections 1, 2, 3, 5 and 6 as a proportion of total recognised non-financial revenues, in accordance with the economic classification.</p>

3. ECONOMETRIC SPECIFICATION AND VARIABLES FOR THE ANALYSIS OF THE RELATIONSHIP BETWEEN REVENUE DECENTRALISATION AND ECONOMIC GROWTH IN THE SPANISH AUTONOMOUS COMMUNITIES

3. 1. Econometric specification

As stated in the introduction, very few previous studies have analysed the relationship between tax decentralisation and economic growth at the subcentral level. Our study, following the approach generally employed in such studies, such as Akai and Sakata (2002) for the North American states or Jin and Zou (2005) for the Chinese provinces, will evaluate the possible relationship between revenue decentralisation and economic growth in the Spanish ACs in the period 1984-1995, using the following linear approximation:

$$Y_{it} = \alpha_i + \beta_i' X_{it} + \lambda_t + \varepsilon_{it}; \text{ with } \varepsilon_{it} \sim I.I.D. (0, \sigma_\varepsilon^2) \quad (1)$$

where Y_{it} is the rate of growth of GDP per capita of the Autonomous Community i in the period t , α_i is a term which represents the specific unobservable factors of each individual, β_i' and X_{it} are matrices $1 * H$ y $H * 1$ which represent, respectively, the coefficients and the h explanatory variables. The latter are comprised of a series of control variables and our variable of interest i.e. the different indicators of revenue decentralisation. λ_t is a term which represents the specific factors of each time period and, lastly, ε_{it} is the error term.

The fact that the time period under consideration is limited to 1984-1995 is due to the difficulty of linking the data from the Spanish Regional Accounts (Contabilidad Regional de España-CRE) obtained from the National Statistics Institute (Instituto Nacional de Estadística-INE) until 1995, according to the European System of Accounts of 1979 (ESA-79), with the data obtained from then onwards, in accordance with the new European System of Accounts of 1995 (ESA-95).

3. 2. Dependent variable and explanatory variables

We shall measure the rate of growth of GDP per capita of each Autonomous Community as the variation in the logarithm of that variable. In this calculation, the data for GDP, at constant 1986 prices, and those for population have been taken, respectively, from the CRE and the “Spanish Population Evolution” compiled by the INE.

The control variables we shall consider are those commonly used in the literature regarding economic growth, when working with a data panel i.e.: initial level of GDP per capita, rate of investment, variation in human capital and population growth in each of the ACs⁹.

The initial level of GDP per capita (GDPPCINI) is measured as the logarithm of GDP per capita in the previous year, at constant 1986 prices. Economic theory states that this variable negatively affects economic growth, as a consequence of the convergence processes occurring within a group of economies.

⁹ The first of these is intended to represent the conditional process of β convergence and the remaining ones follow the broadening of Solow's model (1956) proposed by Mankiw *et al.* (1992).

With respect to the rate of investment, we shall distinguish between private (PRVINVR) and public (PUBINVR) investment. The private investment rate is measured as the quotient between Gross Fixed Capital Formation (GFCF) of a productive nature¹⁰ and the GDP of the Autonomous Community, with both magnitudes given in constant 1986 prices. For the first magnitude, we employ the data supplied in studies by the Valencian Institute of Economic Research (IVIE) for the BBVA Foundation (FBBVA); for the second, the data are once more taken from the INE. The rate of public investment, however, is measured as the quotient between public GFCF at constant 1986 prices, and the population of the Autonomous Community¹¹. In this case, the sources for the first and second magnitude are once again the research performed by the IVIE for the FBBVA and the INE, respectively. It is to be expected that, in accordance with the literature, these variables positively affect the economic growth of the Spanish ACs. Nevertheless, with regard to public investment, it must be remembered, as Barro (1990) states, that this has two distinct effects upon growth; one is positive, derived from its utilisation as a factor in private production, while the other is negative, due to the need to finance it by taxes, which necessarily affects capital accumulation in the economy.

The variation in human capital (DLHK), in accordance with the usual approximation, is obtained as the variation in the logarithm of the proportion of the employed population in the Autonomous Community with, at least, secondary education. This information is extracted from the human capital database compiled by the IVIE for the Bancaja Foundation. The literature appears to identify a positive effect of this variable upon economic growth.

Population growth (DLPOP) is calculated as the variation in the logarithm of the total population of the Autonomous Community from January 1 of the year in question to January 1 of the following year, as given in the “Spanish Population Evolution” data

¹⁰ That is to say, excluding residential property.

¹¹ The idea underlying this method of measuring the rate of public investment is that this is not principally aimed at the productive sector of an economy, but instead at the population as a whole. This argument is even more logical in a context of public investment of a redistributive nature, such as that which appears to have occurred in Spain in the period we analyse. Within the literature concerned with the possible effect of fiscal decentralisation upon economic growth at subcentral level, the use, as a control variable, of investment weighted by the population may be seen, for example, in Lin and Liu (2000).

compiled by the INE. The theory of economic growth holds that this variable should have a negative effect upon it.

Table 2 offers information regarding the dependent variable and the control variables.

Table 2. Dependent variable and control variables for the study of the relationship between decentralisation of revenue and economic growth of the Spanish Autonomous Communities

NAME	DESCRIPTION	SOURCE	EXPECTED SIGN
DLGDPPC	Variation in the logarithm of GDP	CRE and “Spanish Population Evolution” – INE	
GDPPCINI	Logarithm of GDP per capita in the previous year	CRE and “Spanish Population Evolution” – INE	–
PRVINVR	Private GFCF in relation to GDP	IVIE – FBBVA and CRE – INE	+
PUBINVR	Public GFCF in relation to population	IVIE – FBBVA and “Spanish Population Evolution” – INE	+ / –
DLHK	Variation in the logarithm of the proportion of employed population with, at least, secondary education	IVIE – Bancaja Foundation	+
DLPOP	Variation in the logarithm of the population from January 1 of the year in question to January 1 of the following year	“Spanish Population Evolution” – INE	–

Lastly, our variable of interest, the decentralisation of revenue, will be represented by the three indicators described in the previous section and presented in Table 1: Full revenue control decentralisation (FREVC DREG), medium revenue control decentralisation (MREVC DREG) and low revenue control decentralisation (LREVC DREG), constructed on the basis of the information provided by the Spanish Public Sector Database (BADESPE) of the Institute of Fiscal Studies (IEF).

4. PRINCIPAL RESULTS OF THE ANALYSIS OF THE RELATIONSHIP BETWEEN DECENTRALISATION OF REVENUE AND ECONOMIC GROWTH IN THE SPANISH AUTONOMOUS COMMUNITIES

4. 1. Econometric questions

As Hsiao (2003) states, the combination of the time and spatial dimensions via the panel data approach allows the number of observations to be raised, thereby increasing the degrees of liberty and reducing the multicollinearity between the explanatory variables, while producing an improvement in the efficiency of the econometric estimations. Thus, the study of long-term relationships may be undertaken with greater confidence through panel regressions. This is one of the reasons we estimate the possible relationship between the decentralisation of revenue and regional economic growth in Spain by using a data panel for the 17 Autonomous Communities and the period 1984-1995 ($N = 17$ and $T = 12$, and therefore, initially, the number of observations will be 204).

However, panel regressions based on a frequency of annual data, as in our case, may be conditioned by short-term movements, as Thiessen (2003) observes, or by fluctuations in the economic cycle, as Woller and Phillips (1998) show, in their studies of the relationship between fiscal decentralisation and economic growth. Consequently, Thiessen (2003), concentrates his analysis solely on the results obtained from cross-section estimations for a group of countries, in order to identify, principally, the long-term effects. Nevertheless, as the literature has repeatedly demonstrated, there is a more satisfactory way of confronting this problem, namely by controlling for these time factors in our regressions.

On the same point, we should emphasise another of the advantages of the standard techniques of panel data is the possibility of controlling for the effect of specific factors in each Autonomous Community, which are extremely difficult to quantify¹². This is achieved by specifying individual effects, different for each region

¹² It should be noted, following Islam (1995), Baltagi (2001) or Hsiao (2003), that the omission of these factors when proposing a model has potentially very negative effects upon the quality of the estimations.

but constant throughout the period, which reflect the influences of such individual factors upon the economic growth of each AC. Additionally, time effects may be proposed, in order to represent those changes over time which also affect such economic growth.

With regard to the specification which we proposed in (1), two possible methods of estimation exist. On the one hand, to consider that the individual and time effects may be understood to be fixed and to include them in the model as variables; on the other, to consider that such effects may be understood to be random and to make them form part of the structure of the error term¹³. Consequently, the procedure we shall employ will be to estimate the different models we propose by a typical regression of Ordinary Least Squares (OLS), a fixed effects regression and a random effects regression, the latter through a Generalised Least Squares (GLS) regression. Subsequently, we shall employ a series of statistical tests, in order to determine which is the most appropriate model. Specifically, an F-test of the joint significance of the fixed effects will determine whether the estimation of the model with fixed effects is better than the OLS estimation, and a Hausman test¹⁴ will permit us to choose between the fixed effects model and the random effects model. Given that, via the F-test, the need to employ individual effects is confirmed in all the models we propose, it is not necessary to perform a Breusch-Pagan test¹⁵, which allows us to determine if the random effects model is better than the OLS estimation. We notify readers in advance that in all the models we develop in the following two sections, the null hypothesis of absence of correlation of individual effects with the remaining variables can be rejected, and thus the fixed effects specification is the most appropriate.

In fact, if such factors are correlated with the variables present in the model, and are not considered, the consistency of the parameters estimated is not guaranteed. On the other hand, even if they are not correlated with the remaining variables, if the model takes them into account in some way, the efficiency of such estimations is improved.

¹³ It is important to observe that, in accordance with the postulates of classic econometrics, the choice between the fixed effects model and the random effects model will depend upon the existence of a correlation between the individual effects and the variables included in the model. In the presence of this type of correlation, the estimation of the random effects model would not be consistent; consistency would only be guaranteed by the fixed effects model. However, in the absence of correlation, the random effects model will provide more efficient estimators.

¹⁴ The null hypothesis of which is the absence of correlation between the individual effects and the remaining variables present in the model. It should be noted that, as Hsiao (2003) states, estimation with fixed effects and estimation with random effects tend to become identical when, the number of individuals (N) being fixed, the number of observations (T) tends towards infinity. Thus, the application of the Hausman test will be all the more necessary when N is large in relative terms with regard to T, as in our case.

¹⁵ The null hypothesis of which is that the variance of OLS residuals is constant.

It should be emphasised that a further argument in support of the fixed effects approach, as opposed to the random one, is that our analysis is intended to control for the differences which exist between the 17 Autonomous Communities which comprise their total population; i.e. in our analysis, the situation is not that each AC is taken randomly from a wider set of ACs, and thus a random effects estimation would not really be appropriate.

Finally, it should be noted that there exists a possible problem regarding the endogeneity of our variables of interest, when estimating the various models we propose. Standard practice advises avoiding this possibility by estimating, in addition, the models using instrumental variables. As Martínez-Vázquez and McNab note (2003), it is difficult to select appropriate instruments for our variables of interest i.e. variables which are correlated to the decentralisation of revenue but not to economic growth and, in addition, for which continuous data are available. In this case, as Behnisch *et al.* (2002) or Thiessen (2003) show, it would seem more logical to assume that our variables of interest are exogenous than to work with instruments of uncertain reliability¹⁶. Such an assumption is not difficult to make for the fiscal decentralisation process occurring in Spain, since the allocation of taxes and expenditure among the various levels of government has been determined more by historical and political issues than by economic development.

4. 2. Regressions

As we have just stated, we decided, following the performance of the relevant tests, to study the possible effects of fiscal decentralisation upon the economic growth of the Spanish ACs, in the period 1984-1995, employing a fixed effects panel. Thus, we shall propose three different models, one for each proposed indicator of revenue decentralisation with this type of effects and with control variables for initial income level, public and private (sector) investment rates, human capital growth and population

¹⁶ In fact, there exists an ever-growing body of literature which holds that estimation with instrumental variables produces problems which have not yet received sufficient attention and concludes that, in many cases, such estimation is of lower quality than that obtained by OLS, assuming the exogeneity of the explanatory variables. The seminal studies within this literature are those of Buse (1992) and Bound *et al.* (1996).

variation, as stated above. From the first estimations performed, the different control variables will be significant, and thus it will not be necessary to exclude any of them from our models. The only one which, in this regard, displays somewhat different behaviour is the rate of public (sector) investment, which will be fluctuating at a significance level of approximately 10%.

Our models are intended to capture both individual and time effects. In the latter case, initially, we use T-1 dummies for each of the years in the period, excluding the first one in order to avoid perfect multicollinearity, in line with Wooldridge (2002). However, these dummy variables do not prove to be significant, and thus, given that the period we analyse covers two completely different stages of the economic cycle (expansion until 1992 and economic crisis and mild recovery between 1992 and 1995), we decided to consider only time dummies for the latter subperiod. Despite this, such effects continue to be insignificant, with the exception of 1993, which is significant at 10% with a negative sign. Consequently, in view of these results, and bearing in mind that these temporary dummy variables supply minimal explanatory capacity to our models, we decided to exclude the former from the estimation of the latter.

One alternative method of including changes over time in our estimations is to consider a time trend for the period under consideration; this, in addition, may display a specific slope for each Autonomous Community. Consequently, we capture additional sources of heterogeneity among the regions, as it would seem reasonable to assume that certain aspects which are characteristic of each of them vary over the period considered. The equation to be estimated would be the following:

$$Y_{it} = \alpha_i + \beta_i' X_{it} + t + \gamma_{it} + \varepsilon_{it}; \text{ with } \varepsilon_{it} \sim I.I.D. (0, \sigma_\varepsilon^2) \quad (2)$$

Thus, our models include a general time trend (t) and specific time trends for each AC (γ_{it}). As a result, we find, on the one hand, a significant and positive general trend is systematically displayed in the various regressions proposed; on the other, in some such regressions, we discover certain specific trends with a degree of significance and an invariably negative sign. This is the case of the island Autonomous Communities (Balearic Islands and Canary Islands), the south-east coast (Valencia and Murcia), the home of the national capital (Madrid) and the foral regions (Navarre and

the Basque Country). Given that these last three are those in which the most specifications are significant, and to a greater degree, they shall be the only ones considered in our models, together with the general trend.

Another factor we have taken into account when estimating these models is the existence of different financing systems among the 17 ACs¹⁷, in order to thereby determine if their economic growth was affected by the differences existing among such systems. In addition, as must be remembered, this is a question which affects the construction of the various revenue decentralisation indicators we propose, particularly the medium revenue control decentralisation indicator. It should be noted that if revenue decentralisation had an important effect upon economic growth, it is reasonable to expect that, with regard to the medium revenue control decentralisation indicator, a dummy variable for the foral financing system would be significant, since the ACs which enjoy that system display, by definition, a much more intense medium revenue control decentralisation indicator. We therefore distinguish, through dummy variables, between the foral and standard system of financing and, within the latter, between those ACs regulated by Article 143 of the Spanish Constitution and those to which Article 151 applies, with regard to their level of competencies. However, when we successively introduce these dummy variables into each of our three models, the former are neither significant nor improve the latter's' explanatory capacity¹⁸. Consequently, we shall estimate these models without taking into consideration the differences which exist between the 17 ACs with respect to their system of financing and the powers they enjoy.

As stated earlier, Table 3 offers the principal results we obtain in the estimation, using a fixed effects panel, of the relationship between the three types of revenue control decentralisation considered (full, medium and low) and the economic growth of the 17 ACs in the period 1984-1995. As can be observed, in the three models, the individual effects of each of the ACs are very significant. In addition, such models explain over one-third of the behaviour of the endogenous variable and their tests of joint significance of the explanatory variables are passed at the level of 1%.

¹⁷ This question has also been considered by Carrión-i-Silvestre *et al.* (2004) and Pérez and Cantarero (2004).

¹⁸ Similar results are provided by Carrión-i-Silvestre *et al.* (2004) and Pérez and Cantarero (2004). In these studies only the dummy variable for the foral system is significant, with a negative sign.

With regard to the control variables, it can be seen that they display the expected signs in all the estimations and, in almost all cases, a high degree of significance. The exception is public (sector) investment, the effect of which upon economic growth is less significant than that of private (sector) investment, in line with the results obtained by Gorostiaga (1999), Salinas (2003) and María-Dolores and Puigcerver (2005). Moreover, the variation in human capital, as we define it, is scarcely significant if considered contemporaneously¹⁹. Nevertheless, when we consider that the improvement in the skills of the employed population has a retarded effect upon economic growth²⁰, the significance of this variable increases considerably, producing models with greater explanatory capacity. Consequently, we include in our estimations the variation in human capital lagged by one period. With regard to time trends, as we have stated above, the general trend is very significant and positive, in the various specifications, while the trends for the Autonomous Community of Madrid and the foral regions are negative and less significant²¹. However, it is important to emphasise that the coefficients estimated for these trends, both general and specific, are of an extremely low magnitude.

Our variables of interest (i.e. the various revenue decentralisation indicators) display positive but not significant signs, with the exception of the low revenue control decentralisation indicator, which is significant at 10%. Although the study periods are different, it should be underlined that the positive sign of the coefficients coincides with that obtained by Carrión-i-Silvestre *et al.* (2004), regarding a traditional revenue decentralisation indicator, for which, additionally, the estimated coefficient is significant. Moreover, the low significance of the estimated coefficients is in line with the results obtained by Pérez and Cantarero (2004), who found almost no significant relationship between their revenue decentralisation indicator, constructed in a traditional fashion, and the economic growth of the ACs in the period 1992-1999. With regard to the studies concerned with the relationship between revenue decentralisation and economic growth in the context of subcentral governments in other countries, it is

¹⁹ In contrast to Carrión-i-Silvestre *et al.* (2004), where the variation in human capital, approximated in the same way, is positive and highly significant.

²⁰ This idea is widely accepted in the literature, as shown by Durlauf *et al.* (2004). From among the studies concerned with the relationship between fiscal decentralisation and economic growth see, for example, Akai and Sakata (2002) and Akai *et al.* (2004).

²¹ We shall return to some of these results below.

interesting to note that the positive result of our estimations coincides with that obtained for the Indian states by Zhang and Zou (2001), in which the usual revenue decentralisation ratio is utilised, and with those provided by Lin and Liu (2000) for the Chinese provinces and Freinkman and Yossifov (1999) and Desai *et al.* (2003) for the Russian regions, in which the indicator employed is the rate of withholding of the revenue collected by the subcentral government.

Two additional aspects should be emphasised in our results. Firstly, the lower the level of intensity of revenue control decentralisation we wish to measure i.e. moving from full to medium or from medium to low, the greater is the degree of significance of the indicator. Secondly, the estimated coefficient with the greatest magnitude is that of the indicator of medium revenue control decentralisation, which is, approximately, twice that estimated for the other two indicators.

Thus, our results would appear to indicate that the decentralisation of revenue to the Spanish ACs in the period 1984-1995 had only a mild direct effect upon economic growth, and that the increased control which the ACs may have had over their revenue was not relevant to this effect, in contrast to the results obtained by Ebel and Yilmaz (2002) and Meloche *et al.* (2004) for a series of countries with transition economies. Therefore, in the period studied, the only effect which revenue decentralisation directly exerted upon the economic growth of the ACs was that caused by the volume of revenue transferred (hence the significance of the coefficient estimated for the low revenue control decentralisation)²², and not that produced by the degree of control exerted over such revenue, since this was negligible for the ACs with standard system of financing.

Lastly, we would like to stress that we have studied the possibility that the relationship between the decentralisation of revenue and the economic growth of the ACs has a non-linear character; consequently we included in each of the regressions, as

²² It should be noted that this indicator principally represents revenue over which no regulatory capacity whatsoever is possessed. Thus, it may be approximated to an standard indicator of decentralisation expenditure, which would permit us to talk of a positive and significant effect of the decentralisation of expenditure to the ACs in the period 1984-1995, in line with the results produced by Carrión-i-Silvestre *et al.* (2004).

an additional factor, the square of the revenue decentralisation indicator in question, but this in no case produced significant estimated coefficients.

4.3. The indirect effect of revenue decentralisation upon economic growth through private (sector) investment

Having studied the direct relationship which exists between the decentralisation of revenue to the ACs and their economic growth in the period 1984-1995, it is interesting to conjecture whether, in this context, it is possible to validate some of the principal results obtained by the theoretical model for revenue decentralisation and economic growth we proposed in Gil-Serrate and López-Laborda (2005) and, specifically, the fact that, according to that model, there exists a relationship between the low productivity of public (sector) investment and a positive effect of the decentralisation of revenue to subcentral levels upon economic growth. This effect would be channelled through private (sector) investment, as a consequence of the "flypaper effect" which accompanies the decentralisation process. We are talking, therefore, of an indirect effect of revenue decentralisation upon economic growth, through private (sector) investment.

In the estimations performed in the previous section, we obtained not only a positive and significant effect of private investment upon regional economic growth, but also a positive effect, although considerably lower and hardly significant, of public (sector) investment upon such growth. This scenario would be compatible with the framework which, according to our model, would have to be provided for there to exist the above-mentioned indirect effect of revenue decentralisation upon economic growth, since private (sector) investment has a clear and positive effect upon economic growth and, moreover, public (sector) investment appears to be considerably less productive than its private counterpart. Thus, in line with Barro (1990), once a certain (relatively low) level of public (sector) investment is reached, its positive effects upon growth (as a consequence of its complementarity with private (sector) investment), does not compensate for the detrimental effects produced by the tax burden necessary to finance it; that is to say, once this level has been surpassed, a process of revenue decentralisation to the subcentral levels would have a positive effect upon economic

growth, since it would free resources from the public to the private sector, via the "flypaper effect" which accompanies such process.

In order to completely validate our theoretical results we need to estimate a model capable of explaining the private (sector) investment undertaken in the ACs in the period 1984-1995, using our revenue decentralisation indicators and a series of control variables, paying attention to the sign and significance of the coefficients obtained for those indicators. Our dependent variable will, therefore, be private (sector) investment (PRVINVR) and the control variables to be considered will be some of those normally employed in equations which are intended to explain investment using fiscal decentralisation as the variable of interest²³, namely inflation (INFL) and the unemployment rate (UNEMPR), lagged by one period to include the cyclical effects. The first of these shall be measured as the annual variation in the Consumer Price Index (CPI) of the Autonomous Community in question, data we take from the INE, and it is to be expected that it has a negative effect on private investment. The second is extracted from the Active Population Survey (EPA, in its Spanish initials), performed by the INE, and it will also presumably have a negative effect upon private investment.

When estimating the three models which result from considering each of the revenue decentralisation indicators with which we are working, we employed the same approach as that described in the previous section. That is to say, we propose a fixed effects model in which we have controlled for changes over time by including both a general time trend and time trends specific to each AC. The former proves to be positive and significant in all the estimations; in the latter, the same ACs as in the study of the relationship between revenue decentralisation and economic growth are once more prominent (i.e. the Autonomous Communities of the Balearic Islands, the Canary Islands, Valencia, Murcia, Madrid, Navarre and the Basque Country). However, given that the time trends for the first four of these do not attain, normally, a level of significance of 10%, we only consider the time trends for the remaining three. Furthermore, the dummy variables for the different systems of financing of the ACs, namely foral and standard, distinguishing within the latter between those regulated by

²³ See, for example, Thiessen (2000 and 2003).

Article 143 and Article 151, respectively, of the Constitution, do not prove to be significant.

In Table 4 we present the principal results obtained in the estimation, utilising a fixed effects panel, of the effect which the three types of revenue control decentralisation considered (full, medium and low) had upon the behaviour of private (sector) investment in the period 1984-1995. In the three models estimated, the individual effects of each of the ACs are very significant. Additionally, these models have an explanatory capacity of close to 40% and their tests of joint significance of the explanatory variables are passed at the level of 1%.

The control variables display the expected sign and a high significance level. Given that inflation lagged by one period presents an estimated coefficient which, although it has a negative sign, is less significant than that obtained when its contemporary value is considered in our models, we have selected the latter option concerning this control variable; consequently, the explanatory capacity of the model has improved. With regard to the time trends, the general trend is positive and very significant, which indicates that, during the study period, over time, the average rate of private investment for the ACs as a whole tended to increase. The specific time trend for the foral region of Navarre is also positive and very significant. By contrast, the time trends associated with the Autonomous Communities of Madrid and the Basque Country present lower significance, the former having a positive sign and the latter a negative one.

The negative sign associated with the specific time trend for the Basque Country implies that in this Autonomous Community, in the period 1984-1995, over time, and apart from the effects controlled by the remaining variables, the rate of private (sector) investment decreased. This may be explained as one of the consequences of the deep industrial crisis which began in this region in the late 1970s and was particularly pronounced in the first half of the 1980s. Thus, the coefficient estimated in the previous section for the time trend specific to the Basque Country, in the models by which we attempt to explain the economic growth of the ACs in the period 1984-1995, and which proved to be negative and significant, would seem to be explained by the reduction in the levels of private (sector) investment (basically industrial) in the Basque Country.

With regard to the effects of the various revenue decentralisation indicators, the coefficients estimated for full and medium revenue control decentralisation are positive, very significant and display a similar magnitude. By contrast, although the low revenue control decentralisation indicator presents a positive estimated coefficient, this is by no means significant and has a much lower magnitude. These estimations validate the scenario derived from the theoretical model proposed in Gil-Serrate and López-Laborda (2005), with regard to the positive effect upon economic growth, through private (sector) investment, exerted by the decentralised revenue over which subcentral governments possess some regulatory capacity. This explains why the coefficients estimated for the indicators of full and medium revenue control decentralisation are positive and significant, and not, by contrast, that estimated for the low revenue control decentralisation coefficient, the magnitude of which is much lower, moreover, as we stated earlier.

5. CONCLUSIONS

From the results presented in the previous section it may be deduced that the low regulatory capacity which Spanish regional governments had over their revenue in the period 1984-1995 would not have been sufficient for the Decentralisation Theorem to have been fulfilled in the dynamic context of their economic growth, in line with Oates (1993) and, therefore, for that regulatory capacity to have had a significant effect upon such growth. By contrast, however, the existent regulatory capacity would have been sufficient to have stimulated private (sector) investment, as stated in the theoretical model proposed in Gil-Serrate and López-Laborda (2005) and, through such investment, to have had an indirect and positive effect upon Spanish regional economic growth.

Finally, we would like to underline how useful it would have been to have had available homogenous data which would have allowed the study period to have been extended until present. It should be noted that, from 1997 onwards, significant progress has been made in the regulatory capacity of the Spanish ACs, which, from among the indicators proposed is reflected in the evolution of the indicator of medium revenue

control decentralisation²⁴. If it had been possible to have included in the panel this increase in regulatory capacity, a feasible result would have been an estimated coefficient for the indicator of medium revenue control decentralisation which was positive and significant in the regression on regional growth. In fact, it may be observed in Table 3 that the estimated coefficient for this indicator in the period 1984-1995 was already that with the greatest magnitude, positive and close to being significant at 10%. This result allows us to talk not only of an indirect effect of revenue decentralisation upon Spanish regional economic growth, but also of a direct effect, in which, moreover, the degree of control which regional governments have over such revenue would be important.

²⁴ Moreover, the extension of the study period would have allowed us to place the economic crisis of the 1990s in better perspective, instead of occupying a central position in the period, as occurred between 1984 and 1995, which may be conditioning some of our results.

Table 3. Estimated coefficients for the effects of revenue decentralisation upon economic growth in the Spanish Autonomous Communities (1984-1995)

<i>Explanatory variables</i>	<i>Dependent variable: DLGDPPC</i>		
	(1) FULL CONTROL DECENTRALISATION	(2) MEDIUM CONTROL DECENTRALISATION	(3) LOW CONTROL DECENTRALISATION
GDPPCINI	-0.360*** (-5.090)	-0.360*** (-5.096)	-0.358*** (-5.198)
PRVINVR	0.392*** (3.335)	0.373*** (3.165)	0.385*** (3.276)
PUBINVR	0.095* (1.662)	0.098* (1.718)	0.089 (1.626)
DLHK(-1)	0.209** (2.550)	0.215** (2.613)	0.205** (2.542)
DLPOP	-2.990*** (-3.473)	-2.872*** (-3.339)	-3.411*** (-3.760)
TREND	0.007*** (3.889)	0.007*** (3.998)	0.007*** (3.970)
TREND MADRID	-0.004* (-1.833)	-0.004* (-1.745)	-0.005* (-1.829)
TREND NAVARRE	-0.005* (-1.787)	-0.004* (-1.693)	-0.004 (-1.619)
TREND BASQUE COUNTRY	-0.003* (-1.844)	-0.004** (-2.091)	-0.003** (-2.032)
FREVCDREG	0.034 (0.505)		
MREVCDREG		0.080 (1.229)	
LREVCDREG			0.044* (1.881)
ANDALUSIA	0.431 (5.321)***	0.428 (5.284)***	0.430 (5.442)***
ARAGON	0.539 (5.083)***	0.529 (4.997)***	0.524 (5.174)***
ASTURIAS	0.470 (4.998)***	0.461 (4.912)***	0.457 (5.083)***
BALEARIC ISLANDS	0.637 (5.236)***	0.632 (5.195)***	0.617 (5.314)***
CANARY ISLANDS	0.507 (5.230)***	0.502 (5.183)***	0.496 (5.332)***
CANTABRIA	0.499 (5.114)***	0.493 (5.066)***	0.487 (5.184)***
CASTILE – LEÓN	0.471 (5.030)***	0.464 (4.962)***	0.460 (5.118)***
CASTILE – MAN.	0.443 (5.117)***	0.439 (5.073)***	0.438 (5.212)***
CATALONIA	0.588 (5.143)***	0.584 (5.116)***	0.581 (5.245)***
VALENCIA	0.523 (5.123)***	0.518 (5.084)***	0.518 (5.233)***
EXTREMADURA	0.363 (5.062)***	0.358 (5.004)***	0.358 (5.155)***
GALICIA	0.408 (4.882)***	0.405 (4.858)***	0.403 (4.968)***
MADRID	0.632 (5.375)***	0.621 (5.293)***	0.632 (5.486)***
MURCIA	0.502 (5.201)***	0.494 (5.123)***	0.491 (5.318)***
NAVARRRE	0.608 (5.233)***	0.561 (4.682)***	0.569 (5.183)***
BASQUE COUNTRY	0.579 (5.025)***	0.508 (4.018)***	0.539 (4.959)***
LA RIOJA	0.593 (4.878)***	0.585 (4.809)***	0.581 (4.958)***
PROB (F): F. E.	0.000	0.000	0.000
PROB (HAUSMAN): R. E. vs .F. E.	0.000	0.000	0.000
Adjusted R ²	0.341	0.347	0.352
PROB (F): V. A.	0.000	0.000	0.000

Notes: See table 4.

Table 4. Estimated coefficients for the effects of revenue decentralisation upon private (sector) investment in the Spanish Autonomous Communities (1984-1995)

Explanatory variables	Dependent variable: PRVINVR		
	(1) FULL CONTROL DECENTRALISATION	(2) MEDIUM CONTROL DECENTRALISATION	(3) LOW CONTROL DECENTRALISATION
INFL	-0.233** (-2.162)	-0.211* (-1.936)	-0.250** (-2.332)
UNEMPR(-1)	-0.192*** (-4.324)	-0.196*** (-4.418)	-0.192*** (-4.230)
TREND	0.002*** (3.691)	0.002*** (3.695)	0.002*** (2.755)
TREND MADRID	0.002* (1.956)	0.002* (1.914)	0.001 (0.992)
TREND NAVARRE	0.004*** (4.822)	0.005*** (5.680)	0.004*** (4.886)
TREND BASQUE COUNTRY	-0.002 (-1.204)	-0.003* (-1.738)	-0.002 (-1.301)
FREVCDREG	0.129*** (2.963)		
MREVCDREG		0.115*** (3.137)	
LREVCDREG			0.016 (0.714)
ANDALUSIA	0.174 (9.600)***	0.174 (9.571)***	0.182 (10.126)***
ARAGON	0.141 (8.598)***	0.143 (8.996)***	0.164 (9.638)***
ASTURIAS	0.147 (7.905)***	0.149 (8.094)***	0.169 (9.184)***
BALEARIC ISLANDS	0.162 (11.721)***	0.163 (11.697)***	0.169 (8.248)***
CANARY ISLANDS	0.184 (10.659)***	0.185 (10.682)***	0.193 (9.961)***
CANTABRIA	0.156 (10.576)***	0.157 (10.607)***	0.168 (10.415)***
CASTILE – LEÓN	0.153 (9.776)***	0.154 (9.971)***	0.171 (11.029)***
CASTILE – MAN.	0.173 (11.965)***	0.173 (11.886)***	0.184 (12.847)***
CATALONIA	0.166 (10.822)***	0.167 (10.753)***	0.178 (11.451)***
VALENCIA	0.161 (10.637)***	0.161 (10.651)***	0.173 (11.680)***
EXTREMADURA	0.181 (10.153)***	0.182 (10.233)***	0.194 (11.116)***
GALICIA	0.164 (12.726)***	0.164 (12.582)***	0.174 (13.607)***
MADRID	0.113 (5.834)***	0.115 (6.061)***	0.141 (8.429)***
MURCIA	0.140 (8.632)***	0.141 (8.732)***	0.155 (8.470)***
NAVARRE	0.137 (8.755)***	0.077 (2.556)**	0.139 (5.597)***
BASQUE COUNTRY	0.177 (9.552)***	0.078 (1.857)*	0.173 (6.195)***
LA RIOJA	0.126 (7.599)***	0.128 (7.765)***	0.146 (8.498)***
PROB (F): F. E.	0.000	0.000	0.000
PROB (HAUSMAN): R. E. vs .F. E.	0.000	0.000	0.000
Adjusted R ²	0.390	0.389	0.365
PROB (F): V. A.	0.000	0.000	0.000

Notes: t-statistics corrected for White heteroscedasticity are in parentheses; *, (**) and [***] indicate significant coefficients at the 10%, (5%) and [1%] level; PROB (F): F. E. is the p-value of the F-test used for testing the fixed effects model against the classical regression model with no individual effects; PROB (HAUSMAN):R. E. vs F. E. is the p-value of the Hausman test used for testing the random effects model against the fixed effects model; PROB (F): V. A. is the p-value of the F-test used for testing the joint significance of the explanatory variables.

REFERENCES

- AKAI N. and M. SAKATA (2002) Fiscal decentralization contributes to economic growth: evidence from state-level cross-section data for the United States. *Journal of Urban Economics* 52: 93-108
- BAHL R. and J. LINN (1992) *Urban public finance in developing countries*. Oxford University Press, Oxford
- BALTAGI B. (2001) *Econometric analysis of panel data (Second edition)*. John Wiley & Sons, Nueva York
- BARRO R. (1990) Government spending in a simple model of endogenous growth. *Journal of Political Economy* 98: s103-125
- BEHNISCH A., T. BÜTTNER and D. STEGARESCU (2002) Public sector centralization and productivity growth: reviewing the German experience. *Zentrum für Europäische Wirtschaftsforschung (ZIW) Discussion Paper* 02-03, Mannheim
- BIRD R. (1993) Threading the fiscal labyrinth: some issues in fiscal decentralization. *National Tax Journal* 46: 207-227
- BOUND J., A. JAEGER and R. BAKER (1996) Problems with instrumental variable estimation when the correlation between the instruments and the endogenous explanatory variable is weak. *Journal of the American Statistical Association* 90: 443-450
- BRUECKNER J. (1999) Fiscal federalism and capital accumulation. *Journal of Public Economic Theory* 1: 205-224
- BRUECKNER J. (2005) Fiscal federalism and economic growth. *CESifo Working Paper Series* 1601, Ifo Institute for Economic Research, Munich
- BUSE A. (1992) The bias of instrumental variable estimators. *Econometrica* 60: 173-180
- CARRIÓN-I-SILVESTRE J., M. ESPASA and T. MORA (2004) Fiscal decentralization and economic growth in Spain. *XXX Reunión de Estudios Regionales*, Barcelona
- DAVOODI H. and H. ZOU (1998) Fiscal decentralization and economic growth: a cross-country study. *Journal of Urban Economics* 43: 244-257
- DESAI R., L. FREINKMAN and I. GOLDBERG (2003) Fiscal federalism and regional growth, evidence from the Russian Federation in the 1990s. *World Bank Policy Research Working Paper* 3138, Banco Mundial, Washington DC
- DURLAUF S., P. JONSON and J. TEMPLE (2004) Growth econometrics. *University of Wisconsin-Madison Economics Department Research Paper* 2004-18, University of Wisconsin-Madison, Madison

EBEL R. and S. YILMAZ (2002) On the measurement and impact of fiscal decentralization. *World Bank Policy Research Working Paper* 2809, Banco Mundial, Washington DC

FUKASAKU K. and L. DE MELLO (1998) Fiscal decentralisation and macroeconomic stability: the experience of large developing and transition countries. En Fukasaku K. y R. Hausmann (eds.) *Democracy, decentralization and deficit in Latin America*, OCDE, París

GIL-SERRATE R. and J. LÓPEZ-LABORDA (2005) Modelling tax decentralisation and regional growth. *Papeles de Trabajo, Serie Economía* 14/05, Instituto de Estudios Fiscales (IEF), Madrid

GONG L. and H. ZOU (2002) Optimal taxation and intergovernmental transfers in a dynamic model with multiple levels of government. *Journal of Economic Dynamics and Control* 26: 1975-2003

GONG L. and H. ZOU (2003) Fiscal federalism, public capital formation and endogenous growth. *Annals of Economics and Finance* 4: 471-490

GOROSTIAGA A. (1999) ¿Cómo afectan el capital público y el capital humano al crecimiento? Un análisis para las regiones españolas en el marco neoclásico. *Investigaciones Económicas* 23: 95-114

GRAMLICH E. (1993) A policymaker's guide to fiscal decentralization. *National Tax Journal* 46: 229-235

HSIAO C. (2003) *Analysis of panel data (Second edition)*. Cambridge University Press, Cambridge

IIMI A. (2005) Decentralization and economic growth revisited: an empirical note. *Journal of Urban Economics* 57: 449-461

ISLAM N. (1995) Growth empirics: a panel data approach. *The Quarterly Journal of Economics* 110: 1127-1170

JIN H., Y. QIAN and B. WEINGAST (1999) Regional decentralization and fiscal incentives: federalism, Chinese style. *Hoover Institution Working Paper*, Stanford University, Palo Alto

JIN J. and H. ZOU (2005) Fiscal decentralization, revenue and expenditure assignments, and growth in China. *Journal of Asian Economics* 16: 1047-1064

LIN J. and Z. LIU (2000) Fiscal decentralization and economic growth in China. *Economic Development and Cultural Change* 49: 1-22

MANKIW G., D. ROMER and D. WEIL (1992) A contribution to the empirics of economic growth. *Quarterly Journal of Economics* 107: 407-437

MARÍA-DOLORES R. and M. PUIGCERVER (2005) El papel del capital público y el capital humano en el crecimiento de las CC. AA. españolas: un análisis mediante datos de panel. *Investigaciones Regionales* 7: 5-22

MARTÍNEZ-VÁZQUEZ J. and R. MCNAB (2002) Fiscal decentralization, macroeconomic stability, and economic growth. *International Studies Program Working Paper*, Andrew Young School of Policy Studies, Georgia State University, Atlanta

MARTÍNEZ-VÁZQUEZ J. and R. MCNAB (2003) Fiscal decentralization and economic growth. *World Development* 31: 1597-1616

MELOCHE J., F. VAILLANCOURT and S. YILMAZ (2004) Decentralization or Fiscal Autonomy? What does really matter? Effects on growth and public sector size in European transition countries. *World Bank Policy Research Working Paper* 3254, Banco Mundial, Washington DC

MUSGRAVE R. (1959) *The theory of public finance*. McGraw-Hill, Nueva York

OATES W. (1972) *Fiscal federalism*. Harcourt Brace Jovanovich, Nueva York

OATES W. (1993) Fiscal decentralization and economic development. *National Tax Journal* 46: 237-243

PÉREZ P. and D. CANTARERO (2004) Descentralización fiscal y crecimiento económico en las regiones españolas. *XXX Reunión de Estudios Regionales*, Barcelona

QUIAO B., J. MARTÍNEZ-VÁZQUEZ and Y. XU (2002) Growth and equity tradeoff in decentralization policy: China's experience. *International Studies Program Working Paper* 02-16, Andrew Young School of Policy Studies, Georgia State University, Atlanta

RODDEN J. (2004) Comparative federalism and decentralization. On meaning and measurement. *Comparative Politics* 36: 481-500

RODRÍGUEZ-POSE A. and A. BWIRE (2004) The economic (in)efficiency of devolution. *Environment and Planning A* 36: 1907-1928

SALINAS M. (2003) Efficiency and TFP growth in the Spanish regions: the role of human and public capital. *Growth and Change* 34: 157-174

SOLOW R. (1956) A contribution to the theory of economic growth. *Quarterly Journal of Economics* 71: 65-94

STEGARESCU D. (2005) Public sector decentralization: measurement concepts and recent international trends. *Fiscal Studies* 26: 301-333

STIGLER G. (1957) The tenable range of functions of local government. En: *Federal expenditure policy for economic growth and stability*, Joint Economic Committee, Subcommittee on Fiscal Policy, Washington DC: 213-219

THIESSEN U. (2000) Fiscal federalism in Western European and selected other countries: centralization or decentralization? What is better for economic growth? *Deutsches Institut für Wirtschaftsforschung (DIW) Discussion Paper 224*, Berlin

THIESSEN U. (2003) Fiscal decentralisation and economic growth in high-income OCDE countries. *Fiscal Studies* 24: 237-274

TIEBOUT C. (1956) A pure theory of local expenditures. *Journal of Political Economy* 64: 416-424

WOLLER G. and K. PHILLIPS (1998) Fiscal decentralization and LDC economic growth: an empirical investigation. *Journal of Development Studies* 34: 139-148

WOOLDRIDGE J. (2002) *Econometric analysis of cross section and panel data*. MIT Press, Cambridge (MA)

XIE D., H. ZOU and H. DAVOODI (1999) Fiscal decentralization and economic growth in the United States. *Journal of Urban Economics* 45: 228-239

YILMAZ S. (2000) The impact of fiscal decentralization on macroeconomic performance. National Tax Association, *Proceedings of the 92nd Annual Conference on Taxation*: 251-260

ZHANG T. and H. ZOU (1998) Fiscal decentralization, public spending and economic growth in China. *Journal of Public Economics* 67: 221-240

ZHANG T. and H. ZOU (2001) The growth impact of intersectoral and intergovernmental allocation of public expenditure: with applications to China and India. *China Economic Review* 12: 58-81

ZOU H. (1996) Taxes, federal grants, local public spending and growth. *Journal of Urban Economics* 39: 303-317