

MODELLING TAX DECENTRALISATION AND REGIONAL GROWTH

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ABSTRACT

The aim of this paper is to determine a theoretical linkage between tax decentralisation and regional growth. For this purpose Zou's (1996) analytical framework, which account for the potential effects of intergovernmental policies on regional growth, is considered. In this context a tax decentralisation indicator with a *flypaper effect* is introduced and a Cobb-Douglas form for the production technology is specified. As a consequence an optimal level of tax decentralisation for regional growth is obtained, it depends on private and public capital productivities, the tax burden rate in the absence of decentralisation and the intensity of the *flypaper effect*. Finally a hypothesis for the Spanish economy is obtained. It will be checked empirically in subsequent work.

Keywords: tax decentralisation, general equilibrium analysis, regional growth.

JEL classification: H77, O41, R13.

I. 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 arose out of a much wider tradition concerned with the relationships between fiscal decentralisation and a series of economic and political goals, which was founded 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 government size, macroeconomic stability, fostering appropriate conditions in the markets and for government, and poverty reduction.

The main spur to the development of this new line of research has been the devolution process from central to lower tiers of government, a process that has taken place 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, motivated scholars to take up or continue this line of research. Consequently, the process holds a key place in the study of these economies with research focusing on the possible relationship with economic growth, one of the basic academic concerns of the 1990s.

A detailed review of the current state of research into the question of the relationship between fiscal decentralisation and economic growth is to be found in Martínez-Vázquez and McNab (2003). These scholars 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. Moreover, they argue that a series of problems need to be overcome if we are to arrive at consistent estimates of the relationship between fiscal decentralisation and economic growth and avoid accepting potentially erroneous results. At the same time, they highlight the need to develop the theoretical basis for the relationship further by answering the question of why we should expect fiscal decentralisation to have any effect on economic growth. The aim of this paper is precisely to contribute to this theoretical development.

Let us begin by clarifying the concept of fiscal decentralisation. We mean by this expression those processes by which policy is devolved from central to lower tiers of government, without specifying whether this refers to spending or revenue



raising powers. Hence, when we wish to refer explicitly to the transfer of spending, we shall use the term “expenditure decentralisation”, and when devolution affects revenues either “revenue decentralisation” or “tax decentralisation”.

Martínez-Vázquez and McNab (2003) draw a clear distinction between the direct and indirect relationships between fiscal decentralisation and economic growth, indicating that it is the latter which may be identified via the traditional effects of fiscal decentralisation. In this paper, however, we shall concentrate on the direct relationship, which is clearly described in Oates (1993)¹, who transposes the essence of his proposition concerning the positive impact of fiscal decentralisation on economic efficiency to the dynamic sphere of economic growth, though without formal analysis. The economic efficiency proposition was developed within a static framework in Oates’ (1972) Decentralisation Theorem and was further reinforced with the population mobility arguments put forward by Tiebout (1956). Thus, regional and national economic growth could be increased if decisions concerning investment in different types of capital were taken at 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 taken as the starting point for the empirical and theoretical research undertaken between the second half of the 1990s and the present to study the existence of possible fiscal decentralisation effects on economic growth. This series of studies includes eminently empirical work seeking to quantify the effect, such as 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) and Iimi (2005) and papers that not only attempt to quantify the effect but also to construct a simple analytical model reflecting the relationship existing between the two phenomena, these include papers by Davoodi and Zou (1998), Xie *et al.* (1999), Zhang and Zou (2001), and Martínez-Vázquez and McNab (2002). Finally, there is the work of Zou (1996), Brueckner (1999) and Gong and Zou (2002 and 2003), who focus exclusively, and therefore in greater detail, on the construction of the analytic framework.

Our aim here is to add to the latter group of papers, which is to say those that seek to establish an analytical framework that would describe as fully as possible the relationships existing between the phenomena of fiscal decentralisation and economic growth, and for this reason we shall concentrate on the pioneering work of Zou (1996). In this paper, the author identifies long-term effects from taxes and transfers on the accumulation of private and public capital in a representative region and, therefore, on economic growth. However, we observe what we consider to be two significant limitations in Zou’s model.

¹ Nevertheless, other scholars of fiscal federalism also describe effects on economic growth. See, for example, Bahl and Linn (1992), Rivlin (1992), Bird (1993) and Gramlich (1993).

The first is the partial consideration of central or federal government, which is assumed not to invest or spend on its own behalf within the region, but to act simply as a tax collector and provider of funding through transfers².

The second limitation in Zou (1996) is that it fails specifically to include a process for fiscal decentralisation, on the basis of which we might identify its effects on economic growth in the representative region in order to propose any explanatory hypothesis. Let us note here, that in modelling the fiscal decentralisation process within the framework of growth models the literature has hitherto concentrated on expenditure decentralisation to arrive at growth-maximising expenditure shares among different levels of government³, while disregarding any consideration of the effects of tax decentralisation on economic growth⁴. It is this limitation, specifically in Zou (1996) and generally in the literature on the subject, that we seek to resolve in this paper.

The rest of this paper is structured as follows. Firstly, we briefly present the model described in Zou (1996) and explain key results. We then go on to describe how tax decentralisation might be included in such model and propose a hypothesis about the effects of this process on Spanish economic growth. We end with our conclusions and an indication of possible avenues to extend this research.

II. ZOU'S (1996) MODEL

In 1996, Heng-fu Zou, a World Bank researcher, published *Taxes, federal grants, local public spending, and growth*⁵. The paper considers a two-tier structure of local and federal government, each with their own income tax, a local consumption tax, intergovernmental transfers and balanced budgets. Based on this scenario, Zou describes a regional economic growth model for the accumulation of local private and public capital, allowing investigation of the manner in which changes in taxes and transfers affect the long-term equilibrium values for private consumption and the stock of private capital, as well as local public consumption and stock of capital. This analysis is based on two different preferen-

² Gong and Zou (2003) and Gil-Serrate (2003) propose expanding the model in order to overcome this limitation.

³ See Davoodi and Zou (1998), Xie *et al.* (1999), and Zhang and Zou (2001).

⁴ Except for Agúndez (2002).

⁵ This work was presented as the development and expansion of a previous paper, *Dynamic effects of federal grants on local spending*, published in 1994, which described a very partial dynamic analysis focusing on the effects of intergovernmental transfers on local public consumption and investment but assuming that tax revenues were constant and ignoring any effects on private sector's consumption and investment.

structures for a representative agent, the first including local public as well as private consumption as an argument in the utility function, and the second considering local public investment as well as public and private consumption. The latter structure was originally proposed by Arrow and Kurz (1970). The result is a dynamic system that assumes the federal government does not invest or consume on its own behalf in the region and therefore comprises four differential equations and four endogenous variables reflecting local private and public consumption, and local private and public investment (c , E , k_p , k_s).

These equations are obtained on the basis of:

1. A utility function for the representative agent (productive family) in the representative region defined in accordance with the commonest preferences structure on the basis of private consumption (c) and local public consumption (E)⁶ such that intertemporal utility is given by:

$$\int_0^{\infty} [u(c) + v(E)] e^{-\rho t} dt, \quad \text{with } 0 < \rho < 1 \quad (1)$$

where ρ is a constant representing the intertemporal discount rate which, in the form it appears in the expression, reflects the preference for present as opposed to future consumption.

The utility function is increasing, concave and continuously differentiable, while its additive form simplifies the analysis but does not affect key results.

2. A production function for the representative agent, which is defined by two inputs, private capital (k_p) and local public capital (k_s):

$$y = y(k_p, k_s) \quad (2)$$

This is also an increasing, concave and continuously differentiable function, in which the two types of capital are complementary.

The production function also satisfies the Inada's conditions:

- 1) $y_i \rightarrow \infty$ as $k_i \rightarrow 0$
- 2) $y_i \rightarrow 0$ as $k_i \rightarrow \infty$

where y_i is the production function first derivative of k_i , with $i=p, s$.

In order to simplify subsequent analysis no capital depreciation is considered.

3. A federal government that collects an income tax from the private sector in the representative region at the rate τ_f in each period. Expenditures consist of two types of matching grants to the representative local government: a matching

⁶ As we have already explained, the author also considers a preferences structure including local public investment (k_s) as well as consumption in the utility function. However, he makes clear that this is not the most usual structure to be found in the literature and goes on to remark that this specification results in the disappearance of such desirable properties for the equilibrium of the resulting system as unity and stability.

grant for local public investment (at the rate α , with $0 < \alpha < 1$) and a matching grant for local public consumption (at the rate β with $0 < \beta < 1$). The budget is balanced, such that:

$$\tau_f y = \alpha \dot{k}_s + \beta E \quad (3)$$

where \dot{k}_s is local public investment in the representative region for each period.

4. A representative local government that collects an income tax at the rate of τ_s on the private sector and a consumption tax at the rate τ_c on private consumption. Hence, total revenue of a typical local government will consist of these taxes plus the transfers received from the federal government, and its total expenditure will consist of local public consumption and local public investment. Once again, a balanced budget is assumed such that:

$$\tau_s y + \tau_c c + \alpha \dot{k}_s + \beta E = \dot{k}_s + E \quad (4)$$

Based on (3) and (4) Zou arrives at what he terms an integrated budget constraint for the local and federal governments, although this could in fact be defined simply as a local budget constraint in view of the structure of the model as regards the federal government:

$$\dot{k}_s = (\tau_s + \tau_f)y + \tau_c c - E \quad (5)$$

A budget constraint can now be defined for the representative agent, and this is given by the condition that the agent's income after tax is equal to total consumption and investment expenditures:

$$(1 - \tau_f - \tau_s)y - \tau_c c = \dot{k}_p + c \quad (6)$$

where \dot{k}_p is private investment made by the representative agent in the period of time considered.

Reordering the terms, Zou obtains:

$$\dot{k}_p = (1 - \tau_f - \tau_s)y - (1 + \tau_c)c \quad (6')$$

He then goes on to address dynamic optimisation by the private agent and the representative local government. Both seek to maximise the well-being of the agent, taking into account their respective budget constraints, based on the respective control variables (local private and public consumption) and state variables (local private and public investment), thereby obtaining the four equations referred to above:

$$\dot{k}_p = (1 - \tau_f - \tau_s)y - (1 + \tau_c)c \quad (6')$$

$$\dot{k}_s = (\tau_s + \tau_f)y + \tau_c c - E \quad (5)$$

$$\dot{c} = \frac{u'(c)}{-u''(c)} [(1 - \tau_f - \tau_s)y_p - \rho] \quad (7)$$

$$\dot{E} = \frac{v'(E)}{-v''(E)} [\tau_s (1 - \alpha)^{-1} y_s - \rho] \quad (8)$$

Finally, Zou proves that the dynamic system, composed of these four equations, has a unique perfect foresight equilibrium.

Table I summarises the main results obtained by Zou. It reflects the effects of changes in the exogenous variables: federal income tax (τ_f), local income tax (τ_s), local consumption tax (τ_c), investment matching grants to the representative local government (α), and matching grants to the representative local government for public consumption (β) on the long-term equilibrium values of the endogenous variables: stock of private capital (\bar{k}_p), stock of public capital (\bar{k}_s), private consumption (\bar{c}) and local public consumption (\bar{E}). These effects are studied for the two types of preferences assumed, which are private and local public consumption as factors in utility function (A), and private consumption, local public consumption and local public investment as arguments in utility function (B).

Table I
LONG-TERM EFFECTS OF TAXES AND TRANSFERS. ZOU (1996)

Endogenous variables	Exogenous variables									
	τ_f		τ_s		τ_c		α		β	
	A	B	A	B	A	B	A	B	A	B
\bar{k}_p	-	-	?	?	0	+	+	+	0	-
\bar{k}_s	-	-	?	?	0	+	+	+	0	-
\bar{c}	-	-	?	?	-	?	+	+	0	-
\bar{E}	?	?	?	?	+	+	+	+	0	-

Applying Zou's (1996) model under the commonest preferences structure (A), it may thus be affirmed that any increase in federal taxation has negative effects on long-term capital accumulation and therefore on economic growth; that the effect of an increase on the local income tax is indeterminate; that an increase in local public investment transfers will stimulate local economic growth; and that economic growth is not affected by changes in transfers for local public consumption. The complementary nature of private and local public capital is a determining factor for these results.

This paper is the first to propose a general equilibrium framework to analyse the effects of changes in taxation and grants on local economic growth. However,

it has nothing explicit to say regarding the effects of a fiscal decentralisation process. In subsequent research, Davoodi and Zou (1998), Xie, Zou and Davoodi (1999), and Zhang and Zou (2001), within the framework of endogenous growth, consider the possible effects of expenditure decentralisation arriving as we have said at growth-maximising expenditure shares among different levels of government. These turn out to be the ratios of individual productivity over the aggregate productivity of spending by different levels of government. Hence, if expenditure allocations do not coincide with these ratios, a simple reallocation can lead to higher economic growth without altering the total budget share in GDP⁷. The effects of tax decentralisation on growth have yet to be investigated, and we shall address this issue in the next section using Zou's (1996) model as the framework.

III. ZOU'S (1996) MODEL AND TAX DECENTRALISATION

Leaving aside the local consumption tax (τ_c) for the sake of simplicity, and given that the exclusion of this tax does not alter the results we are interested in, our basic aim is to incorporate a process of tax decentralisation into the model and identify its effects on long-term economic growth in the representative region. This process of tax decentralisation may be viewed as a gain for the tax autonomy of the region, insofar as the percentage of total local government funding obtained through federal government transfers will decline accordingly or, to look at the other side of the coin, because the percentage of total funding raised through the local income tax will rise.

In the first place, we need to define a tax decentralisation indicator. Starting from the representative local government budget constraint in Zou's (1996) model:

$$\tau_s y + \alpha \dot{k}_s + \beta E = \dot{k}_s + E \quad (4')$$

Dividing both terms by total expenditure ($\dot{k}_s + E$) and reordering the expression, we may obtain an indicator of the proportion of total local expenditure funded by own taxes ($\tau_s y$):

$$\tau_s y / (\dot{k}_s + E) = 1 - (\alpha \dot{k}_s + \beta E) / (\dot{k}_s + E) \quad (9)$$

Let us call this indicator Φ .

If we consider that equal percentages are transferred for local public consumption and investment ($\alpha = \beta$), the tax decentralisation indicator would be reduced to the expression:

⁷ This result was obtained using CES and Cobb-Douglas technologies.



$$\tau_s y / (\dot{k}_s + E) = 1 - \alpha \quad (9')$$

which is to say,

$$\Phi = 1 - \alpha \quad (9'')$$

Hence, if we wish to study the effects of a tax decentralisation process on Zou (1996), we need to consider a reduction in transfers from federal to local government (α). As a consequence, the federal government will reduce its tax rate (τ_f), assuming same level of income, because of the fall in the cost of transfers. If the local government wishes for its part to maintain its level of expenditure, it will need to respond with an increase in the tax rate (τ_s) to offset the decline in the funds transferred.

On the other hand, empirical studies described in a large literature following Gramlich (1977) suggest that in general one monetary unit received in the form of transfers results in an increase in regional public expenditure that is greater than the increase generated in such expenditure by an increase of one monetary unit in regional income due to a federal tax cut. This phenomenon has been labelled as the *flypaper effect* because, according to the studies cited, money tends to “stick” in the first sector (public or private) where it “lands”⁸.

In order to consider the *flypaper effect* in the model, let us denote τ to be total income tax rate when local public expenditure is financed exclusively through transfers. So, we have:

$$\tau_f = \tau \quad (10)$$

If local public expenditure is financed exclusively through local taxes we have, in turn:

$$\tau_s = \tau(1 - \pi), \quad 0 \leq \pi \leq 1 \quad (11)$$

where π would be an indicator of the intensity of the *flypaper effect*. So, for a certain level of tax decentralisation, Φ , we have:

$$\tau_f = \alpha \tau [1 - \pi \Phi] \quad (12)$$

$$\tau_s = (1 - \alpha) \tau [1 - \pi \Phi] \quad (13)$$

$$\tau_f + \tau_s = \tau [1 - \pi \Phi] \quad (14)$$

Incorporating our definition of a tax decentralisation indicator and the existence of the *flypaper effect* and excluding the local consumption tax, Zou's (1996) model could be reformulated as follows:

$$\int_0^{\infty} [u(c) + v(E)] e^{-\rho t} dt, \quad \text{with } 0 < \rho < 1 \quad (1)$$

⁸ Explanation of the *flypaper effect* is highly debated: see Bailey (1999), chapter 11.

$$y = y(k_p, k_s) \quad (2)$$

$$\tau_f y = \alpha \left(\dot{k}_s + E \right) \quad (3')$$

$$\tau_s y = (1 - \alpha) \left(\dot{k}_s + E \right) \quad (4'')$$

Hence, the regional government and individual constraints are:

$$\dot{k}_s = \tau [1 - \pi \Phi] y - E \quad (5')$$

$$\dot{k}_p = [1 - \tau [1 - \pi \Phi]] y - c \quad (6'')$$

Dynamic optimisation by the private agent and the representative local government is thus described by the following system of equations:

$$\dot{k}_p = [1 - \tau [1 - \pi \Phi]] y - c \quad (6''')$$

$$\dot{k}_s = \tau [1 - \pi \Phi] y - E \quad (5'')$$

$$\dot{c} = \frac{u'(c)}{-u''(c)} [[1 - \tau [1 - \pi \Phi]] y_p - \rho] \quad (7')$$

$$\dot{E} = \frac{v'(E)}{-v''(E)} [\tau [1 - \pi \Phi] y_s - \rho] \quad (8')$$

It is clear that this system has a single equilibrium and following Buiter (1984), as Zou (1996) does, it can be shown that this equilibrium is stable.

In order to determine the effects of a tax decentralisation process on regional economic growth, we shall consider that the production function takes a Cobb-Douglas form such that:

$$y = A k_p^\gamma k_s^\eta \quad (15)$$

where $0 < \gamma < 1$, $0 < \eta < 1$, and $\gamma + \eta < 1$

Under this assumption the system's equilibrium is reduced to:

$$[1 - \tau [1 - \pi \Phi]] A \bar{k}_p^\gamma \bar{k}_s^\eta - \bar{c} = 0 \quad (16)$$

$$\tau [1 - \pi \Phi] A \bar{k}_p^\gamma \bar{k}_s^\eta - \bar{E} = 0 \quad (17)$$

$$[1 - \tau [1 - \pi \Phi]] \gamma \bar{y} / \bar{k}_p - \rho = 0 \quad (18)$$

$$\tau [1 - \pi \Phi] \eta \bar{y} / \bar{k}_s - \rho = 0 \quad (19)$$

where \bar{k}_p , \bar{k}_s , \bar{c} , \bar{E} and \bar{y} denote steady state variable values and the exogenous variables are τ , π and ρ .

Working out \bar{k}_p and \bar{k}_s from (18) and (19), we obtain:

$$\bar{k}_p = [[1 - \tau[1 - \pi\Phi]]\gamma A/\rho]^{(1-\eta)/(1-\gamma-\eta)} [\tau[1 - \pi\Phi]\eta A/\rho]^{\eta/(1-\gamma-\eta)} \quad (20)$$

$$\bar{k}_s = [\tau[1 - \pi\Phi]\eta A/\rho]^{(1-\gamma)/(1-\gamma-\eta)} [[1 - \tau[1 - \pi\Phi]]\gamma A/\rho]^{\gamma/(1-\gamma-\eta)} \quad (21)$$

Since

$$\partial y/\partial\Phi = y_p(\partial k_p/\partial\Phi) + y_s(\partial k_s/\partial\Phi) \quad (22)$$

and

$$\frac{\partial \bar{k}_p}{\partial\Phi} = (A/\rho)^{1/(1-\gamma-\eta)} [\tau\pi/(1-\gamma-\eta)] [\eta\tau(1-\pi\Phi)]^{\eta/(1-\gamma-\eta)} \left[\gamma(1-\eta)[\gamma[1-\tau(1-\pi\Phi)]]^{\gamma/(1-\gamma-\eta)} - \eta[\gamma[1-\tau(1-\pi\Phi)]]^{(1-\eta)/(1-\gamma-\eta)} [\tau(1-\pi\Phi)]^{-1} \right] \quad (23)$$

$$\frac{\partial \bar{k}_s}{\partial\Phi} = (A/\rho)^{1/(1-\gamma-\eta)} [\tau\pi/(1-\gamma-\eta)] [\gamma[1-\tau(1-\pi\Phi)]]^{\gamma/(1-\gamma-\eta)} \left[\gamma[\eta\tau(1-\pi\Phi)]^{(1-\gamma)/(1-\gamma-\eta)} [[1-\tau(1-\pi\Phi)]]^{-1} - \eta(1-\gamma)[\eta\tau(1-\pi\Phi)]^{\eta/(1-\gamma-\eta)} \right] \quad (24)$$

After a series of calculations we may establish the following proposition:

PROPOSITION 1.—*In Zou's (1996) model, an increase in tax decentralization as defined will*

1. *Generate economic growth if $\gamma \geq [1 - \tau[1 - \pi\Phi]]$ (which is equivalent to $\eta < \tau[1 - \pi\Phi]$, given that $\gamma + \eta < 1$).*
2. *Not generate economic growth if $\eta \geq \tau[1 - \pi\Phi]$ (which is equivalent to $\gamma < [1 - \tau[1 - \pi\Phi]]$, given that $\gamma + \eta < 1$).*
3. *Generate economic growth if $\gamma < [1 - \tau[1 - \pi\Phi]]$ and $\eta < \tau[1 - \pi\Phi]$ provided that: $\gamma/\eta > [1 - \tau[1 - \pi\Phi]]/\tau[1 - \pi\Phi]$.*

Let us note here that the scenario described in the first point of proposition 1 will only arise if the productivity of private capital or the effective tax rate are very high⁹. The scenario described in the second point, on the other hand, would only arise if the productivity of public capital were fairly high or the effective tax rate were very low¹⁰. In any other case, we would be in the scenario described in the third point of the proposition. Thus, for a tax decentralisation process to generate economic growth, it will have to conform to the inequality reflected in this point. If this is the case, and we wish to maximize the equilibrium value of *per capita* income for the representative region, we will need to embark upon a continuous process of tax decentralisation. The limit of this process will be either total decentralisation ($\Phi = 1$) or the equality:

⁹ In the latter case, it would be necessary for the tax rate to be extremely if public spending were financed exclusively by way of transfers. Moreover, the level of tax decentralisation would have to be low (or the level of the *flypaper effect* would have to be low, although this is highly unlikely according to Bailey (1999)).

¹⁰ This would in turn require a fairly low tax rate in the case that public spending were financed exclusively by way of transfers, or a very high level of tax decentralisation.

$$\gamma/\eta = [1 - \tau[1 - \pi\Phi]]/\tau[1 - \pi\Phi] \quad (25)$$

whichever is the first to be achieved. Similarly, in the economic growth scenario described in the first point, if we wish to maximize regional growth, in terms of the level of tax decentralisation, we will need to increase decentralisation until it is complete ($\Phi = 1$) or the equality given in (25) is achieved, following a change of scenario from that described in the first to that described in the third point. Finally, in the scenario reflected in the second point the same objective would be attained by reducing the level of tax decentralisation until it was completely eliminated ($\Phi = 0$) or by arriving at the equality given in (25) after moving to the situation described in the third point.

Hence, we may formulate a second proposition, re-expressing (25) in terms of Φ :

PROPOSITION 2.—*In Zou's (1996) model, the level of tax decentralisation as defined that will maximise the equilibrium per capita income for the representative region is: $\Phi^* = [1 - \eta/\tau(\gamma + \eta)]/\pi$.*

Since $0 \leq \Phi \leq 1$ by definition, any values lower than zero on the right-hand side of the equation given in proposition 2 will indicate that the optimum level of tax decentralisation is null ($\Phi^* = 0$), while values over 1 will signify that total tax decentralisation ($\Phi^* = 1$) is the optimum¹¹.

From the expression of proposition 2 we can also obtain the optimum effective tax rate:

$$\tau[1 - \pi\Phi^*] = \eta/(\gamma + \eta) \quad (26)$$

From these expressions we may deduce certain interesting results with regard to the optimum level of tax decentralisation, which we shall reflect here in a few simple simulations. Let us focus on how a change in one of the parameters affects the optimum level of tax decentralisation given acceptable values for the other parameters ($\gamma = 0,4$; $\eta = 0,1$; $\pi = 0,775$ ¹²; $\tau = 0,35$):

First, as may be observed in chart 1, the optimum level of tax decentralisation will increase the greater the productivity of private capital ($\partial\Phi^*/\partial\gamma > 0$), but it will decrease, as shown in chart 2, the greater the productivity of public capi-

¹¹ Note that values higher than 1 would refer to tax decentralisation processes seeking to maximise growth in the representative region that would arrive at total tax decentralisation before reaching equality between the ratio of the productivity of public and private capital and the ratio of percentage of available and subtracted income. Similarly, values lower than 0 would indicate processes of tax centralisation, once again seeking to maximise regional growth, that would eventually stop at null decentralisation but not because equality between the aforementioned two ratios had been reached.

¹² According to Bailey (1999), $\pi \in [0.6, 0.95]$. Hence, we may take the arithmetic mean of the two extremes of this interval.



tal ($\partial\Phi^*/\partial\eta < 0$). The reason for this result is that tax decentralisation releases public sector income to the private sector via the *flypaper effect*. Consequently, such decentralisation will be more efficient, and should therefore need to be taken further, the greater the productivity of private capital and the lower that of public capital. The limit for this process is the optimum effective tax rate, which will coincide with the coefficient between the productivity of public capital and the aggregate productivity of public and private capital.

Chart 1

OPTIMUM TAX DECENTRALISATION VERSUS PRODUCTIVITY OF PRIVATE CAPITAL

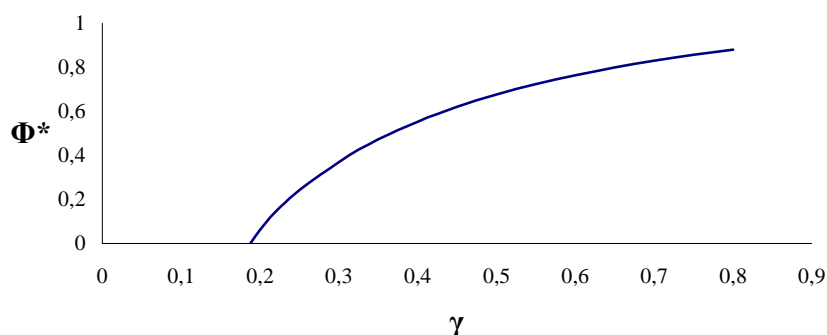


Chart 2

OPTIMUM TAX DECENTRALISATION VERSUS PRODUCTIVITY OF PUBLIC CAPITAL

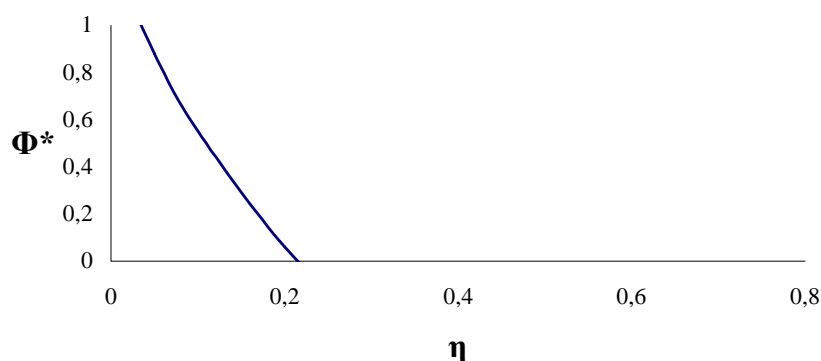
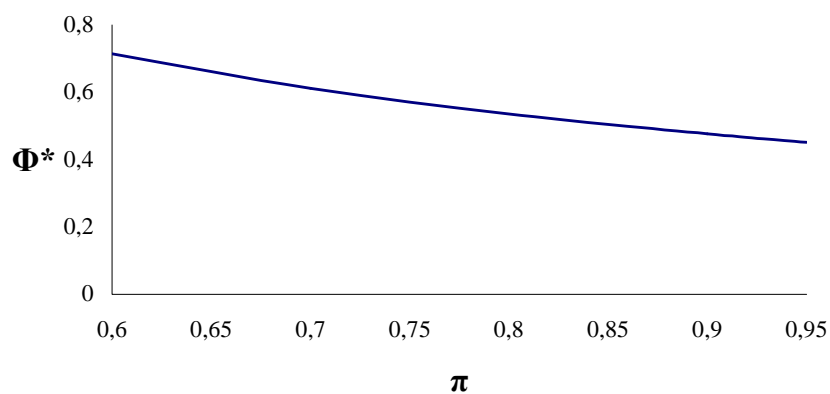


Chart 3

OPTIMUM TAX DECENTRALISATION VERSUS FLYPAPER EFFECT

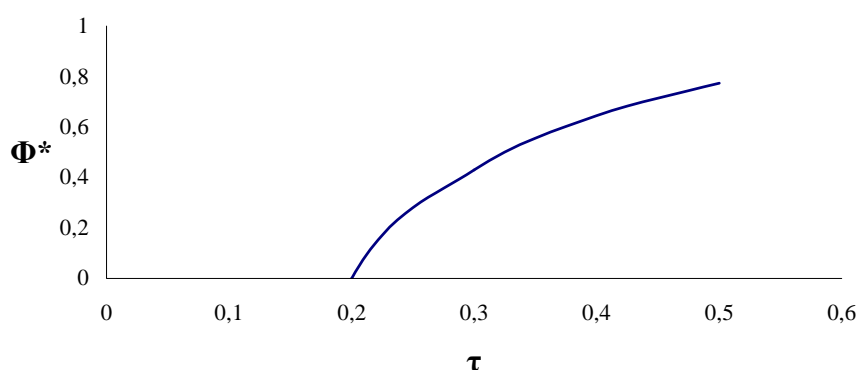


Second, as can be seen in chart 3, the optimum level of tax decentralisation will decline the greater the *flypaper effect* ($\partial\Phi^*/\partial\pi < 0$). This result arises because the more intense the effect the more income is released from the public to the private sector due to the tax decentralisation process, thereby arriving at the optimum effective tax rate at a lower level of tax decentralisation.

Finally, as shown in chart 4, the optimum level of tax decentralisation will increase the higher the tax rate that would exist if public spending were financed exclusively out of transfers ($\partial\Phi^*/\partial\tau > 0$). Naturally, the higher the tax rate in the absence of decentralisation, the more income will be released from the public to the private sector. Hence, the higher the level of tax decentralisation to achieve an effective tax rate that equals the coefficient between the productivity of public capital and the aggregate productivity of public and private capital.

Chart 4

OPTIMUM RATE OF TAX DECENTRALISATION VERSUS TAX RATE IN THE ABSENCE OF DECENTRALIZATION



These results are consistent with other findings contained in the literature. With reference to the literature on economic growth, Barro (1990) uses a Cobb-Douglas technique to show that the tax rate that maximises economic growth corresponds to the share of output that government would receive if the goods and services it provides were an input offered on a competitive basis. From our model, we may deduce that the contribution of the production inputs considered, k_p and k_s , to a unit of output is $\gamma + \eta < 1$, where γ is the contribution of private capital and η that of public capital. Following Barro (1990), then, the share of output that should be received by the public sector in the form of the tax rate if growth is to be maximised will be $\eta/(\gamma + \eta)$, as reflected in the expression for the optimum effective tax rate in (26). As Barro (1990) points out, when the tax rate exceeds this optimum level, the benefits obtained in terms of economic growth as a consequence of the generation of more public capital (let us remind that the two kinds of capital are complementary) does not offset the impediment to growth caused by the disincentive for private investment.

In the literature on decentralisation and economic growth, meanwhile, Agúndez (2002) proposes a model that links tax decentralisation to economic growth starting from those devised by Davoodi and Zou (1998) and Xie *et al.* (1999) which link expenditure decentralisation to economic growth. This model uses a Cobb-Douglas technique to obtain the optimum rate of tax decentralisation.¹³ In its simplest form, however, this optimum rate depends only on the productivity of the two types of public capital considered, in contrast to the expression given in proposition 2, and coincides with the optimum rate of expenditure decentralisation obtained in the two papers providing the framework for the model. Moreover, null or total decentralisation will only appear as the optimum rate at extreme (null) values for the productivities on which it is based. This is not the case with the optimum rate of tax decentralisation obtained in this paper.

Finally let us consider the case of the Spanish economy by way of illustration. We shall take figures for stocks of capital and income for the period 1980-1997¹⁴ and treat the average tax rate for the period¹⁵ as the effective tax rate. We have also obtained simple estimations of the productivity of the different kinds of capital based on the specification of the output function given in this paper¹⁶. Thus, the parameters of our model in this case are:

Table 2
TAX DECENTRALISATION AND REGIONAL GROWTH. PARAMETERS FOR THE SPANISH ECONOMY AS A WHOLE, 1980-1997

γ	η	$\tau[1-\pi\Phi]$
0.3756	0.0890	0.3042

Given that: $\gamma = 0.3756 < 0.6958 = [1 - \tau [1 - \pi\Phi]]$, $\eta = 0.089 < 0.3042 = \tau [1 - \pi\Phi]$ and $\gamma / \eta = 4.22 > 2.28 = [1 - \tau [1 - \pi\Phi]] / \tau [1 - \pi\Phi]$ an increase in the level of tax decentralisation in the Spanish economy compared to the level existing in the taken period would result in economic growth. However, this result should be considered with caution, because it represents no more than an illustration of the model, which at the best provides a hypothesis that would need to be substantiated with the necessary econometric rigour.

¹³ The definition of tax decentralisation (own tax revenues over total tax revenues) is similar to the definition of tax autonomy of the representative region in this paper.

¹⁴ The sources are *Instituto Nacional de Estadística* (INE), *Fundación Banco Bilbao Vizcaya Argentaria* (FBBVA) and *Instituto Valenciano de Investigaciones Económicas* (IVIE). We may note here that the process of tax decentralisation began in the early 1980s in Spain.

¹⁵ OECD (2004).

¹⁶ We would like to thank Jaime Sanaú-Villarroya for these estimations.

IV. CONCLUSIONS

Taking as our starting point the analysis of Zou (1996), one of the leading scholars to study the existence of a direct relationship between fiscal decentralisation and economic growth, we have identified two limitations in the model, which we have sought to resolve in order to contribute to the examination of this relationship. Having addressed the first of these limitations in an earlier paper, this paper concentrates on the need to incorporate a tax decentralisation process and examine its effects on economic growth in a representative region. By including this process in Zou's (1996) model, we have been able to determine the optimal level of tax decentralisation for regional growth. Merely for illustrative purpose, we have considered the case of the Spanish economy as a whole, as a result of which we have arrived at a hypothesis that progress in tax decentralisation does in fact contribute to economic growth in the case of Spain.

After modelling not only expenditure decentralisation (Davoodi and Zou (1998), Xie *et al.* (1999), and Zhang and Zou (2001)) but also tax decentralisation (Agúndez (2002) and this work), one possible avenue for the expansion of this research with regard to the further development of the theoretical basis for the relationship between fiscal decentralisation and economic growth would be to combine both phenomena in a single model. From an empirical standpoint, further research will be required to verify our hypothesis in relation to the Spanish economy.

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SÍNTESIS

PRINCIPALES IMPLICACIONES DE POLÍTICA ECONÓMICA

En la última década, numerosos países con economías en transición o en desarrollo han iniciado procesos de descentralización política y fiscal fomentados, normalmente, por instituciones internacionales y, en particular, por el Banco Mundial. Al mismo tiempo, en los países desarrollados ha surgido, o se ha vuelto a retomar, el debate de la descentralización. Todo esto ha llevado a que desde el ámbito académico se siga profundizando en el estudio de los posibles efectos de la descentralización fiscal en una serie de objetivos políticos y económicos tan relevantes como la eficiencia en el gasto público, la equidad fiscal horizontal o la estabilidad macroeconómica. Recientemente, la consideración de dichos efectos también se ha extendido al fenómeno del crecimiento económico, una de las preocupaciones fundamentales de los investigadores económicos en la actualidad.

En el análisis de la posible relación entre descentralización fiscal y crecimiento económico han surgido tanto trabajos empíricos, para grupos de países y para un país en concreto, como trabajos teóricos, dedicados a establecer y desarrollar un marco de trabajo en el que aparezcan vinculados ambos fenómenos. En este último grupo de trabajos, la atención se ha centrado en la descentralización del gasto, pero apenas se ha ocupado de la descentralización del ingreso.

El objetivo de este trabajo es establecer un vínculo teórico entre la descentralización impositiva y el crecimiento económico, en el contexto de una economía regional. Para ello, se toma como punto de partida el marco teórico descrito en uno de los primeros trabajos que se ocupan de los posibles efectos de las políticas intergubernamentales en el crecimiento regional, Zou (1996). A continuación, se construye un indicador de descentralización impositiva y se considera la existencia del llamado efecto *papel matamoscas*, ampliamente debatido en la literatura, que indica que un aumento en las transferencias intergubernamentales tiene un efecto mayor en el gasto público regional que una reducción impositiva federal.

De acuerdo con un procedimiento habitual en la literatura, consideramos que la función de producción del agente representativo presenta una tecnología Cobb-Douglas, y llegamos a la expresión del grado de descentralización impositiva que hace máximo el nivel de equilibrio de la producción regional per cápita. Observamos, además, que dicho nivel óptimo de descentralización impositiva aumenta conforme mayores son la productividad del capital privado o la tasa impositiva en ausencia de descentralización, y menores son la productividad del capital público y la intensidad del efecto *papel matamoscas*. Finalmente, calibramos nuestro resultado teórico con datos de la economía española para el período 1980-1997, y observamos que un aumento de la descentralización impositiva en dicho periodo habría resultado en un mayor crecimiento económico. No obstante, este resultado tiene que considerarse con mucha precaución, ya que simplemente supone una ilustración del modelo teórico, proveyéndonos, en el mejor de los casos, de una hipótesis que debe de ser probada empíricamente con el máximo rigor.

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