

XXIX Reunión de Estudios Regionales

An exploration into the effects of fiscal variables on regional growth

Diego Martínez López*
centrA and University of Jaén

July 4, 2003

Abstract

This paper explores the effects of several fiscal variables on regional economic growth in Spain over period 1965-1997. Panel estimates are provided for this sample. The results show that public consumption affects negatively growth, public investment exerts a positive (but non significant) effect on growth rate and public deficit reduces private investment and hence economic growth. The effects of taxes and social benefits seem not to be beneficial for regional growth. Alternative estimates to deal with specification problems are considered.

1 Introduction

Regional growth is still a relevant issue. Firstly, the persistence of regional disparities in the European countries makes us doubt about the effectiveness of the regional policies implemented through structural funds, especially if this scheme has been carried out for a few years. Secondly, the future enlargement of the European Union will generate a new scenario for these policies, which will entail fewer resources for each country. Hence, national and regional governments will be forced to a more efficient and effective use of the public policies for regional development.

On the other hand, from an academic point of view, the controversy on neoclassical models versus endogenous models is hold in growth economics (Bernanke and Gurkaynak, 2001). One of the main consequences of this

*I wish to thank Emilio Congregado and Ángel de la Fuente their comments on a very preliminar draft of this paper. I also thank Pablo Hernández de Cos for providing me with a part of data used in this paper. Financial support from Instituto de Estudios Fiscales is acknowledged. All remaining errors are mine. Corresponding address: Fundación Centro de Estudios Andaluces. C/ Bailén, 50. 41001 Seville. Spain. Phone: 34 955 055 217. E-mail: dmartinez@fundacion-centra.org.

debate concerns the role of government in reducing regional disparities. As is well known, whereas neoclassical economists allow a small scope for public intervention, endogenous growth models claim that public policies can alter long-run growth rate.

This paper deals with the effects of fiscal variables on growth. So we admit that governments have various instruments that may exert positive or negative effects on regional growth rate. Hence we will not discuss here whether governments are able to modify the steady-state growth path or not. Instead, we will study differences in growth when using a fiscal variable or the other, and assuming that public policies have effects on growth rate. Moreover, following the empirical growth literature on the effect of fiscal policy, we highlight the importance of the composition of public budget rather than its size (Tanzi and Zee, 1997).

Traditionally, studies on economic growth and fiscal policy have only considered one side of public intervention. Some references, however, stress the importance of taking into account the public budget constraint (Helms, 1985; Modifi and Stone, 1990; Kneller et al., 1999; Bleaney et al., 2001). They claim that the set of fiscal instruments must be considered jointly in this kind of studies; otherwise, biased estimates of growth regressions are obtained and policy implications may be misleading.

In this paper we transfer this discussion to a regional level. We wonder whether budget constraint is relevant for determining regional growth rate in Spain and, if it is, how and to what extent. This purpose is not easy for a regional level, mainly on account of two reasons: the definition of budget constraint is not so clear for regions (where there are territorial equity mechanisms) and the availability of accurate data is lower in regional economies than when we study national economies.

Most references interested in evaluating the effects of fiscal policy on Spanish regional growth focus on public spending variables, especially public investment. De la Fuente (1995) and Mas et al. (1996) find that infrastructures have affected regional growth positively. Conversely, the results obtained by Gorostiaga (1999) and González-Páramo and Martínez (2003) are ambiguous about this positive effect. Regarding public transfers, Bajo et al. (1999) detect a negative effect of these on regional growth in Spanish regions, while this effect becomes positive in the poorest regions. Anyway, no study has tackled an integral treatment of public budget in regional growth empirics for the Spanish case, where both sides of public performance –taxes and expenditure– are taken into account.

The structure of the paper is the following. Section 2 presents details about the relevance of both sides of budget constraint in growth studies, with a special mention to the Spanish regional case. Section 3 describes the data sources we have used and characteristics of the variables involved in our regressions. Section 4 displays the estimates of a growth equation where several fiscal variables are included. Next section provides alternatives

estimates where we consider the likely endogeneity of various regressors. Finally, section 6 concludes.

2 Does public budget constraint matter in economic growth?

One of the main controversies in economic growth lies on whether growth rate of income per capita may be affected by government or not. The answer is clearly “no”, if we use a neoclassical growth model. In short, this theoretical framework establishes that steady-state growth rate is determined entirely by the rate of technological progress, which leaves a small scope for policy makers. Conversely, endogenous growth theories claim that long-run growth rate of income per capita may depend on other variables. Decreasing returns to scale in capital accumulation are the key point in neoclassical growth models because they trigger the exclusive link between growth rate and technological progress. However, endogenous growth models set different ways in order to avoid the fatal consequence of decreasing returns, for examples externalities, diffusion of technology or public activities.

Since our interest is to test what kind of effects fiscal policy has exerted on growth rate, we will use an endogenous growth framework implicitly. As is said above, many of the empirical papers on economic growth are not concerned with both sides of public performance: taxation and spending. Kneller et al. (1999) demonstrate that considering the different types of taxes and public expenditure are worth being considered. Moreover, budget deficit or surplus is also relevant.

The formal presentation by Kneller et al. (1999) is simple. Assume that we are interested in estimating the following equation:

$$g_{it} = \alpha_i + \sum_{i=1}^n \beta_i Y_{it} + \sum_{j=1}^m \gamma_j X_{jt} + u_{it}, \quad (1)$$

where g_{it} is the growth rate of economy i at time t , α_i is a constant that indicates the existence of individual characteristics in region i , $\sum_{i=1}^n \beta_i Y_{it}$ is a group of conditioning (non-fiscal) variables and $\sum_{j=1}^m \gamma_j X_{jt}$ is a set of fiscal variables; according to what we have already said, this vector of fiscal variables should include all taxes and public expenditures that are contained in public budget constraint, except one of them in order to avoid multicollinearity. If the variable to be omitted is X_{mt} , we are actually estimating this equation:

$$g_{it} = \alpha_i + \sum_{i=1}^n \beta_i Y_{it} + \sum_{j=1}^{m-1} (\gamma_j - \gamma_m) X_{jt} + u_{it} \quad (2)$$

Hence the key point is to choose a variable that theory suggests has no effect on growth (i. e., lump-sum taxation) or that an adequate empirical analysis guesses that γ_m is equal to zero. So the estimation of equation (2) will not be biased. The interpretation of coefficients for remaining variables is the effect of a change in the relevant variable offset by a change in the omitted variable. This implies that the variable X_m omitted becomes an implicit financing source if the relevant variable is a spending variable or becomes an implicit increment in public spending if the relevant variable is a tax.

Both Kneller et al. (1999) and Bleaney et al. (2001) have empirically illustrated the importance of considering all fiscal variables by means of a battery of estimates to explain growth rate. Now we are concerned with this question: what can we expect at a regional level? We wonder if, what is true for national economies, is fulfilled in a lower dimension.

The argument above cannot be transferred to regional economies easily. At least three main circumstances hinder a simple replication of the paper by Kneller et al. to a regional case. Firstly, public budget constraint is not so well defined in a regional scale as in a national government since the links between both sides of public budget constraint are fragile. The existence of interregional solidarity flows brings in that tax revenue collected in a region is not equal to the public spending done in that region, so the offset effects of variables omitted is lower than in a national case. However, public sectors in national economies also receive/give resources from/to other economies (for example, European funds). Strictly speaking, any economy could be analyzed according to the view of Kneller et al. In any case, the importance of considering all variables implied in the budget constraint seems to be more appropriated for national economies than for inferior government levels, where the match between taxes and expenditures is weaker.

Secondly, several fiscal variables that are relevant for an analysis of this nature have a nationwide character. This is the case of public deficit/surplus. It would not be reasonable to share national public deficit among regional territories because this variable has been generated by national taxes and expenditures programs and its effects on growth have a national impact¹.

Thirdly, the availability of accurate data for this kind of studies is reduced in the case of regional economies. This comment is not only referred to the poorer databases that exist for regional economies but also to the

¹This is specially true if we believe that the main consequence of public deficit on growth flows through a crowding-out effect of private investment; so a high private capital mobility among regions would reinforce this interpretation.

adjustment of the data to the concept of the variable. Due to the high economic integration of regional economies, a part of the effects of fiscal policy is not limited to regional borders. Both public spending and taxes will exert their effects not only on a region where they were initially assigned but also in regions that belong to the same institutional and economic structure, namely, the spillovers effects that public investment yields in neighbouring regions or the translation of a production or a consumption tax to other parts of the country. All these issues are not easy to attain but incidence studies may be helpful on this matter.

Hence we are aware that the approach followed by Kneller et al. (1999) to provide evidence of the relationships between fiscal policy and growth is not a satisfactory description of the regional performance. However, we wonder if the essence of their contribution may be a valid approximation to the regional growth processes. In other words, can we estimate a more completed specification of growth equations, including spending and tax variables simultaneously?

Next, we will give an overview about this issue. Regardless technical details, the estimates of a very simple growth regression for a panel of Spanish regions are shown in table 1 and 2. As can be seen, table 1 presents estimates where initial income per capita is included in regressions, so growth regression becomes a convergence equation that takes into account the initial situation for each economy. Only two non-fiscal conditioning variables have been considered apart from log of income per capita at the beginning of the period, namely: population growth and rate of private investment ¹.

Table 1: Growth regression for Spanish regions, 1965-1997. Dependent variable: growth rate of income per capita

	(1)	(2)	(3)
Log of initial income per capita	0.003 (0.001)	-0.001 (0.0009)	0.003 (0.001)
Population growth	-0.472 (0.110)	-0.495 (0.119)	-0.446 (0.112)
Private investment	0.138 (0.042)	0.230 (0.044)	0.132 (0.042)
Taxes	-0.110 (0.027)		-0.120 (0.029)
Public investment		-0.064 (0.106)	0.087 (0.111)
S.E. of Regression	0.141	0.148	0.141

Notes: Standard errors between parentheses. Source: FBBVA and IVIE

The evidence that both sides of public budget constraint should be taken into consideration is clear. When public investment is the only fiscal variable

¹Details on sources, construction of variables and estimation procedures will be provided later.

Table 2: Growth regression for Spanish regions (without initial income per capita), 1965-1997. Dependent variable: growth rate of income per capita

	(1)	(2)	(3)
Population growth	-0.510 (0.138)	-0.443 (0.145)	-0.057 (0.145)
Private investment	0.125 (0.045)	0.184 (0.049)	0.127 (0.044)
Taxes	-0.108 (0.024)		-0.148 (0.031)
Public investment		-0.204 (0.133)	0.290 (0.173)
S.E. of Regression	0.136	0.143	0.135

Notes: Standard errors between parentheses. Source: FBBVA and IVIE

included in regression (column (2)), a negative and insignificant coefficient is obtained for this regressor. Consistent with what was said before, this result might indicate that the effects of other fiscal variables omitted in estimation bias the coefficient of a variable expected to be beneficial for growth. As both fiscal variables are regressors, the coefficient for public investment turns into a positive sign, although not statistically significant. Also, it is noticed that the negative coefficient for taxes is bigger (in absolute terms) when the effect of public investment is considered explicitly (column (3)) than when this is ignored (column (4)); the effect of public investment may partially offset the reducing growth effect of taxes.

As no reasonable sign is obtained for the log of initial income per capita, this variable is removed and new estimates of growth regression are provided in table 2². Again, the results support the hypothesis that both sides of budget constraint are important. The coefficient of public investment becomes positive and significant at 10 per cent when a coefficient is estimated for taxes. The same happens for this variable: its negative coefficient increases the absolute value when positive effects of public investment are explicit.

So far, we have underlined the difference between public spending and tax variables in relation to the measurement of the effects of fiscal policy on growth. All this affects the regional dimension of growth processes, although their singular characteristics and limitations of data compel us to relax the framework to be followed.

3 Data sources and characteristics

Kneller et al. (1999) use the IMF's functional classification of fiscal data and distinguish between fiscal variables capable of influencing on growth and, on

²Easterly and Rebelo (1993) note that the significance of several variables in growth regressions is sensitive to the inclusion or not of initial income per capita. In order to avoid mis-specification, fixed effects have been included to control for differences among regions in the starting point; the values for these fixed effects seem to be a good proxy of initial income per capita (the results are available upon request).

the other hand, public expenditures and taxes which are non-productive variables according to the theory (for example, taxation on domestic goods and services, expenditure on recreation and economic services, etc.). Nevertheless, authors test to what extent their estimates are affected by this prior classification. Thus, they can make use of previous data and classifications so that researchers can evaluate several specification of public constraint. Conversely, the problems in a regional dimension are so severe that they impose a change in this strategy of study. Instead of basing the effects of fiscal policy on growth on the equations (1) and (2) and on a well-defined public budget constraint, firstly we have to explore what kind of data are available for this purpose. After studying such information, we reach the conclusion that a good approach is possible, but admitting that a replication strictu sensu is not possible for the regional case.

Our data consist of 17 Spanish regions over the period 1965-1997. We have used these non-fiscal variables:

1. Income per capita (y_{it}); this variable corresponds to regional GDP per active worker, with biannual observations. The choice of active population for measuring per capita regional output is intentional. After having used values corresponding to employed population and working-age population, we have checked that the best behaviour of the estimations takes places in the active population. This circumstance is specially clear if our purpose is to control the regional business cycle through unemployment rate (u_{it}), since some papers point out that the regional differentials in unemployment rates are relevant in the process of regional convergence in Spain (Bentolila and Jimeno 1995; Raymond and Garcia 1995). Hence unemployment rate has been included in later estimations³.
2. Private investment (sp_{it}). This variable has been defined as the ratio of private investment in physical capital over regional GDP.
3. Human capital stock (h_{it}). It is defined as the share of working-age population with secondary and university studies.
4. Population growth (n_{it}). Since our per capita variables are measured in terms of active worker, this variable refers to growth rate of regional active population.

The set of fiscal variables is consists of:

1. Productive public investment (sg_{it}): Percentage of productive public investment (roads, hydraulic infrastructures, urban structures, ports)

³Three observations with values very close to zero have been removed in order to avoid distortions in estimates.

over the regional GDP. For this category, we considered productive capital spending by central, regional and local governments.

2. Taxes (τ_{it}): Share of tax resources collected by the government over the regional GDP. This concept consists of social security contributions, direct and indirect taxes. This variable is a clear case in which a regional dimension impedes the use of an accurate variable; as we said above, the collected taxes in a territory do not have to be equal to the tax burden borne by residents in that territory when there is tax translation⁴.
3. Public consumption (cg_{it}). There are no data for this variable over the period 1965-1997. Then we have had to use two proxy variables. The first is regional labour cost in public sector. The second is the share of production of public services in a region over the value of total production.
4. Budget surplus/deficit (d_t). This is a level-national variable. Its value is common to all regions. A positive value denotes budget surplus and so on.
5. Social benefits (ps_{it}). This variable includes unemployment benefits, retirement pensions and familiar benefits.
6. Interregional fiscal flows (s_{it}). This variable is defined as a ratio; numerator consists of effects of public performance on households' income, i.e., households' gross disposable income minus direct incomes generated by households and other transfers received by households from rest of the world; denominator is regional GDP. This ratio aims to measure to what extent of regional GDP represents the flow of resources that comes from taxes and public spending programmes.

All the previous monetary variables are measured at 1986 prices. The source for human capital data has been IVIE (Instituto Valenciano de Investigaciones Economicas; <http://www.ivie.es/>). Budget surplus/deficit has been taken from the Spanish National Institute of Statistics. The rest of the data can be found in Foundation BBVA (several years); many of them are available in <http://w3.grupobbva.com/TLFB/TLFBindex.htm>.

Before introducing the results of estimates, we have checked that data for public consumption and taxes do not display a biased geographical distribution in favour of the region of Madrid. Although the values of Madrid are among the highest, they are below those corresponding to other regions in many periods.

⁴This fact could be also applied to a national economy, where tax incidence phenomena should be taken into account too.

4 Estimation of the growth regression with fiscal variables

This section provides results derived from the estimation of a growth regression similar to Eq (1), that is, combining fiscal and non-fiscal variables. We have used panel techniques, mainly because of the likely existence of unobservable regional characteristics. As pointed out by Islam (1995), this methodology allows us to yield unbiased estimates. Moreover, to employ panel regressions implies to elude several problems produced by a cross-section analysis; for example, cross-section studies using long observation periods leads to an endogenous selection of tax policy (Fölster and Henrekson, 2001), and cross sectional analyses may have a potentially severe simultaneity problem between fiscal and non-fiscal variables owing to the long period considered. All the estimation exercises have been carried out weighting the observations in the cross-section so as to avoid the heteroskedasticity caused by the different size of the units. We have also used a White covariance matrix. A time trend is included to control for (exogenous) technical progress ⁵.

Table 3 shows the results corresponding to several specifications of growth regression. None of them includes the human capital indicator due to the important problems of multicollinearity caused by this variable⁶. Given that the Hausman tests (Hausman, 1978) provide evidence on the existence of correlations between individual effects and the regressors, the results presented are obtained by a fixed effects (within groups) estimator. An F test is also included to evaluate the joint significance of the regional fixed effects; the null hypothesis of non-significance of these effects is strongly rejected.

The results in the table 3 show that the values and signs of non-fiscal variables are those to be expected. Moreover, their statistical significance is accepted. The negative sign for log of initial per capita income reflects the catching-up effect of poorer economies. Since our specification of this regressor is in terms of logarithms, we can compute an estimate of speed of convergence towards steady-state. This value is around 6-8 per cent for all estimates and similar to those obtained in other studies when using panel data (Islam, 1995). Unlike papers such as Fölster and Henrekson (1999)

⁵This time trend is strongly correlated to income per capita. We have decided not to omit it because its absence affects considerably the coefficient of fiscal variables, especially public investment. These estimates are available upon request. Obviously, coefficient of income per capita will be altered but its statistical significance is still prevail.

⁶Notice that this variable behaves like income per capita. Moreover, we can see that the effects of human capital on growth are very difficult to grasp (see, for instance, De la Fuente, 2002; Wolf, 2000; Kneller et al., 1999). Anyway, the results of estimates with human capital are available upon request.

Table 3: Growth regression with fiscal variables for Spanish regions, 1965-1997. Dependent variable: growth rate of income per capita

	(1)	(2)	(3)
$Log(y_{i0})$	-0.121 (0.016)	-0.133 (0.016)	-0.163 (0.015)
n_{it}	-0.309 (0.120)	-0.414 (0.128)	-0.306 (0.133)
sp_{it}	0.200 (0.036)	0.174 (0.039)	0.188 (0.041)
sg_{it}	-0.160 (0.127)	0.127 (0.128)	0.073 (0.135)
cg_{it}	-0.258 (0.176)	-0.430 (0.186)	-0.710 (0.165)
ps_{it}	-0.474 (0.071)	-0.340 (0.074)	
τ_{it}	0.445 (0.073)		
s_{it}			-0.176 (0.073)
u_{it}	-0.039 (0.032)	-0.0003 (0.033)	-0.058 (0.030)
RSS	0.076	0.083	0.087
Hausman	192.20	25.97	33.01
F-test	2.59	2.27	5.18

Notes: Standard errors between parentheses. Source: FBBVA and IVIE

and Kneller et al. (1999), where a negative and not significant coefficient is reached for private investment in most specifications, reasonable coefficients are achieved for this variable in our sample, although their values are slightly low. In turn, unemployment rate performs according to its character, that is, controlling for business cycle.

Regarding fiscal variables, a more detailed explanation is necessary. Public consumption always presents a negative and most significant coefficient, along the lines of Barro's (1991) results. This occurs using labour cost in public sector as proxy. But these results are replicated when another proxy variable is considered, i. e. share of public services production over total production ⁷. However, the value of public consumption is sensitive to the chosen specification, as was pointed out by Levine and Renelt (1992). These changes according to specification are dramatically evident in the case of public investment. The sign of this variable turns out to be positive in columns (2) and (3) whereas it is negative in the first column. This circumstance could be caused by the high correlations we can find among several variables implied in regressions.

Another example is the case of taxes. They appear with an implausible positive sign in column (1). In fact, we find correlations in a range of 0.8-0.9 between taxes and variables such as initial income per capita, public investment and public consumption. So we have decided to remove taxes as can be seen in columns (2) and (3). Actually, the results in column (2) are not very relevant because the government redistribution function is not fully considered. Notice that this aim is pursued by means of taxes and social

⁷These estimates are not reported here but they are available upon request

benefits and only the latter is taken into account in column (2), so there is a risk of a serious problem of mis-specification. Hence, the last column of table (3) provides results by using the concept of interregional fiscal flow, where the governmental concern about equity is considered.

Under this specification of the growth regression, the coefficient of public investment continues to be positive but not significant. The new inter-regional fiscal flow variable presents a significant and negative sign, which indicates that the joint effect of taxes and public benefits is growth-reducing. There is a wide literature about the negative influence of taxes (Barro, 1990; King and Rebelo, 1990). The underlying idea is that taxes affect savings decisions and consequently, growth rate. Something similar happens in the case of public benefits: many government programs entail negative effects upon save and work incentives, and as a result of this, growth is affected negatively (Fölster and Henrekson, 1999). This circumstance is especially true at a regional level, where a high mobility factor leads efficiency gains through the location of production factors in more productive areas. However, mechanisms of income maintenance entail a disincentive for the mobility of factors, which provide their production services in regions where productivity is not the highest⁸.

Now we will deal with growth effects of fiscal variables more deeply. Actually, budget constraint has not been fully considered yet. Budget deficit or surplus can affect (regional) economic growth and this is the new regressor we are going to include in the estimation.

Table 4 shows the results of the growth regression when budget surplus is included among regressors. Remind that the definition of budget surplus is that a positive value of this variable means a surplus, and vice versa. So the positive and significant sign signifies that budget surplus is growth-enhancing. The explanation of this fact is clear. Since the size of government is fairly large in modern economies, the public sector's decisions on savings are relevant for economic performance. A borrowing government implies lesser resources for private capital accumulation, so economic growth is negatively affected⁹.

As can be seen in table 4, unemployment rate acquires now a non-realistic positive sign. This may be caused by collinearity between budget deficit and unemployment rate. Both of them have a remarkable anticyclical effect, so unemployment rate has been removed from estimates in the second column; no great changes are perceived in the rest of coefficients.

Regarding these other coefficients, various comments can be drawn from table 4. Firstly, the inclusion of public deficit allows obtaining a bigger and

⁸Conversely, other authors (Sala-i-Martin, 1996, 1997) claim that public transfers can be a method to reinforce property rights (which implies a good scenario for capital accumulation) and also to retire low-productivity workers from labor force.

⁹This statement should be qualified if resources obtained by government through debt are devoted to investment.

Table 4: Growth regression with fiscal variables for Spanish regions (including deficit), 1965-1997. Dependent variable: growth rate of income per capita

	(1)	(2)
$Log(y_{i0})$	-0.138 (0.016)	-0.144 (0.015)
n_{it}	-0.423 (0.122)	-0.377 (0.124)
sp_{it}	0.145 (0.040)	0.127 (0.041)
sg_{it}	0.170 (0.128)	0.175 (0.129)
cg_{it}	-0.708 (0.163)	-0.609 (0.155)
s_{it}	-0.120 (0.073)	-0.112 (0.074)
d_t	0.004 (0.0008)	0.004 (0.0006)
u_{it}	0.066 (0.038)	
RSS	0.077	0.079
Hausman	82.21	180.58
F-test	3.96	4.30

Notes: Standard errors between parentheses. Source: FBBVA and IVIE

more significant coefficient for public investment. This is clear evidence that the former estimates for this coefficient were biased since budget deficit was not considered explicitly. Before including public deficit, the estimate for public investment took the effect of budget deficit as an implicit financing element. The same happens for public consumption. When budget deficit is considered, the coefficient of this variable is slightly lower than in column (3) in table 3. Again, the effect of public deficit has been hidden in the estimates for public consumption.

Secondly, table 4 proves that private investment reduces its contribution to growth rate. This can be seen as a consequence of the crowding-out effect that links government savings to private investment. Without considering budget surplus, the coefficient for private investment is bigger than the coefficient obtained when budget surplus is included. This means that private investment is a usual way through which public deficit can affect growth rate.

5 Alternative especificacions of the growth equation

Given the former estimates, at least two partial conclusions can be drawn. The first one refers to the importance of both sides of public budget when we are interested in studying the effect of government on economic growth. The second one is the consistency of the estimated coefficients for most variables included in the growth regression with economic theory. However, an addi-

tional comment should be done if we take into account the non-significant value achieved in our estimates for public investment. Moreover, previous references have stressed the risks of endogeneity when public capital is included in this kind of estimates (see, for example, Sturm, 1998). Similarly, the literature about economic growth has shown that private investment rate may depend on income growth rate (King and Levine, 1994). Hence, the likely endogeneity of some regressors in the growth equation might result in inconsistent estimations.

This possibility is dealt with in this section. We have used two instrumental variables methods. The first option we have followed is the one proposed by Fölster and Henrekson (2001). They estimate a growth equation in first differences by using a two-stage least squared estimator; both taxes and public expenditure variables are instrumented by the lagged levels of taxes and public expenditure, fixed country effects, and levels and first differences of the population and initial income per capita. The results of this strategy can be seen in our table 5; the instruments sets used in each specification are displayed in the appendix¹⁰.

As we said above, the value of coefficients in table 5 has been computed when growth regression is run in first differences, so they must be interpreted accordingly. First of all, one should notice that the estimated signs are the same as before, so an instrumental variables estimator does not add new relevant information. The coefficient of public consumption becomes significant when the lag of this variable is not included among the instruments set (column (3)); hence, endogeneity does not seem to be a problem for public consumption. The value obtained for public investment is now statistically significant and higher than private investment. This fact remains when the likely endogeneity of private investment is considered (columns (2) and (3) of table 5). In spite of recognising that an underprovision of infrastructures might be the cause for this phenomenon, it is difficult to explain why a coefficient for public investment is three times bigger than one for private investment.

Still, the main shortcoming of this specification is based on an econometric argument. Besides the fact the fit of the regressions in table 5 is worse than those previously presented, the two statistics $m1$ and $m2$ show evidence of serially correlated errors. To assume the lack of serial correlation in the disturbances is essential for the consistency of estimators. In order to test this hypothesis, we adopt the strategy suggested by Arellano and Bond (1991): if the errors are not correlated, the series of differentiated residuals should present a significant first-order correlation, while indications of second-order serial correlation ought not to be present. Unfortunately, these

¹⁰ Different definitions of the instruments set have been considered for running these regressions but all of them reinforce the result presented here; anyway, they are available upon request.

tests suggest a bad behaviour for the errors so that the results have to be interpreted with caution.

Table 5: Growth regression with fiscal variables for Spanish regions, 1965-1997. IV-1 Dependent variable: growth rate of income per capita

	(1)	(2)	(3)
$Log(y_{i0})$	-0.308 (0.017)	0.306 (0.017)	-0.299 (0.022)
n_{it}	-0.299 (0.145)	-0.296 (0.142)	-0.383 (0.131)
sp_{it}	0.225 (0.038)	0.192 (0.069)	0.225 (0.041)
sg_{it}	0.744 (0.277)	0.742 (0.277)	0.706 (0.284)
cg_{it}	-0.111 (0.485)	-0.105 (0.492)	-0.892 (0.335)
s_{it}	-0.770 (0.168)	-0.775 (0.170)	-0.572 (0.158)
d_t	0.001 (0.111)	0.001 (0.001)	0.0004 (0.001)
RSS	0.104	0.104	0.093
m1	-2.894	-2.973	-2.743
m2	-2.142	-2.145	-1.880

Notes: Standard errors between parentheses. Source: FBBVA and IVIE

A second method to control for endogeneity is to use a GMM procedure. Since the nature of this estimation procedure is minimizing the correlations between regressors and residuals, its utilization will allow us to generate an efficient instruments set. The potential heteroskedasticity in the disturbances suggests a two-step GMM procedure. Nevertheless, different Montecarlo simulations show that the standard errors estimated in a two-step procedure may be biased, so it is advisable to take one-step GMM estimators in the case of the inference based on asymptotic standard errors¹¹. Unlike the previous IV estimator, where first differences were considered, we come back to the within-groups estimator. Thus using lagged regressors as possible instruments is not the best option. We will employ, therefore, the transformation of variables in orthogonal deviations (Arellano, 1988).

The results of this methodology are shown in table 6. Different instruments sets have been considered. Once again no relevant changes are found. These estimates are very close to those in tables 3 and 4. Public investment and interregional fiscal flow undergo the expected signs but their statistical significance is far from the conventional threshold, although their standard errors are smaller. The fit of the regressions is better than in the case of the IV first differences estimator. The statistics $m1$ and $m2$ shows no evidence of serially correlated errors. A Sargan test has been used to check the validity of the instruments sets. Though the values are not reported here, the results reject the different groups of instruments; these tests are robust for

¹¹For a further discussion, see Arellano and Bond (1991). Also Judson and Owen (1999) justify one-step GMM estimator from another point of view: the smaller bias generated in non-balanced panels with a time dimension close to 20.

different definitions of the matrix of instruments¹².

Table 6: Growth regression with fiscal variables for Spanish regions, 1965-1997. IV-GMM Dependent variable: growth rate of income per capita

	(1)	(2)	(3)	(4)
$Log(y_{i0})$	-0.172 (0.021)	-0.168 (0.021)	-0.164 (0.020)	-0.160 (0.020)
n_{it}	-0.229 (0.122)	-0.254 (0.127)	-0.255 (0.127)	-0.234 (0.115)
sp_{it}	0.249 (0.056)	0.225 (0.050)	0.207 (0.048)	0.166 (0.033)
sg_{it}	0.117 (0.146)	0.203 (0.126)	0.180 (0.122)	0.175 (0.131)
cg_{it}	-0.578 (0.238)	-0.520 (0.227)	-0.529 (0.193)	-0.576 (0.222)
s_{it}	-0.139 (0.083)	-0.107 (0.070)	-0.109 (0.060)	-0.089 (0.085)
d_t	0.003 (0.0006)	0.003 (0.0006)	0.003 (0.0005)	0.004 (0.0005)
RSS	0.083	0.081	0.081	0.080
m1	3.266	3.235	3.255	3.037
m2	1.956	1.814	1.838	1.670

Notes: Standard errors between parentheses. Source: FBBVA and IVIE

6 Conclusions

This paper has provided evidence about the influence of different fiscal variables on regional economic growth. Basically, empirical studies about the effect of government on growth rate must take into account both sides of public budget constraint. Otherwise, the risk of achieving biased estimates for a growth equation is present and the conclusions might be misleading.

We have carried out this approach to the case of the Spanish regions over the period 1965-1997. Obviously, the transfer of this framework is not straightforward at a regional level. We find several difficulties, mainly those related to the variables used and to the availability of regional data. Anyway, a first view over our sample shows that it is important to consider taxes and public spending simultaneously in growth regressions.

We have run several regressions of a growth equation where fiscal and non-fiscal variables are included. The results do not differ from economic theory. Public consumption, taxes and social benefits affect growth rate negatively, whereas budget surplus and public investment exert a positive effect. The effect of public deficit seems to flow through private investment. In order to avoid a mis-specification problem, we have checked our results by including different sets of control variables and using instrumental variables estimators to control for endogeneity. The results remain the same.

¹²Arellano and Bond (1991) demonstrate the trend to over-reject the null hypothesis of the Sargan test in the presence of heteroskedasticity. Remind that we have chosen the option of estimating via one-step GMM. In turn, a remarkable sensitivity of the results is not appreciated as far as the choice of the matrix of instruments is concerned.

These findings suggest several policy implications. According to the estimates, the composition of public expenditure is relevant for the growth processes. Since public capital appears as a weighty production factor, public resources devoted to this aim will promote economic growth. Thus, current regional policies based on public investment have academic arguments to be implemented. However, this fact should not lead to automatically defend a significant increase of infrastructures programs because it is clear that public intervention implies a welfare cost as a result of the taxes used to finance it.

On the other hand, policy-makers must be aware that redistribution policies have an efficiency cost. Both social benefits programs and a part of public consumption linked to them satisfy equity principles but they may also introduce disincentives in job and savings decisions. From a regional point of view, social benefits play an important role in work force mobility, so an adequate design of them is really worthy. The dilemma between efficiency and equity exists and must be thought through.

A Appendix

This appendix collects the definition of instruments sets we have used in section 5. Table 5 includes estimates in first differences of the growth equation, and the instruments used are:

- Column (1): lagged levels of public investment, public consumption, interregional fiscal flow, public surplus/deficit; fixed country effects; levels and first differences of the population and initial income per capita; and first differences of private investment.
- Column (2): lagged levels of public investment, public consumption, interregional fiscal flow, public surplus/deficit and private investment; fixed country effects; levels and first differences of the population and initial income per capita.
- Column (3): lagged levels of public investment, interregional fiscal flow, public surplus/deficit; fixed country effects; levels and first differences of the population and initial income per capita; and first differences of private investment and public consumption.

Table 6 includes GMM estimates of the growth equation, and the instruments used are:

- Column (1): Levels of public investment, public consumption, interregional fiscal flow and public surplus/deficit with one lag.

- Column (2): Levels of public consumption, interregional fiscal flow and public surplus/deficit with one lag; and levels of public investment with one and two lags.
- Column (3): Levels of public consumption and public surplus/deficit with one lag; and levels of public investment and interregional fiscal flow with one and two lags.
- Column (4): Levels of public investment, public consumption, interregional fiscal flow and public surplus/deficit and private investment with one lag.

References

- [1] Agell, J., Lindh, T. and Ohlsson, H. (1997): Growth and the public sector: a critical review essay, *European Journal of Political Economy*, 13, pp. 33-52.
- [2] Arellano, M. (1988): An alternative transformation for fixed effects model with predetermined variables, *Applied Economics Discussion Paper*, n° 57. Institute of Economics and Statistics, Oxford.
- [3] Arellano, M. and Bond, S. R. (1991): Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations, *Review of Economic Studies*, 58, pp. 277-297.
- [4] Bajo-Rubio, O., Díaz, C. and Montávez, D. (1999): Política fiscal y crecimiento en las comunidades autónomas españolas, *Papeles de Economía Española*, 80, pp. 203-218. English version at: http://www.unavarra.es/organiza/econ/pdf/dt_9904.pdf.
- [5] Barro, R. J. (1990): Government spending in a simple model of endogenous growth, *Journal of Political Economy*, vol 98, n° 5, pp. 103-125.
- [6] Barro, R. (1991): Economic growth in a cross-section of countries, *Quarterly Journal of Economics*, 106, 2, pp. 407-443.
- [7] Bernanke, B. and R. Gurkaynak (2001): Is growth exogenous? Taking Mankiw, Romer and Weil Seriously, *NBER Working Papers*, 8365.
- [8] Bleaney, M. F., Gemmell, N. and Kneller, R., (1999): Testing the endogenous growth model: public expenditure, taxation and growth over the long-run, *Canadian Journal of Economics*, 34, pp. 36-57.

- [9] De la Fuente, A. (2002): Human capital in growth regressions: how much difference does data quality make? An update and further results, *mimeo*.
- [10] De la Fuente, A. and X. Vives (1995): Regional policy and Spain: Infrastructure and Education as Instruments of Regional Policy: Evidence from Spain, *Economic Policy*, 20, April 1995, 11-54.
- [11] Easterly, W. and Rebelo, S. (1993): Fiscal policy and economic growth: an empirical investigation, *Journal of Monetary Economics*, 32, pp. 458-493.
- [12] Fölster, S. and Henrekson, M. (2001): Growth effects of government expenditure and taxation in rich countries, *European Economic Review*, 45, pp. 1501-1520.
- [13] Fundación BBV (1999): *Renta Nacional de España y su Distribución Provincial. Serie Homogénea. Años 1955 a 1993 y avances 1994 a 1997*, varios tomos, Fundación BBV, Bilbao.
- [14] Fundación BBV (2000): *Renta Nacional de España y su Distribución Provincial. Año 1995 y avances 1996 a 1999*. Fundación BBV, Bilbao.
- [15] Helms, L. (1985): The effects of state and local taxes on economic growth: a time series-cross section approach, *The Review of Economics and Statistics*, 67 (3), pp. 574-582.
- [16] González-Páramo, J. M. and Martínez, D. (2003): Convergence across Spanish regions: New evidence on the effects of public investment, *The Review of Regional Studies*, forthcoming.
- [17] 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*, XXIII (1), pp. 95-114.
- [18] Judson, R. A. and Owen, A. L. (1999): Estimating dynamic panel data models: a guide for macroeconomist, *Economics Letters*, 65, pp. 9-15.
- [19] King, R. and Levine, R. (1994): Capital fundamentalism, economic development and economic growth, *Carnegie-Rochester Conference Series on Public Policy*, 40, pp. 259-292.
- [20] King, R. and Rebelo, S. (1990): Public policy and economic growth: Developing neoclassical implications, *Journal of Political Economy*, 98 (1), pp. 126-151.
- [21] Kneller, R., Bleaney, M. F. and Gemmell, N. (1999): Fiscal policy and growth: evidence from OECD countries, *Journal of Public Economics*, 74, pp. 171-190.

- [22] Hausman, J.A. (1978): Specification test in econometrics, *Econometrica*, 46, pp. 1.251-1.271.
- [23] Islam, N. (1995) Growth empirics: a panel data approach, *Quarterly Journal of Economics*, 95, 1127-1170.
- [24] Levine, R. and Renelt, D. (1992): A sensitivity analysis of cross-country growth regressions, *American Economic Review*, 82, pp. 942-963.
- [25] Mas, M., Maudos, J. Pérez, F. and Uriel, E. (1996): Infrastructure and productivity in the Spanish regions, *Regional Studies*, 30 (7), pp. 641-650.
- [26] Modifi, A. and Stone, J. (1990): Do state and local taxes affect economic growth?, *The Review of Economics and Statistics*, 72 (4), pp.686-691.
- [27] Sala-i-Martin, X. (1996): The classical approach to convergence analysis, *Economic Journal*, 106, pp. 1019-1036.
- [28] Sala-i-Martin, X. (1997): Transfer, social safety nets and economic growth, *International Monetary Fund Staff Papers*, 44, pp. 81-102.
- [29] Sturm, J.-E. (1998): *Public capital expenditure in OECD countries*, Edward Elgar Publishing Limiting, Cheltenham.
- [30] Tanzi, V. and Zee, H. (1997): Fiscal policy and long-run growth, *International Monetary Fund Staff Papers*, 44, pp. 179-209.
- [31] Wolf, E. N. (2000). Human capital investment and economic growth: exploring the cross-country evidence, *Structural Change and Economics Dynamics*, 11, 433-472.