



## Essays on Fiscal and Monetary Unions

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Thesis submitted for assessment with a view to obtaining the degree of  
Doctor of Economics of the European University Institute

Florence, 02 November 2015



European University Institute  
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# Abstract

Are we better together? Versions of this question have been heard repeatedly around Europe on the aftermath of the Great Recession. On the Eurozone, the suboptimal design of the monetary union has contributed to create imbalances before the crisis and slow recoveries after it. Meanwhile, tensions are arising in some fiscal unions within the European Union, like the cases of Scotland in Great Britain or Catalonia in Spain. On this thesis, I discuss three topics on monetary and fiscal unions.

The first chapter examines the effect of monetary unions on the competitiveness of its members. In this paper, I explore the effect of the robust increase in public wages following the introduction of the Euro on the overall loss of competitiveness of the economies of the Eurozone periphery during the past decade. To that end, I simulate the drop on interest rates (risk premium) that these countries experienced just before the introduction of the common currency within a DGSE model with search and matching frictions and two sectors. I find that around 15% of the total increase in private wages during the 1999-2007 period can be attributed to the public wage channel, a mechanism described in the chapter.

Then, I turn my attention to fiscal unions. The second paper, joint with Reinhard Ellwanger, explores the relationship between fiscal decentralization and fiscal policy effects. We document a positive relationship between decentralization and the effectiveness of fiscal policy: on average, spending and revenue multipliers tend to be larger in more decentralized countries. The second part of the paper is a case study for the decentralization process in Spain. Using the narrative approach, we find that shocks to decentralization have a positive impact on subsequent output growth, particularly for the decentralization of direct taxation competences. Finally, the third

chapter explores the relation between the degree of decentralization of a country and its debt level. Contrary to the current literature and the prevailing public opinion, a panel data analysis of 31 European countries over a 12 year period shows that higher levels of regional decentralization have no effect on the levels of debt, even though it affects their spending and taxation income.

# Acknowledgments

First and foremost, I would like to thank my supervisor, Evi Pappa, without whom these pages would not exist. Her support, both academically and personally, will not be forgotten. I also thank the rest of the faculty of the Department of Economics, in particular to my second reader, Juan J. Dolado, and all the professors that put some time aside to listen to my ideas and offer invaluable help.

I warmly thank my colleagues and friends of my promotion: Alastair Ball, Janine Baumert, Antoine Camous, Matteo Fiorini, Andre Gama, Anna Gibert, Andrew Gimber, Adam Jakubik, Mathilde Lebrand, Wojciech Paczos, Marek Raczko and Kirill Shakhnov. I could not have picked myself a better group of people to make this five year journey with, and I am sure that we will continue to strengthen the network between us in the years to come.

I would like to thank the Spanish-speaking community of the European University Institute, a true support group and the core of my social life these intense years. They are unfortunately too many to name them all, so I would just name my fellow colleagues on the Economics Department: Brais Alvarez, Nicolas Aragon, Andreu Arenas, Gabriel Facchini, Ignacio Gonzalez, Antoni-Italo Moragas and Luis Rojas. I can only hope to keep their friendship whenever our professional careers may take us.

This dissertation was also possible, in no small part, thanks to the invaluable work of the administrative personnel of the Institute, ensuring that our deadlines were met, the money arrived, the Italian bureaucracy didn't pester us much and our stomachs were full. I thank them all.

Finally, I thank my friends and family, who offered their absolute, unconditional

support, even without knowing what I was doing or why was I doing it. And, of course, to my wife Cristina that, as a fellow PhD candidate, knew what I was doing and why I was doing it and decided to support me anyway. Without coursing my PhD I would have never met her, and that by itself justifies the whole endeavor.

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# Chapter 1

## The public wage channel on the post-EMU loss of competitiveness in the Eurozone periphery

### 1.1 Introduction

The loss of competitiveness of the peripheral economies of the Euro Area remains a concern for the European authorities, starting even before the onset of the current crises. The correction of these differentials on inflation, wages and productivity is proving to be a painful process. Without independent monetary policy and limited maneuvering room for fiscal policy, the governments of these economies have engaged in costly internal devaluation to correct course and converge with the core of the Eurozone.

The aforementioned differentials are reflected on imbalances on the real effective exchange rates (REER) within the fixed exchange rates regime of the common currency. These imbalances can be quantified thanks to the European Central Bank's data on harmonized competitiveness indicators, based on unit labor costs indexes. For every country, the indicator shows the REER calculated vis-à-vis 20 trading partners plus the other Euro Area countries. The REER of the main peripheral

	1971-1998	1999-2008
Ireland	0.8	3.0
Spain	-2.3	1.7
Portugal	-0.3	1.7
Italy	-0.1	1.4
Austria	-0.1	0.2
France	0.3	-0.1
Germany	-0.6	-0.1

Table 1.1: Annual growth of public wages minus annual growth of private wages.

economies of the Euro Area have appreciated markedly since their adoption of the Euro until the end of 2007: a 31.3% in Ireland, a 16.1% for Spain, 13.5% for Italy and 7.2% for Portugal; thereby hurting the competitiveness of their economies. By comparison, the REER of France has appreciated at a much slower pace, a 4.3%, whereas the REER of Austria and Germany actually depreciated, a 4.5% and 14.0%, respectively.

At the same time that labor costs and wages were going up in some Euro Area countries, public wages were going up even more. The wage premium paid to workers in the public sector in Ireland, Portugal, Spain and Italy went notably up. Table 1.1 presents data on the difference on average annual growth in wages per employee between the public and the private sectors for the pre- and post-EMU period. As can be seen in the table, public wages in the countries with the worst REER record for the post-EMU period have risen well over private wages, in comparison with the relative restraint of the northern countries on the post-EMU period or of all countries in the pre-EMU period.

The increase in public wages can have a “pull-effect” on private wages. This argument has been extensively documented on the literature, both theoretically and empirically. Theoretically, just to name a couple of examples, in Quadrini and Trigari (2007), Ardagna (2007) or Afonso and Gomes (2008) increases in public wages push the private wage up by improving the outside option of workers, thereby affecting wage bargaining. In Fernández-de-Córdoba, Pérez, and Torres (2012), the increase in public wages crowds out private employment and so the private wage goes up,

both because private employers need to match public wages to attract workers and because workers are more productive via the increase in public good provision. Empirically, Pérez and Sánchez (2010) found evidence of a public sector leadership role in wage setting for Germany, Spain, France and Italy, albeit in conjunction with bi-directional channels in the case of Germany and Spain. Also focusing on the causal two-way relationship between the public and private wage settings, Lamo, Pérez, and Schuknecht (2012) conclude that the private sector appears to have a stronger influence. However, the public wage setting has stronger feedback effects than the private wage setting, so that increases in public wages are likely to have strong effects on private wages.

On the other hand, the introduction of the EMU had the potential to relax the governments' budget constraint, making it easier to observe wage increases not attached to higher productivity. The reason for the relaxation of the budget constraint was the reduction on borrowing costs. As can be observed in figure 1.1, during the built-up to the introduction of the European common currency there was a reduction on the interest rate spread between the countries in the periphery of the Euro area and its core. This trend reverted during 2007 with the beginning of the Great Recession.

Therefore, the goal of this project is to evaluate the importance of the “public wage channel” on the loss of competitiveness of Spain following the introduction of the EMU. This channel works in the following way: the adoption of the Euro by this country had the effect of decreasing significantly its costs of financing. The subsequent relaxation of the budget constraint of the government (which can be modeled as a risk premium shock) leads to the observed increases in public wages. Finally, the higher public wages would have feedback effects on the private wages, with the final effect being a deteriorating competitiveness with respect to the core of the Euro Area, that was not affected by the drop on interest rates.

A hypothesis similar to this one was proposed by Johnston (2011). On her paper, the author argues that the pre-EMU period was marked by the efforts of the countries to meet the convergence criteria defined by the Maastricht Treaty. These efforts limited the bargaining power of public unions, reducing the pressure they could exert

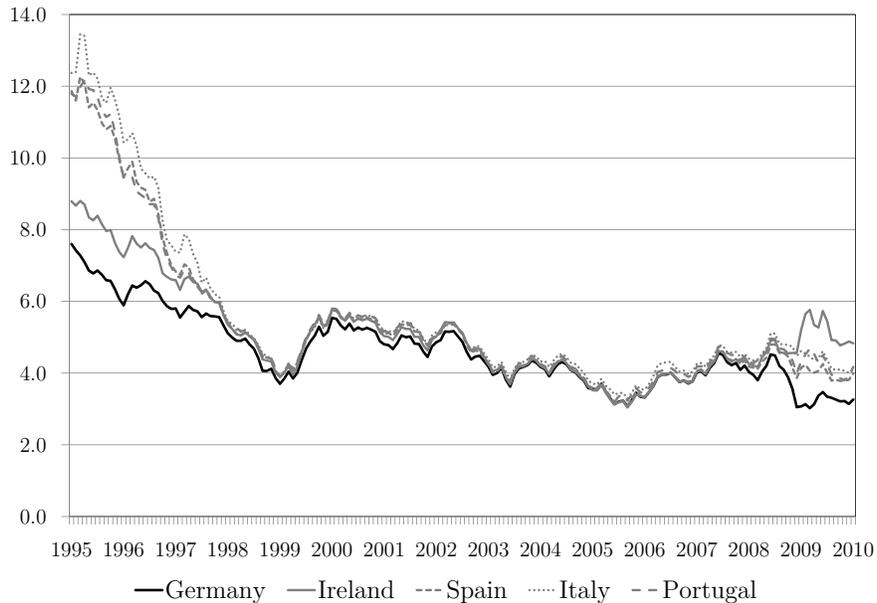


Figure 1.1: 10-year Government bond yield, monthly average.

on their governments. Once in the Euro, the conditions of the Maastricht Treaty were replaced with the softer conditions, in terms of enforceability, of the Growth and Stability Pact. Therefore, public unions could again pressure their governments for higher wages. On the other hand, private sector wages were constrained by the higher competitive environment resulting from the newly created monetary union. This way, the creation of the Euro led to an increase on the public wage premium: the author estimates that wage growth on the EMU's public sectors, relative to wage growth in manufacturing, was on average 0.6 per cent higher per year than it was in non-EMU and non-Maastricht years, on average for the whole EMU. This estimation is consistent with the data of table 1.1. What the author fails to notice is that the increase was focused exclusively in the peripheral economies, which were the ones most affected by the reduction in their financing cost. This asymmetry would support the hypothesis that it was changes in government financing conditions what led to the increase in the public wage premium, not changes in the bargaining position of the public unions.

Even though public wage bargaining can probably be excluded as a causal mechanism, it is still an important part of the picture. In the articles considered in the previous paragraphs, the public sector is usually modeled so as to follow exogenous rules, either on wages, on vacancies or both. However, as shown in Gomes (2014), if public jobs are safer, then the optimal policy for the public sector is to offer a lower salary than in the private sector, to avoid “queuing” for public jobs, which would increase unemployment. Given that we do not observe that in the data, but quite the opposite, it is evident that public unions are an important player, pushing up public wages. The influence of public unions will be introduced in the rules of the public sector, with unions pushing up for higher wages when the fiscal deficit of the government goes down; i.e., when unions perceive the governments’ budget constraint to be looser.

Estimating this proposed wage rule can be difficult, as the government wage bill itself is part of the evolution of the deficit. Instead, I estimate a public wage rule that reacts to changes in interest payments by the government. Such a wage rule reflects the reasoning developed during this introduction: a reduction in interest payments, due to decreasing interest rates in this case, is interpreted by the unions as a sign of a looser budget constraint and used as an argument to push wages up.

In the regression, I use data for Spain, Italy and Portugal from 1999 to 2007, representing the period where the countries had already entered the Euro (and were therefore not constrained by the Maastricht criteria) and before the beginning of the crisis. Data is annual and taken from the OECD Economic Outlook No. 90. Public wages ( $WG$ ) are defined as *real (base 2005) compensation rate of public employees* and computed in logs and the interest payments ( $IP$ ) are defined as *net government interest payments as a percentage of GDP*. The estimating equation relates the logarithm of public wages  $\log WG_{ct}$  to the interest payments  $IP_{ct}$ , controlling for total government debt ( $DEBT$ , defined as *Gross public debt, Maastricht criterion, as a percentage of GDP*) and unemployment ( $URATE$ , defined as *unemployed workers as percentage of active population*):

where  $\alpha_c$  are country fixed effects,  $\gamma_t$  are year fixed effects and  $u_{c,t}$  is an error term clustered at the country level. The coefficient  $\theta_1$  estimated is -0.166, which goes

$$\begin{array}{cccccc}
\log WG_{c,t} = \alpha_c + \gamma_t & +\rho \log WG_{c,t-1} & +\theta_1 IP_{c,t} & +\theta_2 DEBT_{c,t} & +\theta_3 URATE_{c,t} & +u_{c,t} \\
& 0.925^{***} & -0.166^{**} & -0.004 & 0.036 & \\
& (0.04) & (0.03) & (0.00) & (0.02) & 
\end{array}$$

in the expected direction: an increase of interest payments reduces public wages and vice versa. On the other hand, the value of the coefficient  $\rho$  of the lagged public wage is 0.925; both values will be used later in the calibration for the persistence of the wage rule and the reaction of the public wage to changes in interest payments.

In the next sections, I will construct and calibrate a DGSE model to replicate the economy of Spain just before the introduction of the Euro and then simulate the effects of the interest rate drop described above. The model includes two sectors, searching frictions on the labor market, staggered wage bargaining, capital adjustment costs and working capital.

## 1.2 The model

### Labor market

The economy is populated by a measure one of agents and composed of two sectors: a public and a private sector. At any point in time, agents are either working on the public sector, working in the private sector or unemployed. In the private sector, there is a continuum of infinitely lived firms of measure one, indexed by  $i$ . Each private firm  $i$  employs  $n_t^p(i)$  workers at time  $t$ . It also posts  $v_t^p(i)$  vacancies in order to attract new workers for the next period of operation. Therefore, the total number of private vacancies and employed workers are  $v_t^p = \int_0^1 v_t^p(i)di$  and  $n_t^p = \int_0^1 n_t^p(i)di$ . Denoting by  $n_t^g$  the number of workers employed in the public sector in period  $t$ , then:

$$1 = u_t + n_t^g + n_t^p \tag{1.1}$$

Through the paper, a superindex  $p$  will be used to represent a private sector variable and a superindex  $g$  to represent a public sector variable.

The evolution of employment in both sectors depends on the number of new

matches  $m_t^g$  and  $m_t^p$  and on the separations that occur every period. Jobs are destroyed at a constant fraction  $\sigma^j$ , different across sectors. The evolution of employment on each sector is then given by:

$$n_{t+1}^g = (1 - \sigma^g)n_t^g + m_t^g \quad (1.2)$$

$$n_{t+1}^p = (1 - \sigma^p)n_t^p + m_t^p \quad (1.3)$$

On the other hand, the new matches are determined by a Cobb-Douglas matching function for each sector:

$$m_t^g = \mu^g (u_t^g)^{\eta^g} (v_t^g)^{1-\eta^g} \quad (1.4)$$

$$m_t^p = \mu^p (u_t^p)^{\eta^p} (v_t^p)^{1-\eta^p} \quad (1.5)$$

Because I am assuming directed search,  $u_t^j$  represents the number of unemployed workers looking for a job in sector  $j$ . Call  $s_t$  to the proportion of unemployed agents looking for jobs in the public sector, so that  $u_t^g = s_t u_t$  and  $u_t^p = (1 - s_t)u_t$ . From the matching functions, I can define the probabilities of vacancies being filled on each sector as  $q_t^j$  and the job-finding rates conditional on searching in a particular sector  $p_t^j$ :

$$q_t^j = \frac{m_t^j}{v_t^j}, \quad p_t^j = \frac{m_t^j}{u_t^j}; \quad j = g, p \quad (1.6)$$

## Households

Each household is infinitely lived and derives utility from private consumption  $c_t$  and public good  $g_t$ , supplied by the government. It also derives utility from unemployment  $u_t$ , which captures leisure and home production. Following Merz (1995), I assume that all incomes in the household are pooled so as to eliminate the possibility of heterogeneity due to unemployment risk. Therefore, the problem of the household is to maximize:

$$E_t \sum_{t=0}^{\infty} \beta^t [u(c_t, g_t) + v(u_t)] \quad (1.7)$$

subject to the laws of motion of employment (1.2) and (1.3), and the budget constraint in period  $t$ :

$$(1 - \tau^c)c_t + i_t + \pi_t g_t = [r_t - \tau^k(r_t - \delta)]k_t + (1 - \tau^n)(w_t^g n_t^g + w_t^p n_t^p) + bu_t + \Pi_t \quad (1.8)$$

where  $w_t^j$  for  $j = g, p$  is the wage on each sector,  $r_t$  is the return to capital,  $b$  are unemployment benefits,  $\delta$  is the depreciation rate,  $\Pi_t$  encompasses transfers from the government and (potentially) profits from the firm,  $\tau^c$ ,  $\tau^n$  and  $\tau^k$  are taxes on consumption, labor and capital (allowing for depreciation), respectively, and  $\pi_t$  is the relative price of the public good.

Finally, capital evolves over time according to:

$$k_{t+1} = (1 - \delta)k_t + i_t - \frac{\omega}{2} \left( \frac{k_{t+1}}{k_t} - 1 \right)^2 k_t \quad (1.9)$$

where  $\frac{\omega}{2} \left( \frac{k_{t+1}}{k_t} - 1 \right)^2 k_t$  are adjustment costs, paid by the household.

Therefore, denoting the Lagrange multipliers of the budget constraint and the laws of motion of the public and private employment as  $\lambda_t^c$ ,  $\lambda_t^{ng}$  and  $\lambda_t^{np}$ , respectively, the FOCs of the households' problem are:

$$(c_t) \quad \lambda_t^c(1 - \tau^c) = U_{c,t} \quad (1.10)$$

$$(g_t) \quad \lambda_t^c \pi_t = U_{g,t} \quad (1.11)$$

$$(s_t) \quad \lambda_t^{ng} p_t^g = \lambda_t^{np} p_t^p \quad (1.12)$$

$$(n_{t+1}^g) \quad \lambda_t^{ng} = \beta \left\{ U_{u,t+1} + E_t \left[ \lambda_{t+1}^c [(1 - \tau^n)w_{t+1}^g - b] + \lambda_{t+1}^{ng} (1 - \sigma^g - p_{t+1}^g) \right] \right\} \quad (1.13)$$

$$(n_{t+1}^p) \quad \lambda_t^{np} = \beta \left\{ U_{u,t+1} + E_t \left[ \lambda_{t+1}^c [(1 - \tau^n)w_{t+1}^p - b] + \lambda_{t+1}^{np} (1 - \sigma^p - p_{t+1}^p) \right] \right\} \quad (1.14)$$

$$(k_{t+1}) \lambda_t^c \left[ 1 + \omega \left( \frac{k_{t+1}}{k_t} - 1 \right) \right] = \beta E_t \lambda_{t+1}^c \left\{ 1 - \delta + r_{t+1} - \tau_k (r_{t+1} - \delta) + \frac{\omega}{2} \left[ \left( \frac{k_{t+2}}{k_{t+1}} \right)^2 - 1 \right] \right\} \quad (1.15)$$

## Private good production

Each private good firm produces the consumption good with labor, capital and public good,<sup>1</sup>

$$y_t(i) = a_t [n_t^p(i)]^{(1-\varphi_p)} [k_t(i)]^{\varphi_p} (g_t)^{\varphi_{pg}} \quad (1.16)$$

where  $a_t$  is an aggregate technology shock that follows an AR(1) process with persistence  $\rho_a$  and standard deviation  $\sigma_a$ . Following Gertler and Trigari (2009), because there will be wage dispersion across firms, I replace the assumption of fixed costs of posting a vacancy with quadratic labor adjustment costs on the hiring rate,  $x_t^p(i)$ , defined as the ratio of new hires to the existing private workforce:

$$x_t^p(i) = \frac{q_t^p v_t^p(i)}{n_t^p(i)} \quad (1.17)$$

For simplicity, I assume capital is perfectly mobile across firms and that there is a competitive rental market for capital. The price of the good is normalized to one. Firms use working capital as in Neumeyer and Perri (2005) or Mendoza (2010): they take intra-period loans at the international rate  $R_t$  to finance a fraction  $\theta$  of their wage bill. Finally, since current hires give future value, the optimization problem is dynamic and firms maximize the discounted value of future profits. The problem

---

<sup>1</sup>Notice how the public good both gives utility to the household and is an input in the private production function. Public goods in this model are, for example, hospitals or highways, that are valuable to the individual but also increase the productivity of the firm (through healthier workers and lower transport costs, in these cases).

becomes:

$$Q^p(n_t^p(i), k_t^p(i)) = \max_{k_t(i), v_t^p(i)} \{y_t(i) - [1 + \theta R_t]w_t^p(i)n_t^p(i) - r_t k_t(i) - \frac{\kappa}{2}[x_t^p(i)]^2 n_t^p(i) + E_t[\Lambda_{t,t+1}Q^p(n_{t+1}^p(i), k_{t+1}(i))]\} \quad (1.18)$$

where  $\kappa$  is the a parameter for the adjustment costs and  $\Lambda_{t,t+1} = \beta \frac{U_{c_{t+1}}}{U_{c_t}}$  is the stochastic discount factor. The firm maximizes profits by choosing the number of vacancies posted and its capital stock, taking as given its existing employment stock, the probability of filling a vacancy, the rental rate on capital and the current and expected path of wages. As explained below, if the firm can renegotiate the wage, it bargains with its workforce over a new contract. If it is not renegotiating, it takes as given the wage at the previous period's level, as well as the likelihood it will be renegotiating in the future. The FOCs of their problem are:

$$(k_t^p(i)) \quad r_t = \varphi^p \frac{y_t(i)}{k_t^p(i)} = \varphi^p \frac{y_t}{k_t^p} \quad (1.19)$$

$$(v_t^p(i)) \quad \kappa x_t^p(i) = E_t \Lambda_{t,t+1} \left[ (1 - \varphi^p) \frac{y_{t+1}(i)}{n_{t+1}^p(i)} - (1 + \theta R_t)w_{t+1}^p(i) - \frac{\kappa}{2}[x_{t+1}^p(i)]^2 + (1 - \sigma^p)\kappa x_{t+1}^p(i) \right] \quad (1.20)$$

## Private wage determination

For the private firm  $i$ ,  $V_{n_t^p}^F(i)$  is the expected value of the marginal job, given by:

$$V_{n_t^p}^F(i) = (1 - \varphi^p) \frac{y_t^p(i)}{n_t^p(i)} - (1 + \theta R_t)w_t^p(i) - \frac{\kappa}{2}[x_t^p(i)]^2 + (1 - \sigma^p)\kappa x_t^p(i) \quad (1.21)$$

and  $V_{n_t^p}^H$  is the expected marginal value for the household of having an additional member employed in the private firm:

$$V_{n_t^p}^H = \lambda_t^c(1 - \tau^n)w_t^p(i) - U_{u,t} + \lambda_t^{np}(1 - \sigma^p - p_t^p) \quad (1.22)$$

The private wage is determined as the result of Nash bargaining between workers and firms. However, every period, each firm only has a probability  $\lambda$  of renegotiating with their workers. This process implies that it is not necessary to keep track of individual firms' wage histories, which makes aggregation simpler. Due to constant returns, all workers are the same at the margin, so all workers employed at the firm receive the same negotiated wage. When firms are not allowed to renegotiate the wage, all existing and newly hired workers employed at the firm receive the wage paid on the previous period. The problem then is to maximize the weighted sum of the surpluses, taking into account that the firm may not be able to renegotiate the wage:

$$\begin{aligned} \max_{(w_t^p)^*} \quad & \left\{ (1 - \vartheta) \ln V_{n_t^p}^H + \vartheta \ln V_{n_t^p}^F \right\} \\ \text{s.t.} \quad & w_t^p = \begin{cases} (w_t^p)^* & \text{with probability } 1 - \lambda \\ w_{t-1}^p & \text{with probability } \lambda \end{cases} \end{aligned} \quad (1.23)$$

The solution to the maximization gives a first order forward looking difference equation for the contract wage:

$$\begin{aligned} \Delta_t (w_t^p)^* = \frac{(1 - \vartheta)}{\Gamma} \left[ (1 - \varphi^p) \frac{y_t^p}{n_t^p} - \frac{\kappa}{2} [x_t^p]^2 + (1 - \sigma^p) \kappa x_t^p \right] + \\ \frac{\vartheta}{\Gamma \lambda_t^c (1 - \tau^n)} [U_{u,t} - \lambda_t^{np} (1 - \sigma^p - p_t^p)] + \lambda (1 - \sigma^p) \Delta_{t+1} (w_{t+1}^p)^* \end{aligned} \quad (1.24)$$

where  $\Gamma = \vartheta + (1 - \vartheta)(1 + \theta R_t)$  and  $\Delta_t = E_t \sum_{s=0}^{\infty} [(1 - \sigma^p \lambda \beta)^s \Lambda_{t,t+s}]$  captures the worker's cumulative discount factor, reflecting the uncertain duration of his tenure on the firm.<sup>2</sup>

Finally, the aggregate wage  $w_t^p$  can be expressed simply as:

$$w_t^p = (1 - \lambda)(w_t^p)^* + \lambda w_{t-1}^p \quad (1.25)$$

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<sup>2</sup>A more detailed explanation can be found in Gertler and Trigari (2009).

## Government

The public good is produced with labor. The cost of vacancies is subtracted from production as in Gomes (2014),

$$g_t = (n_t^g)^{1-\varphi_g} - \kappa v_t^g \quad (1.26)$$

Government income consists on the revenue from the taxes levied to the households, at fixed tax rates. The government uses an internationally traded bond  $b_t$  with return  $R_t$  to finance its deficit. The return  $R_t$  is determined exogenously as

$$R_t = \bar{R} * \epsilon_t^R \quad (1.27)$$

where  $\epsilon_t^R$  follows an AR(1) process with persistence  $\rho_R$  and standard deviation  $\sigma_R$ . Government spending includes the public wage bill, unemployment benefits and the lump-sum transfers to the households  $T_t$ . The government budget constraint is:

$$w_t^g n_t^g + bu_t + T_t = \tau^c c_t + \tau^n (w_t^g n_t^g + w_t^p n_t^p) + \tau^k (r_t - \delta)k_t + def_t \quad (1.28)$$

where  $def_t$  is the government deficit,

$$def_t = (1 + R_t)B_{t+1} - B_t \quad (1.29)$$

To ensure determinacy of equilibrium and a non-explosive path of debt, I assume a debt-targeting rule of the form:

$$T_t = \bar{T} \exp\{\nu(B_t - \bar{B})\} \quad (1.30)$$

where  $\bar{B}$  is the steady state value of debt.

Public vacancies and wages evolve according to rules. Public vacancies follow a simple autoregressive rule, but including an additional term to allow for interactions

with the private sector:

$$v_{t+1}^g = \bar{v}_g + \rho_{v_g}(v_t^g - \bar{v}_g) + \rho_{v_p}(v_t^p - \bar{v}_p) + \epsilon_t^{vg} \quad (1.31)$$

where  $\bar{v}_g$  and  $\bar{v}_p$  are the steady state value of public and private vacancies, respectively. Public wages also follow an autoregressive rule with an interaction term with the private sector, but are in turn affected by the interest payments made by the government, defined as  $ip_t = R_t B_t$ . This extra term reflects the pressures of public unions, which are able to extract higher wages when they perceive that the government budget constraint is looser, that is, when interest payments go down:

$$w_{t+1}^g = \bar{w}_g + \rho_{w_g}(w_t^g - \bar{w}_g) + \rho_{w_p}(w_t^p - \bar{w}_p) - \rho_{ip}(ip_t - \bar{ip}) \quad (1.32)$$

where variables with bars represent steady state values.

## Closing the model and functional forms

The aggregate resources constraint is given by

$$y_t = c_t + i_t + \frac{\kappa}{2}(x_t^p)^2 n_t^p \quad (1.33)$$

The utility function for the households takes the following form:

$$u(c_t, g_t) + v(u_t) = \frac{1}{\gamma} \ln(c_t^\gamma + \zeta g_t^\gamma) + \chi u_t \quad (1.34)$$

The model features two exogenous disturbances: the shocks to productivity  $a_t$  and to the return to the internationally traded bond  $R_t$ . The shock to  $R_t$  would be calibrated to replicate the decrease of the risk premium faced by the peripheral economies of the Euro Area described on the introductory section.

## 1.3 Calibration

The model is calibrated so its steady state matches some key statistics from the second half of the 1990s in the Spanish economy. This period represents an intermediate state between the period of economic crisis at the beginning of the decade and the introduction of the common currency in 1999. The calibration is detailed in table 1.4 in the Appendix.

Time is in years. The steady state value of unemployment ( $u$ ) and of public employment out of total employment ( $n_g$ ) are set to match observed values. The total separation rate ( $\sigma$ ) is taken from Hobijn and Sahin (2009) and then computed for each sector. The matching elasticities ( $\eta_g$  and  $\eta_p$ ) are taken from Gomes (2014).

For the tax rates ( $\tau_c$ ,  $\tau_k$  and  $\tau_n$ ) I use the average implicit tax rate for the period, computed by Eurostat. The depreciation rate ( $\delta$ ), the discount factor ( $\beta$ ), the capital share in the production function ( $\varphi_p$ ) and the adjustment cost of capital ( $\omega$ ) are taken from the literature. The exponent of the public good in the production function ( $\varphi_{pg}$ ) is calibrated from the average public investment to output ratio, as in Baxter and King (1993). The productivity shock ( $a$ ) is normalized to 1. The vacancy cost per filled job ( $\kappa/w_p$ ) is taken from Galí (2011). This ratio is used together with the private wage obtained from the firm's FOC for private vacancies to isolate  $\kappa$ .

The public wage premium ( $w_g/w_p$ ), the public spending ratio ( $g/y$ ), the debt-to-GDP ratio ( $b/y$ ), the debt interest rate ( $R$ ), the replacement rate ( $b/w_p$ ) and the working capital-to-GDP ratio are set to match observed values, and used to obtain the public wage ( $w_g$ ), public good production ( $g$ ), public debt ( $B$ ), unemployment benefits ( $b$ ) and the proportion of private wages paid in advance ( $\theta$ ). Then, the labor elasticity in the public production function ( $\varphi_g$ ) can be obtained from the public good production function. The workers' bargaining power ( $\vartheta$ ) can be extracted from the private wage determination function. Finally, the reaction of the public wage rule to changes to interest payments ( $\rho_{ip}$ ) is taken from the regression of the introductory section.

## 1.4 Main results

In this section I present the effects on the model economy of the decrease in financing costs occurred during the process of adoption of the Euro in Spain. This decrease is simulated with a shock to the interest rate paid by the government and used by the firms to finance their working capital. For reference, figures 1.2 and 1.3 in the Appendix present the impulse responses of the economy to a productivity shock and to a negative international interest rate shock, respectively.

When the interest rate shock hits, the first direct effect is the reduction in interest payments. Unions take advantage of this reduction to push for higher public wages, as can be seen in equation 1.32. Then, the rise of public wages affect private wages through three different mechanisms. First, a higher public wages affects the outside option of the private worker during wage bargaining. The value of unemployment rises for the unemployed worker, because they discount the possibility of obtaining a (now more lucrative) public job in the future, so firms must increase private wages. Second, as we will see below, an interest rate shock decreases capital accumulation on impact. With less capital in the economy, the workers are less productive and the firms reduce the private wage. Finally, higher public wages lure more people into looking for jobs in the public sector, producing more matches and more employment in the private sector and so increasing the production of public good. As the public good increases the productivity of the firm, each worker is now more valuable for the firm and private wages go up. The net effect of these three effects, two positive and one negative, is an increase of private wages following the interest rate shock.

On the other hand, the presence of working capital creates an additional mechanism of transmission from interest rates to private wages. When the interest shock hits, firms can finance their intra-period loan more cheaply, reducing the cost of their wage bill and, as can be seen in equation 1.21, the value of a job for the firms rises, therefore increasing private wages. Therefore, to study the public wage channel is necessary to shut down this mechanism, simply by setting  $\theta = 0$ , so that no intra-period loans are taken.

With working capital, the relative accumulated response of private wages to public

wages for the first five periods, that is, the ratio between the accumulated response of public and private wages, is of 1.2866. Without working capital, just setting  $\theta = 0$ , the elasticity falls to 0.0955, implying that around 7.4% of the total effect registered on the benchmark economy is due to the public wage channel.

Using the same data of table 1.1, I can therefore compute the effect of the increase of public wages on private wages. During the 1999-2007 period, public wages increased at an annual rate of a 4.4%, which would produce an increase in private wages of a 0.420%. As private wages increased during that same period at an annual rate of a 2.7%, then the model estimates that a 15.57% of the total increase was a consequence of the lower interest rates via the public wage channel.

As a counterfactual, according to the simulation, if public wages had increased at the same annual rate than private wages (2.7%), the annual increase of private wages would have been a 2.44%, due to the reduced pull effect of public wages. If public wages would have been frozen during the period, then the increase of private wages would have been just a 2.28%, a reduction of almost 0.5 percentage points. For comparison, the annual growth rate of private wages from 2008 to 2013 was a 2.55%, even with the country involved in a process of internal devaluation.

As commented before, we can also observe that the negative shock to the interest rates is pro cyclical: as the interest rate goes down, so does consumption and production, whereas unemployment goes up. In the standard literature, interest rates shocks are countercyclical, as the lower interest rates make investment cheaper and allow for increased capital accumulation. The difference is that in this model only the government holds bonds, to isolate the public wage channel. Then, the decrease in the interest rate pushes up public wages, as we have seen, which moves unemployed workers to search with more intensity in the public sector. The proportion of people looking for jobs in the public sector goes up and, correspondingly, the proportion of people looking for jobs in the private sector goes down. With less unemployed workers looking for jobs, the private sector reduces the number of vacancies it offers, decreasing the probability of a given vacancy being filled. These two effects push unemployment up: there are more people “queuing” for public jobs and less total vacancies in the economy, because public vacancies do not move. The lower number

of private vacancies reduces private employment, which in turn slows production and consumption.

## 1.5 Sensitivity

As I discussed on the previous section, the rise on public wages affect private wages through three channels: first, altering the outside option of workers while bargaining for wages; second, producing a resources redistribution that decreases capital and production, pushing private wages down; and, finally, making public employment go up and so increasing the production of public good. More public good means more productivity per private worker, so that the expected value of an extra job for the firm goes up and private wages rise.

In the benchmark calibration I have assumed a value for the output elasticity of the public capital of 0.1. By setting  $\varphi_{pg} = 0$ , the public capital becomes unproductive and we can observe the importance of the third channel. With  $\varphi_{pg} = 0$ , the ratio between the accumulated response of public and private wages decreases to 0.0953, so this channel accounts for about 0.19% of the total effect. In this version of the model, the simulation estimates that a 15.54% of the total increase in private wages from 1999-2007 was a consequence of the public wage channel.

Similarly, the presence of adjustment costs in capital helps enhance the effect of public wages on private wages by affecting the second channel, the decrease of capital. With adjustment costs, the decrease in capital is smaller than with no adjustment costs and, therefore, the productivity of the private worker does not fall as much, helping keep their wages up. If I set  $\omega = 0$ , so as to eliminate adjustment costs, the ratio between the accumulated response of public and private wages decreases to 0.0822; a reduction of about a 13.99% in the total effect. Without adjustment costs, the proportion of private wage increase consequence of the increase on public wages on the period of interest falls to a 13.39 per cent.

Another element of the model affects the outside option of the unemployed workers and hence the first channel: unemployment benefits. Reducing unemployment benefits by half, so that the replacement rate is around that of the United States,

	$\epsilon_{w_g, w_p}$	% of benchmark
Benchmark	0.0955	—
Unproductive $k^g$	0.0953	0.19%
No $k$ adjustment cost	0.0822	13.99%
Reduced unemployment benefits	0.0779	18.45%

Table 1.2: Results of the sensibility exercises.

makes the accumulated response of public and private wages fall to 0.0779, a reduction of 18.45% of the benchmark. The simulation with reduced unemployment benefits estimates that 12.69% of the total increase in private wages during the 99-07 period was consequence of the public wage channel.

Finally, the size of the interest rate shock, that is, changes to  $\epsilon_t^R$ , have no effect on the ratio between the accumulated response of public and private wages. Whereas the size of the shock affects the size of the response of public wages, the change on private wages is proportional to that of public wages, so the ratio stays the same.

## 1.6 Validation

A common approach in the literature for evaluating the fit of the model is to compare the theoretical second moments of the model to those observed in the data. Table 1.3 reports standard deviations relative to output and contemporaneous cross-correlations for the model's simulated series under a TFP shock and for the data. The data series for the real variables are taken from the OECD Economic Outlook No. 90 and constructed by taking logs and filtering the raw data using the Hodrick-Prescott (HP) filter. Data is yearly for the 1970-2008 period and the model is recalibrated for that time period.

In general, the model does a good job replicating the relations between the series but not their intensity. For example, the model replicates the higher variability of investment with respect to consumption, but both simulated variabilities are low with respect to the variabilities observed in the data. In terms of employment, the model generates relative standard deviations which are far from those in the

SD relative to output	$c$	$i$	$n$	$n_p$	$n_g$	$w_p$	$w_g$
Data: Spain 1970-2008	1.03	2.81	1.46	1.65	0.98	1.16	1.17
Model simulation	0.75	1.86	0.10	0.10	0.26	0.86	1.82

Cross-correlations	$(n, n_p)$	$(n, n_g)$	$(n_p, n_g)$	$(n_p, w_p)$	$(n_g, w_g)$	$(w_p, w_g)$
Data: Spain 1970-2008	0.99	0.31	0.25	-0.09	-0.18	0.46
Model simulation	0.93	0.57	0.23	0.05	-0.67	-0.22

Table 1.3: Standard deviations (relative to output) and cross-correlations of Spanish data and model-generated series.

data. This problem is common on search and matching models, where the Nash bargaining process tends to induce too much volatility in wages which, in turn, dampens the cyclical movement in firms incentives to hire. In fact, the introduction of wage stickiness as in Gertler and Trigari (2009) was intended to be a remedy to the low volatility of vacancies and employment. However, to replicate the level of employment volatility observed in the data it would be necessary to introduce in the model an unrealistic level of wage stickiness, giving the yearly nature of the data. On wages, the model replicates well the volatility of wages on average, but the variability of private wages is too low and that of public wages too high.

On the other hand, the model does a remarkable job in replicating the correlation between the different labor market series. For employment, the model replicates the very close relation between private employment and total employment, the procyclicality of public employment and the small but positive relation between private and public employment. All these relations are standard in the empirical literature for OECD countries. The model also captures the lack of correlation between wages and employment on the private sector. In the public sector, the model also replicates the negative correlation between wages and employment of the data, albeit with higher intensity, simply reflecting the high wage stickiness of public wages in the model. Finally, the model misses the correlation between private and public wages for this calibration and with only a TFP shock as the main driver of the variations. The explanation can be found in the construction of the public wage rule, equation 1.32: following a TFP shock that makes the private wage jump, the public wage only

increases gradually, following the leadership of the private wage through  $\rho_{w_p}$ , but limited by the stickiness that  $\rho_{w_g}$  imposes. The model, then, is better prepared to replicate the nature of the relation between public and private wages when public wage leadership plays a bigger role, as was the case following the introduction of the Euro in Spain.

## 1.7 The effect of the post-crisis public wage cuts

As we have seen in previous sections, public wages played a significant role in the loss of competitiveness experienced by some Eurozone countries prior to the current crisis. In the aftermath of the crisis, public wages have kept a central role, as European authorities raced to cut spending, reduce debt and improve competitiveness.

These efforts translated in pay cuts or freezes for public employees all around Europe, but specially in the countries affected the most by the crisis or under austerity programs. For example, the Spanish government introduced a 5% cut in civil servants' wages in 2010 and a freeze of their pay in 2011 as part of the program to reduce expenditure by 15,000€ million during those two years. Similarly, the emergency package introduced by the Italian government during the spring of 2010 included a three year public sector wage freeze and cuts of 5% and 10% for those with annual incomes over 90,000€ and 150,000€, respectively. In Portugal, the government announced in 2010 a freeze of the wages of civil servants and employees in public companies as part of the effort to save up to 3,000€ million. Finally, the case of Greece was particularly intense: after receiving a loan from the IMF and the EU, the government introduced a cut in public sector wages, a 30% cut in special bonuses, a reduction in overtime pay and the suspension of recruitment of new workers. It is estimated that cuts in wages and bonuses will result in a de facto loss of income for public sector workers of between 12 to 20%.<sup>3</sup>

What are the effects of a public wage cut in the public finances and the economy? In the model developed in previous sections, this event can be modeled as

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<sup>3</sup>Source: European Federation of Public Service Unions.

a shock to  $\bar{w}_g$  in equation 1.32. On top of that, to better reflect the state of the economies in which these cuts have been implemented, it is necessary to change the value of  $\lambda$ , the parameter governing private wage stickiness. Private wages in the southern economies of the Euro have shown strong nominal downward rigidity since the beginning of the crisis, despite the sharp contraction in aggregate demand and the withdrawal of external credit.<sup>4</sup> Taking into account this phenomenon is key to analyze the effects on output and public finances, given that debt reduction was the main motivation for the public wage cuts. I will set  $\lambda = 0.8$ , implying that the average contract duration is 5 years.

The effects of such a shock can be seen in figure 1.4 in the Appendix. Private wages go down following the public wage cut, but not much: after 5 years, the accumulated decrease of private wages is just a 0.158 per cent. This result is an obvious consequence of the existence of downward wage stickiness, which makes it very difficult to try to correct the previous loss of competitiveness through public wage cuts only.

Of course, the main goal of the public wage cuts was not directly to address the loss of competitiveness, but the deterioration of the public finances. In the simulation, public spending does go down, compounding the decrease in public wages with the decrease in public employment, as less people look for public jobs. In total, public spending is reduced from 41.82% of GDP before the public wage cut to 38.66% of GDP after 5 years, a contraction of a 7.56 per cent. However, it is interesting to note that public income also goes down, as the reduction in both public and private wages shrinks the tax base of the labor tax. In this case, public income decreases from 38.06% of GDP after the cut to 37.24%, a reduction of a 2.16 per cent. In the simulation, public deficit moves from a 3.76% of GDP before the public wage cuts to 1.41% of GDP after 5 years. The tax cut, therefore, is not enough to move the country into superavit and reduce their debt levels.

These results, however must be taken with caution. As can be seen in figure 1.4 in the Appendix, the shock is procyclical, pushing private production, consumption and investment up and unemployment down. The mechanism is similar as with

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<sup>4</sup>See, for example, Schmitt-Grohé and Uribe (2013).

the case of the interest rate shock: lower public wages move unemployed workers to search with more intensity in the private sector. With more unemployed workers looking for jobs, the private sector increases the number of vacancies it offers, pushing private employment up, which in turn accelerates production and consumption. The problem is that the model does not fully consider the depressed state of the economy, because of the crisis initiated in 2007, when austerity measures were introduced. Consequently, the private sector may not be in position to accommodate the new influx of unemployment workers looking for jobs due to lower public wages, which could increase unemployment and hurt public income. A proper assessment of the public wage cuts is left for future work.

## 1.8 Conclusions

This paper provided an estimation of the effect of increases in public wages on private wages. More specifically, this question was studied in the context of the Spanish economy following the introduction of the common currency. The introduction of the Euro was accompanied a decrease in the cost of financing, through a reduction of the interest rate premium, that relaxed the budget constraint of the government. This slack translated into strong increases on public wages, through the pressures of public unions, that in turn pushed private wages up.

For this simulation exercise, I used a DGSE model with search and matching frictions, two sectors and a modified public wage rule to account for union pressures. When the interest rate shock hits, interest payments go down. Unions take advantage of this reduction to push for higher public wages, which also pushes the value of being unemployed up, because a public job works as an outside option when bargaining the private wage, and that outside option is now more valuable. Furthermore, the increase in private wages produces a resources redistribution that decreases capital and production, pushing private wages down. Also, higher public wages make public employment go up and increase the production of public good. More public good means more productivity per private worker, so that the expected value of an extra job for the firm goes up and private wages rise. The net effect is an increase in

private wages.

These results offer an important policy lesson for the countries that either joined the EMU in recent years or are planning on doing so, and also for non-core members moving forward. As we have seen, the decrease on interest rates associated with the introduction of the Euro can put an upward pressure on wages, creating a differential with the countries at the core of the Eurozone. These differentials are very difficult to correct within a monetary union from the periphery, as demonstrated by the current austerity programs ongoing in the periphery of the Eurozone, without the possibility of using monetary policy and with a constrained fiscal policy. These countries are therefore advised to contain the growth of public wages in order to avoid or mitigate future imbalances.

As an additional exercise, I also studied the effect of the public wage cuts observed in various countries during the current Eurozone crisis. I increased the parameter governing wage stickiness to induce downward wage rigidity in the model, so as to replicate the conditions of the southern economies of the Eurozone during this particular time. When a public wage cut is simulated in this economy, public spending is effectively reduced. However, labor tax income also falls, limiting the impact of the measure on the fiscal position of the country.

# Appendix

## A Calibration

Param.	Value	Definition	Source or target
$\sigma_g$	0.0329	Separation rate, public sector	Hobijn and Sahin (2007)
$\sigma_p$	0.0659	Separation rate, private sector	Hobijn and Sahin (2007)
$\eta_g$	0.2	Matching elasticity, public sector	Gomes (2012)
$\eta_p$	0.5	Matching elasticity, private sector	Gomes (2012)
$\mu_g$	0.1285	Matching efficiency, public sector	Gomes (2012)
$\mu_p$	0.5548	Matching efficiency, private sector	Gomes (2012)
$\kappa/w_p$	0.45	Vacancy cost to private wage ratio	Gali (2011)
$\varphi_g$	0.1318	Capital share, public production	From (1.26)
$\varphi_p$	0.36	Capital share, private production	Literature
$\varphi_{pg}$	0.0333	Public good share, private production	From public inv. to GDP ratio
$\delta$	0.025	Depreciation rate	Literature
$\omega$	5.5	Adjustment cost of capital	Literature
$a$	1	Productivity shock	Normalization
$\theta$	0.3252	Private wages paid in advance	From working cap. to GDP ratio
$u$	0.14	Unemployment rate	OECD
$n_g$	0.13	Public employment	OECD
$n_p$	0.63	Private employment	OECD
$R$	0.06	International interest rate	Eurostat
$w_g/w_p$	1.17	Public wage premium	OECD
$g/y$	0.3	Public spending to GDP ratio	OECD
$B/y$	0.626	Public debt to GDP ratio	OECD
$\beta$	0.99	Discount rate	Literature
$\gamma$	1	Elasticity of substitution, public-private goods	Literature
$\zeta$	0.1	Public good coefficient on utility	Gomes (2012)
$\chi$	0.46	Unemployment coefficient on utility	Gomes (2012)
$\nu$	2	Sensibility of transfer to public debt	Bermperoglou et al. (2015)
$\vartheta$	0.0817	Workers bargaining power	From (1.24)
$b/w_p$	0.35	Replacement rate	ILO
$\tau_c$	0.151	Tax rate on consumption	Eurostat
$\tau_k$	0.293	Tax rate on capital	Eurostat
$\tau_n$	0.305	Tax rate on labor	Eurostat
$\rho_a$	0.9	Autocorrelation of productivity shock	Literature
$\sigma_a$	0.08	Variability of productivity shock	Literature
$\rho_{ip}$	0.166	Elasticity of interest payments on public wage	Regression
$\rho_{wg}$	0.925	Autocorrelation of public wage rule	Regression

Table 1.4: Parameters and steady state values.

## B Impulse responses

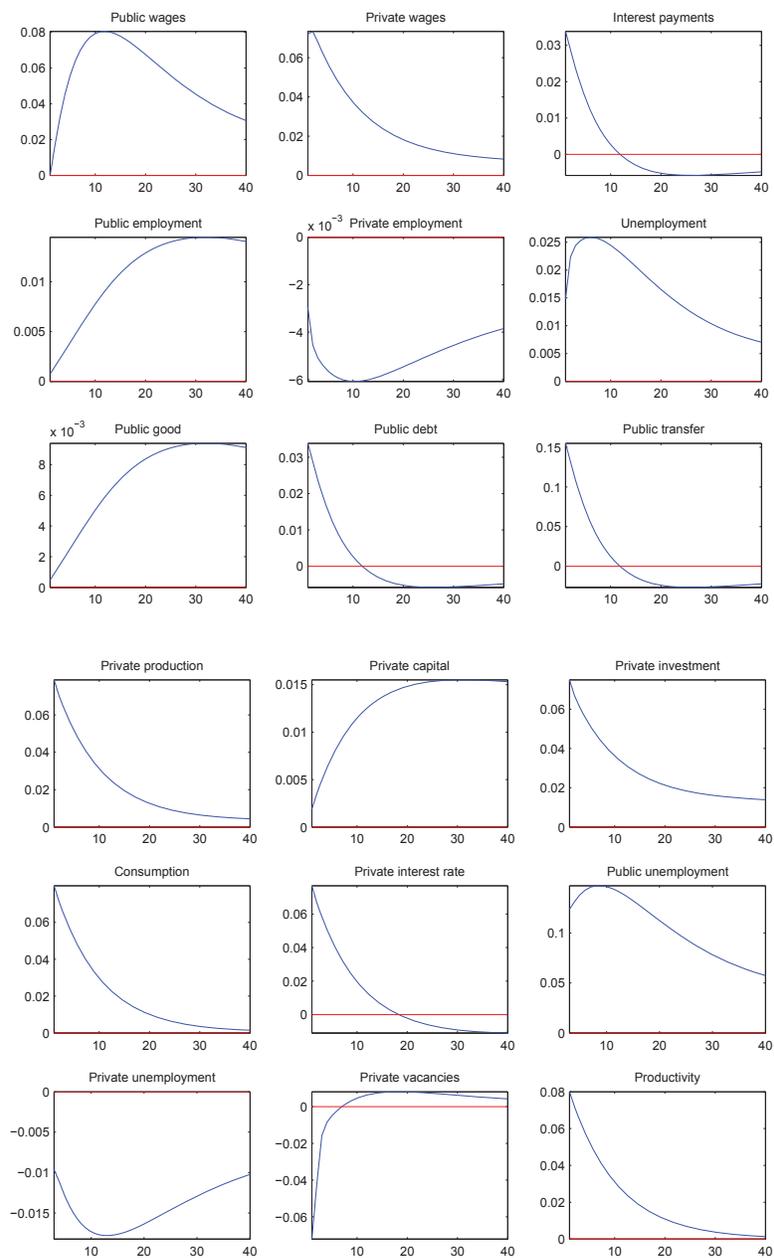


Figure 1.2: Impulse responses to a productivity shock

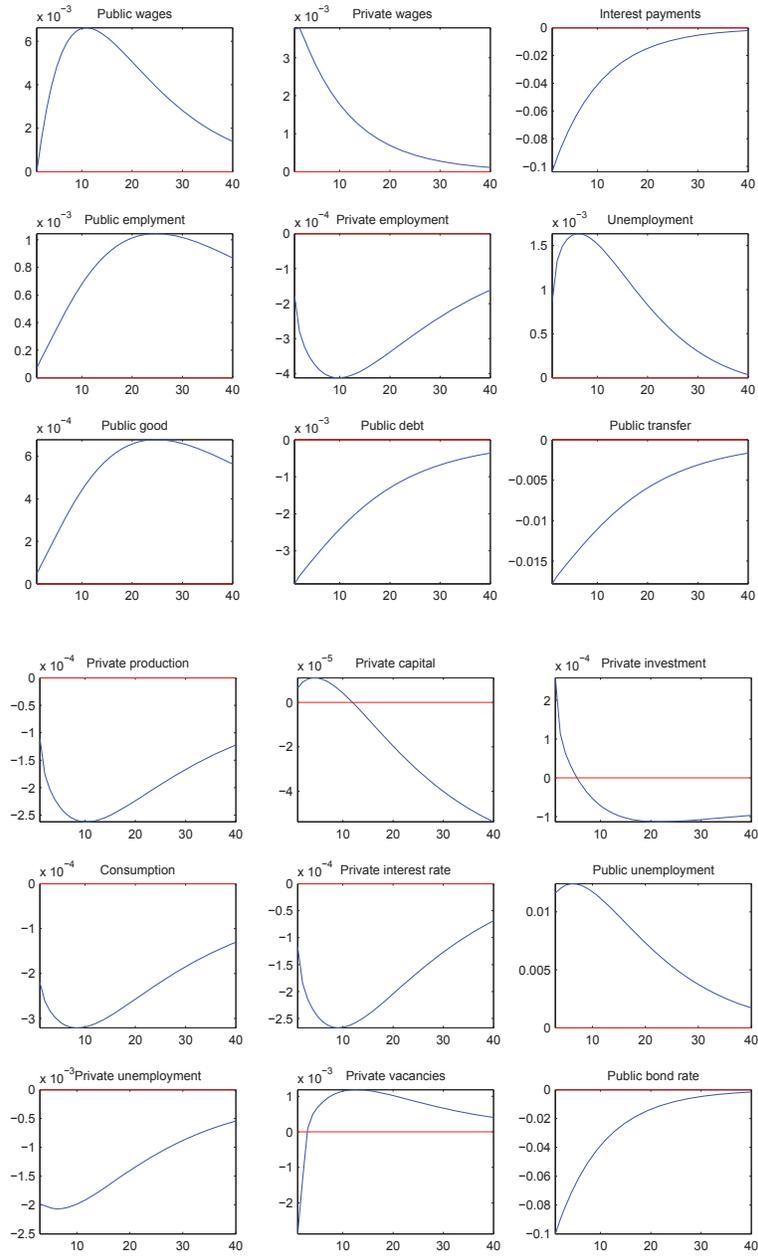


Figure 1.3: Impulse responses to an interest rate shock

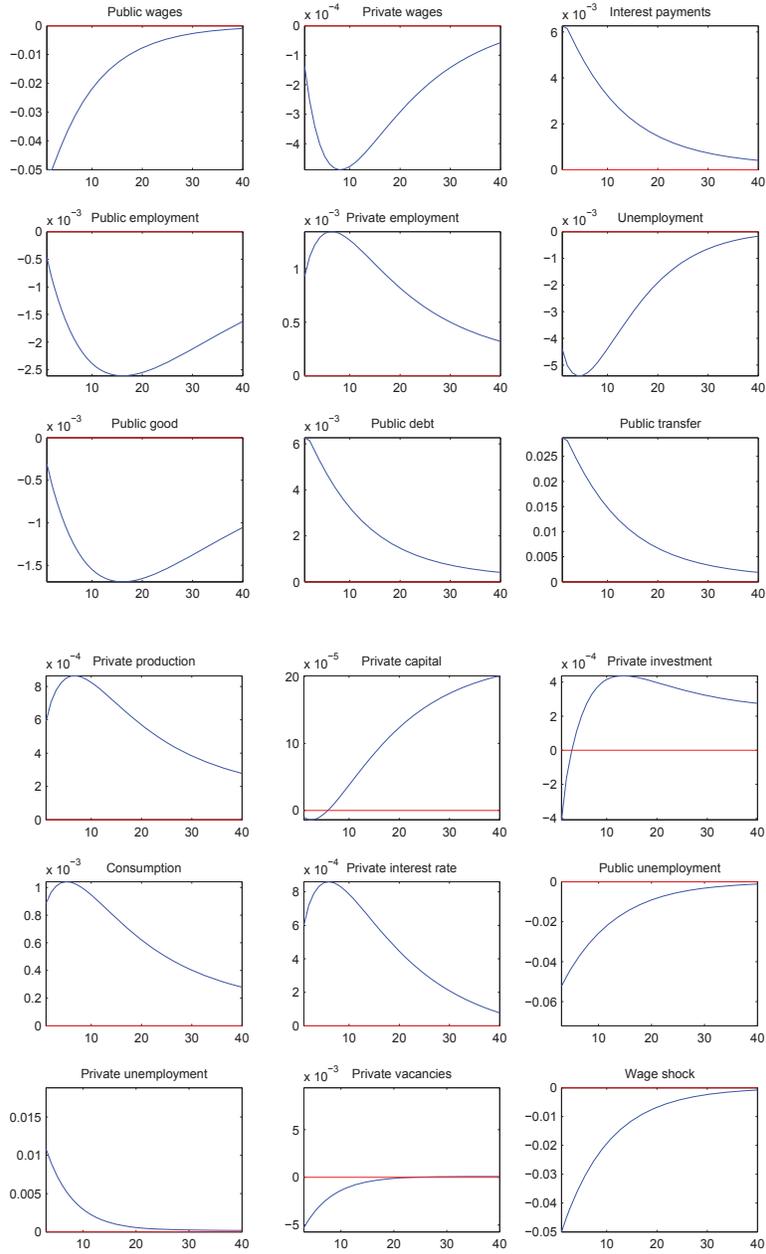


Figure 1.4: Impulse responses to a 5% public wage cut

## Chapter 2

# Regional decentralization and fiscal policy effects - international and intranational evidence

*Joint with Reinhard Ellwanger*

### 2.1 Introduction

This paper investigates the relationship between government structure and the effectiveness of fiscal policy. The effects of fiscal policy on economic outcomes is highly important for policy makers and academics alike; also, it is a striking feature that countries vary substantially in their organization of taxing and spending competences between different levels of government. We refer to the latter as the degree of “decentralization” and provide evidence that more decentralized countries, in other words, countries in which the regional governments have more fiscal competences, are associated with more effective fiscal policies.

The organization of taxing and spending competences between different levels of government has been shown to be important for government deficit reduction (Schaltegger and Feld 2009), the size of the government (Feld, Kirchgässner, and

Schaltegger 2004), economic growth (Thießen 2003) and fiscal discipline (Rodden 2002). At the same time, the academic literature on the determinants and transmission mechanisms of fiscal policy is still inconclusive (see e.g. Perotti 2007; Corsetti, Meier, and Müller 2012). While determinants of fiscal policy effectiveness such as the level of development, exchange rate regime, openness to trade and public indebtedness have been addressed in the literature before (see e.g. Ilzetzi, Mendoza, and Végh 2013) this paper is to our best knowledge the first study to investigate the relationship between decentralization and fiscal policy effectiveness in terms of multipliers.

Using two distinct empirical approaches we show that fiscal decentralization is associated positively with the effectiveness of fiscal policy for stimulating economic growth. The first approach exploits cross country variation in the degree of relative spending competences between central and regional governments. In none of the various European countries considered in our study, government spending is completely carried out by the central government, and, in some countries, regional governments are responsible for more than half of the total government spending. In a first step, we construct a “decentralization index” based on the relative spending of the regional governments and classify countries accordingly. We then estimate the response of GDP to unexpected government spending shocks using the SVAR approach introduced by Blanchard and Perotti (2002) for each country separately. The results indicate that a higher degree of decentralization in terms of government spending and taxation revenue is, on average, associated with a larger impact of shocks to these elements on economic growth. In particular, the corresponding fiscal multipliers tend to be larger in countries that are more decentralized. While the empirical approach is similar to studies including cross country evidence such as Corsetti, Meier, and Müller (2012) or Ilzetzi, Mendoza, and Végh (2013), we acknowledge two potential shortcomings of our approach. First, the countries and their corresponding regions used in our study vary importantly in size of their regional and central governments, which makes the comparison of the different type of governments across countries difficult. Second, our SVAR approach is based on total government spending, i.e. the sum of central and regional government spending; thus it does not identify if

at any point in time, the government spending shocks resulted from the regional or central government.

We address these shortcomings by contrasting our results with a case study from Spain, which is one of the few countries in our sample displaying significant time variation in the degree of decentralization. Spain offers a unique example of fiscal decentralization due to historical reasons. The dictatorship that ruled the country for almost forty years until 1975 imposed a very centralized fiscal system on a country with very heterogeneous regions. An important pillar of the Spanish transition to democracy involved transferring fiscal autonomy to the regions. We exploit this time variation as well as the fact that the decentralization process was not implemented in all regions at the same time. We argue that the timing of the implementations was a reaction to political rather than economic forces, therefore yielding an identification for the effects of decentralization on economic growth. The exact timing and sizes of these shocks are pinpointed via the “narrative approach” to fiscal policy evaluation (Romer and Romer 2010). We use data on fiscal spending and revenues at the regional level, which also allows for a more thorough decomposition of fiscal policy instruments into three series: direct taxation income, indirect taxation income and spending. Our results provide evidence for significant positive effects of decentralization on regional GDP growth, with the size of the effect being particularly large for the direct taxation series. Contrary to the cases of the decentralization of spending or indirect taxation, the regional governments were allowed to modify important legislative aspects concerning direct taxation. Hence the increased decision power of the regions to employ fiscal instruments in general, and direct taxation in particular, leads to the positive impact of fiscal decentralization on regional output growth documented in this paper.

Our results are consistent with standard theories of fiscal federalism (Oates et al. 1972; Bordignon, Manasse, and Tabellini 2001) postulating that local governments have an informational advantage when implementing fiscal policy. While central governments will tend to make rather homogeneous allocations, regional fiscal policy can be tailored to the preferences of the constituency and will therefore be more effective, if there is a large degree of heterogeneity in preferences and / or economic

conditions within a single country. The case study also shows that when it comes to fiscal decentralization, the “how” is important relative to the “how much”: decentralization of direct taxation, which can be designed and implemented relatively freely by the regions, seems to be more effective than the decentralization of other fiscal instruments such as indirect taxation and spending.

The remainder of this paper is structured as followed: section 2 presents the cross country evidence, starting with a discussion of the decentralization measure, followed by the empirical implementations and results; section 3 presents evidence from Spain, while section 4 concludes.

## 2.2 International evidence

### 2.2.1 Measuring decentralization

This section investigates the cross-country relationship between decentralization and fiscal policy effectiveness in the form of government spending and revenue multiplier. Measures of decentralization typically fall in one of the two categories: the first focuses on fiscal policy, and the relation between expenditures and allocations, while the second focuses on the nature of the intergovernmental relations and their regulation (see e.g the survey Sharma (2006)). We draw on the former, since it provides a clearer quantitative measure and the focus of this study is fiscal policy. Indeed, Sharma (2006) concludes that when it comes to the measurement of *fiscal* decentralization, the share of sub-national expenditures and revenues is considered to be the best indicator. Following this idea, the measure of decentralization we consider in the subsequent analysis is subnational (regional) spending as a percentage of total public spending of a respective country. Since we are interested in the effect of direct government spending, we exclude transfers (“social protection”) from both the regional and the total government spending. However, as shown below, alternative decentralization measures based on total spending (i.e. including transfers) and relative tax rather than spending competences lead to a similar classification of “centralized” and “decentralized” countries.

One caveat to our approach to measuring decentralization is that it does not account for potentially delegated spending, i.e. regional spending that was not carried out in an autonomous manner but rather as part of a central government’s mandate. However, similar decentralization measures are common in the literature and a good proxy for decentralization (Davoodi and Zou (1998), Oates (1985) or Mello (2001)). Ebel and Yilmaz (2002) suggest that the measure should perform reasonably well for developed countries, like the ones studied in this exercise.

We use yearly data from 1996 to 2011 on regional central government spending. Our decentralization index, presented in figure 2.1, is then computed as the average regional government spending net of transfers over the total government spending net of transfers:<sup>1</sup>

$$D^i = \frac{1}{T} \sum_t \frac{\text{government spending by non-central government}_t^i}{\text{total government spending}_t^i}, \quad (2.1)$$

where  $D^i$  is the value of the index for country  $i$ .

The average of the decentralization measure for the period considered is about 45%, implying that, on average, less than half of total non-transfer spending is carried out at the sub-national level. However, there is a high degree of variability between the extremes of the index, with values as low as 8% for Greece and as high as 82% for Switzerland. In the medium of the spectrum, between 45% and 60%, there is a group of five countries, from Germany to Italy, that are very close in terms of the index.

As shown in figure 2.13 in Appendix C, the measure of decentralization is very similar to the one computed including social spending. Similarly reassuring is that the decentralization index based on tax income, (figure 2.14 in Appendix C), suggests an almost identical grouping of the countries. The main difference is that Denmark appears to be the most decentralized country. Based on these observations, we group

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<sup>1</sup>The particular selection of the countries is based on data availability (excluding for example Eastern European countries) and variation in decentralization. Countries such as Belgium and Netherlands, for example, have a decentralization index very close to the median and where hence excluded.

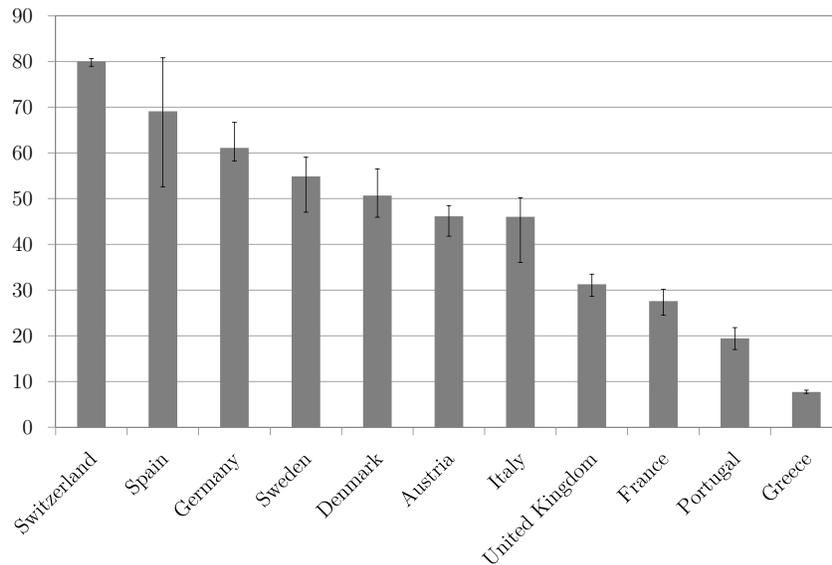


Figure 2.1: Decentralization Index: Regional share of spending net of transfers. Averages along with highest and lowest observation. Calculation based on yearly data 1996 - 2011.

countries into decentralized countries (Group 1: Switzerland, Spain and Denmark), centralized countries (Group 3: UK, Greece, Portugal and France), and a range of medium centralized countries (Group 2: Sweden, Germany, Italy and Austria) for our later analysis.

A potential caveat is that there might be important time variation in our index that is “averaged away” through our computation of the index. In fact, due to data availability, the data we use to construct the index starts in 1996, while the VAR analysis is based on data starting from 1980. However, empirically we find the index to be relatively stable over time. The graphs 2.1, 2.13 and 2.14 in Appendix C also depict the maximum and the minimum observation for each country (indicated by the end of the whiskers). The range appears relatively small, except in the case of Spain. We will exploit this time variation on the second part of this study.

	Spending	Cons. Spending	Inv. Spending	Revenues
Group 1	0.211 (0.0595)	0.175 (0.0571)	0.0361 (0.00722)	0.410 (0.0975)
Group 2	0.262 (0.0645)	0.233 (0.0557)	0.0292 (0.00994)	0.479 (0.0742)
Group 3	0.246 (0.0263)	0.213 (0.0254)	0.0339 (0.0116)	0.389 (0.0817)

Table 2.1: Spending and Revenues over GDP by decentralization group. Spending denotes the sum of government consumption and investment expenditure; Cons. and Inv. Spending stand for consumption and investment spending, respectively. Standard deviations in parenthesis. Quarterly observations, 1980-2007.

### Decentralization and other determinants of fiscal multipliers

The government structure is not the only source of variability in the effect of government spending shocks. In order to identify effects that might arise through the degree of decentralization, we would like the index not to covary systematically with other determinants of government spending and taxation effectiveness. Indeed, the extensive literature on fiscal multipliers has identified several factors that can determine the size of fiscal multipliers. For example, Ilzetzki, Mendoza, and Végh (2013) show that, for a large set of countries, openness to trade, exchange rate flexibility and outstanding government debt influence the size of multipliers. Auerbach and Gorodnichenko (2012) findings suggest that, for a given country, multipliers depend on the current state of the economy. In particular, multipliers appear to be significantly larger in recessions than in expansions. Corsetti, Meier, and Müller (2012) find fiscal multipliers to be larger during financial crisis and fixed exchange rate regimes. Although the evidence concerning the determinants of fiscal multipliers is far from conclusive,<sup>2</sup> we discuss below how the specific countries and groups might be affected differently by these various factors.

Table 2.1 displays the average government spending, its disaggregated consumption and investment components and revenues, divided by GDP, for the various

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<sup>2</sup>In contrast to Auerbach and Gorodnichenko (2012), for example, Ramey and Zubairy (2014) do not find evidence for elevated fiscal multipliers during economic slacks and the recent financial crisis.

	GDP growth (pc)	(X+IM)/GDP	Population	Gross debt/GDP (pct.)
Group 1	1.847 (1.788)	2.228 (0.532)	17.33 (16.10)	48.59 (13.93)
Group 2	1.853 (1.430)	2.342 (0.614)	38.39 (31.38)	71.05 (21.26)
Group 3	2.082 (2.031)	1.843 (0.379)	34.01 (23.86)	53.91 (21.00)

Table 2.2: Descriptive statistics for additional determinants of fiscal multipliers by decentralization group, yearly observations 1980-2007. Population is in million. Standard deviation in parenthesis. Source: International Monetary Fund, World Economic Outlook Database and eLibrary.

groups.<sup>3</sup> Government spending, in particular consumption, appears to be somewhat smaller in decentralized countries (Group 1), but as seen in figure 2.15 in Appendix C, this relationship is rather weak. On the other hand, the average share of revenues tend to be larger in medium decentralized countries (Group 2).<sup>4</sup> Also, there does not seem to be a systematic relationship between decentralization and the level of government debt. The average government debt-to-GDP ratio is around 50% for both centralized and decentralized countries, but larger for the medium group (table 2.2). As seen in figure 2.16 in Appendix C, this fact is mainly driven by the high debt-to-GDP ratio in Italy. Moreover, the numbers presented in table 2.2 document that the decentralized and centralized groups of countries appear to be quite similar along the crucial dimensions of GDP growth (capturing boom vs. recessions), debt-to-GDP ratio and the sum of imports and exports relative to GDP as a measure of openness.<sup>5</sup> Only the medium group displays a considerably higher average debt-to-GDP ratio, and also the highest openness indicator as measured by import plus exports-to-GDP.<sup>6</sup>

Corsetti, Meier, and Müller (2012) provide definitions for fixed exchange rates

<sup>3</sup>Table 2.6 in Appendix C provides a more detailed overview over these variables by country.

<sup>4</sup>Note that table displays gross revenues (including transfers), which means that spending and revenues do not necessarily have to be equal to imply a balanced budget.

<sup>5</sup>Table 2.7 in Appendix C provides a more detailed overview over these variables by country.

<sup>6</sup>To the extent that decentralization is associated with factors such as fiscal discipline, as argued by Rodden (2002), for example, the effect from decentralization to fiscal multipliers might be indirect but can still be traced back to the former.

	Group	Currency Peg	Financial Crisis
Denmark	decentralized	1980 - 2007	1987 - 1992
Spain	decentralized	1984 - 2007	1984 - 1985
Austria	medium	1980 - 2007	-
Italy	medium	1983 - 1991, 1998 - 2007	1990 - 1991
Sweden	medium	1980 - 1992	1991 - 1994
France	centralized	1982 - 2007	1994 - 1995
Portugal	centralized	1990 - 2007	-
UK	centralized	-	-

Table 2.3: Overview of exchange rate characteristics and financial crisis periods according to Corsetti, Meier, and Müller (2012) for available countries.

regimes and financial crisis episodes for most countries in our sample.<sup>7</sup> Table 2.3 shows that most countries, with the exception of UK, had a pegged exchange rate for most of the sample period. Financial crisis, however, seemed to be more frequent in the decentralized countries. Taken together though, we find only little evidence for major overlaps between decentralization and other determinants of fiscal multipliers that might be driving our results.

## 2.2.2 Econometric framework and data description

Our cross-country analysis considers unexpected changes in government spending and revenue in order to evaluate the impact of fiscal policy on output growth. Following Fatás and Mihov (2001) and Blanchard and Perotti (2002) we employ Structural VARs (SVAR) to quantify this impact. Their approaches have in common that they exploit decision lags in fiscal policy-making, which allow the identification of fiscal shocks. Since we are using quarterly data in our study, the assumption that discretionary government purchases and revenues are not going to be made effectively law and implemented within the same observation period as a GDP shock is likely to be met; hence they can be predetermined with respect to the macroeconomic variables.

Proceeding with the description of the reduced form model, for our baseline

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<sup>7</sup>Not covered are Greece, Germany and Switzerland.

specification, we consider the following vector

$$X_t = (g_t, y_t, r_t)', \quad (2.2)$$

where  $g_t$  is the growth rate of real government consumption and investment spending,  $y_t$  is the growth rate of real GDP and  $r_t$  is real government revenue growth.<sup>8</sup>

The following reduced form model is then estimated individually for each country:

$$X_t = c_0 + \sum_{i=1}^k \phi X_{t-i} + e_t, \quad (2.3)$$

where  $c_0$  is a constant and  $e_t \sim \text{WN}(0, \Sigma)$  represent the reduced form error shocks. In order to ensure comparability between the countries, we choose a lag length of  $k = 5$  in each estimation. This appears to be a reasonable compromise between the four lags proposed by Blanchard and Perotti (2002) and the 6 lags employed by Mountford and Uhlig (2009).

The data for government investment and consumption spending, revenues and GDP for 11 European countries are obtained from Oxford Economics. The spending and the GDP variables are already obtained in real terms, while we transform nominal revenues using the GDP deflator.<sup>9</sup> Growth rates are computed via log changes. For all countries, we use data from 1985-2007, yielding  $T = 85$  observations. Using pre-2008 data ensures that our results are not affected by the financial crisis.

### 2.2.3 Identification of structural innovations

We assume that the reduced form errors are related to their structural counterparts via the representation  $Ae_t = Bu_t$ , where  $u_t \sim (0, I)$  are the structural shocks. Without restrictions on the parameters in  $A$  and  $B$  the structural model is not identified. Hence additional assumptions will be necessary to disentangle  $A$  and  $B$  from the estimates of the variance-covariance matrix of the reduced form errors. Our model is

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<sup>8</sup>Ideally, the government revenue should be net of transfers. However, we take the gross series as a proxy as we did not find consistent data regarding net transfers for all countries.

<sup>9</sup>The series not already seasonally adjusted were adjusted using the Census X-13 methodology.

similar to the one of Blanchard and Perotti (2002) and Perotti (2005), who applied this approach to estimate the effect of government spending and tax shocks for the US and several other OECD countries. In particular, let the structural relationship between the reduced form and the structural errors take the form

$$\begin{pmatrix} 1 & 0 & 0 \\ \alpha_{21} & 1 & \alpha_{23} \\ 0 & \alpha_{32} & 1 \end{pmatrix} \begin{pmatrix} e_t^g \\ e_t^y \\ e_t^t \end{pmatrix} = \begin{pmatrix} \sigma_g^2 & 0 & \beta_{13} \\ 0 & \sigma_y^2 & 0 \\ \beta_{31} & 0 & \sigma_t^2 \end{pmatrix} \begin{pmatrix} u_t^g \\ u_t^y \\ u_t^t \end{pmatrix}, \quad (2.4)$$

where  $\alpha_{21}$ ,  $\alpha_{23}$  and  $\alpha_{32}$  are, respectively, the value of the elasticities of output relative to government spending and taxes, and the elasticity of taxes relative to output. The parameter  $\beta_{13}$  captures the response of government spending to unexpected (structural) shocks in revenue, while conversely,  $\beta_{31}$  presents the response of government revenues to unexpected (structural) shocks in spending. Since the reduced form variance-covariance matrix has six distinct elements, additional assumptions are necessary to identify the parameters  $\alpha_{21}$ ,  $\alpha_{23}$ ,  $\alpha_{32}$ ,  $\beta_{13}$  and  $\beta_{31}$ . They are derived from both exclusion restrictions and outside information. On a quarterly frequency, fiscal policy is plausibly subject to decision lags; i.e., the time needed for fiscal policy makers to respond to changes in output is at least one quarter. Then any remaining correlation between the unpredicted components of government spending and output is due to the impact of government spending on output. Similarly,  $\alpha_{32}$ , the output elasticity of taxes, can then be obtained by regressing revenue on the tax base and the corresponding estimate can be imposed directly in equation 2.4. One caveat is that the tax multipliers obtained this way are quite sensitive to the particular estimate of  $\alpha_{32}$  (Caldara and Kamps 2012). However, for the countries considered in this study, the values appear quite similar and close to 1, according to recent OECD estimates (Price, Dang, and Guillemette 2014). This estimation is considerably lower than the estimate of 1.85 obtained by Blanchard and Perotti (2002) for the United States, but close to the one of 0.95 obtained by Tenhofen, Wolff, and Heppke-Falk (2010) for Germany. Moreover, since the main purpose of this study is to derive *relative* values of fiscal multipliers across countries, and the elasticities appear indeed similar between them, we expect the uncertainty regarding the output elasticity of taxes

not to influence our results significantly.<sup>10</sup> Finally, we follow Blanchard and Perotti (2002) in setting  $\beta_{13} = 0$ , which implies that spending decisions come before tax decisions.

One caveat of our specification is that given that  $g_t$  presents aggregate government spending, we have insufficient information if, in each given point in time, spending came from the central or local governments.<sup>11</sup> Our VAR results therefore identify the average effect of government spending on growth, without discriminating between the regional and central government spending more directly.

## 2.2.4 Results

This section describes the estimation results of the model presented in the previous section. We present the results in the following form. First, each countries' output cumulative response to a fiscal shock is standardized by dividing the cumulative GDP response to fiscal shocks by the ratio of GDP relative to the respective fiscal variable and the standard deviation of the fiscal shocks:

$$\text{Dynamic Multiplier} = \frac{\text{Output response}}{\text{Initial Fiscal Shock}} * (\text{Average fiscal variable share of GDP}).$$

Second, we present average results for the three groups of countries. Averages are taken over the country specific multipliers in the respective group at each point in time. This approach is similar to the one employed by Ilzetzi, Mendoza, and Végh (2013), who classify countries according to a certain characteristic and then estimate fiscal multipliers separately for each group using panel VARs. Instead, our averaging method does not restrict the dynamics for each country in the group to be the same. We employ a bootstrap procedure, which is outlined in Appendix C in more detail, in order to compute the corresponding confidence intervals.

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<sup>10</sup>In fact, we performed robustness analysis using different values for  $\alpha_{32}$ , which changed the size of the multipliers somewhat, but not the relative ordering.

<sup>11</sup>Having this info would allow us to more directly evaluate the relative effect of central and regional government shocks, respectively. Unfortunately historical time series for quarterly series of regional expenditure is not available for most countries.

## The effect of government spending shocks

Figure 2.2 depicts the multipliers for total government spending. The multiplier for the most decentralized countries is about one on impact, and slightly increasing to a value of around two after ten quarters. The multiplier for the centralized countries is noticeably lower and around 0.5 on impact, and reaches its maximum of one after about one year before declining afterward. In contrast, the multiplier for the medium countries is only slightly positive on impact but indistinguishable from zero thereafter. One explanation for this results is that the group of medium countries also exhibits the highest average debt to GDP and openness measure, displayed in table 2.2, both of which are associated with lower multipliers (Ilzetzki, Mendoza, and Végh 2013).

## Disaggregated government spending

This subsection considers the effect of government consumption and government investment spending separately. Hemming, Kell, and Mahfouz (2002) note that fiscal multipliers can vary across different policy instruments, so we expect to obtain additional insights from the disaggregation of the different components of government spending. The estimation follows the baseline model described above, where  $g_t$  contains either consumption or investment spending. Figure 2.3 depicts the multipliers for government consumption spending only, with a pattern strikingly similar to the aggregate spending multiplier. The only differences appear to be a dip in the multiplier for the centralized countries after 3 quarters, and a slightly larger long-run response of output growth for the medium countries.

In contrast, the results for the government investment spending only, presented in figure 2.4, indicate much larger multipliers, around two, for both the centralized and decentralized countries. Here we notice little difference according to decentralization. Moreover, the multiplier for the medium group turns negative after several quarters. Obtaining negative estimates for the multipliers is not uncommon (Perotti 2005), and can occur when distortionary taxes are imposed following debt financed spending (Baxter and King 1993).

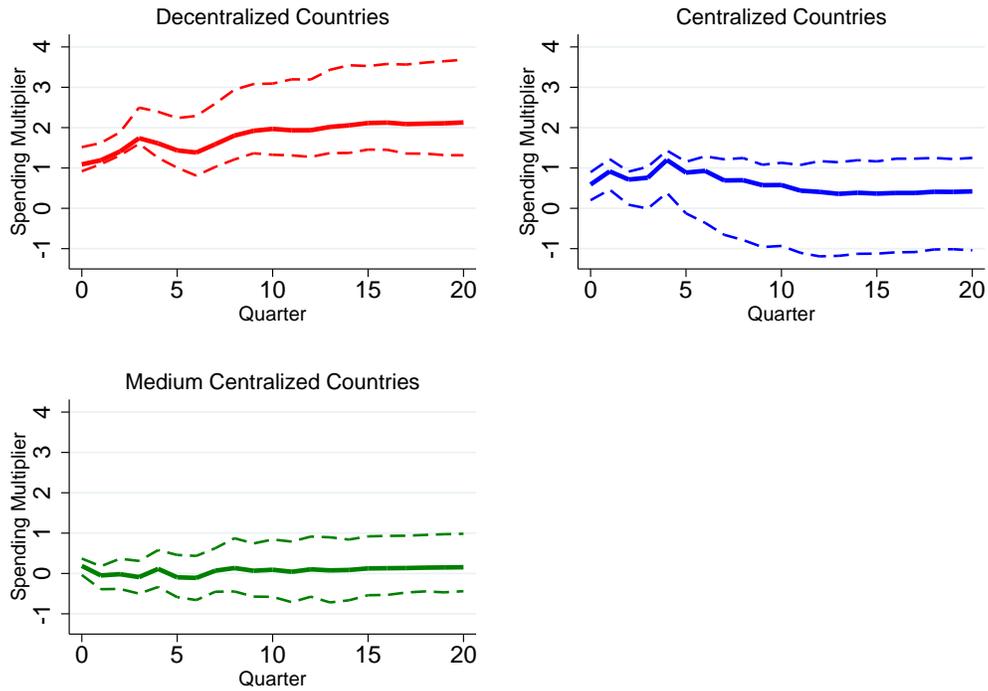


Figure 2.2: Cumulative spending multipliers, average across country group. Point estimates with 84% and 16% bootstrap percentiles.

### The effect of government revenue shocks

Figure 2.5 displays the estimated revenue multipliers, which appear to be of a smaller magnitude. On impact all multipliers are similar and around 0.5, but while the multipliers for the decentralized and medium countries increase over time to a value around 1, the multiplier for the centralized countries slowly declines.

Taken together, for all cases considered, the decentralized countries exhibit relatively larger multipliers. Only in the case of government investment spending, the group of centralized countries exhibits multipliers of a similar magnitude than the decentralized countries. For government consumption spending and revenues, the multipliers are substantially lower and appear to be less persistent.

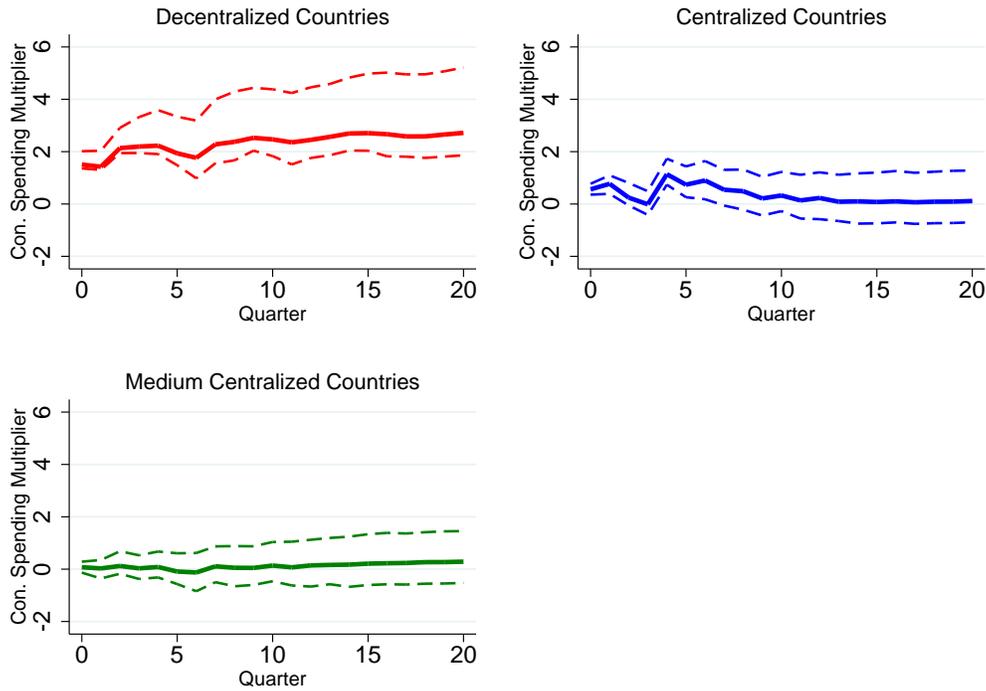


Figure 2.3: Cumulative government consumption multipliers, average across country group. Point estimates with 84% and 16% bootstrap percentiles.

### 2.2.5 Robustness

This section discusses two robustness checks for the results presented in the previous subsection. The first is based on the estimation of bivariate VARs that identify government spending and government revenue shocks separately; the second contrasts our results from those reported in Dellas, Neusser, and Wälti (2005), who provide point estimates for multipliers for the majority of the countries in our sample.

#### Estimates based on bivariate VARs

This robustness check involves contrasting our results from a series of bivariate VARs that identify government spending and government revenue shocks separately. An

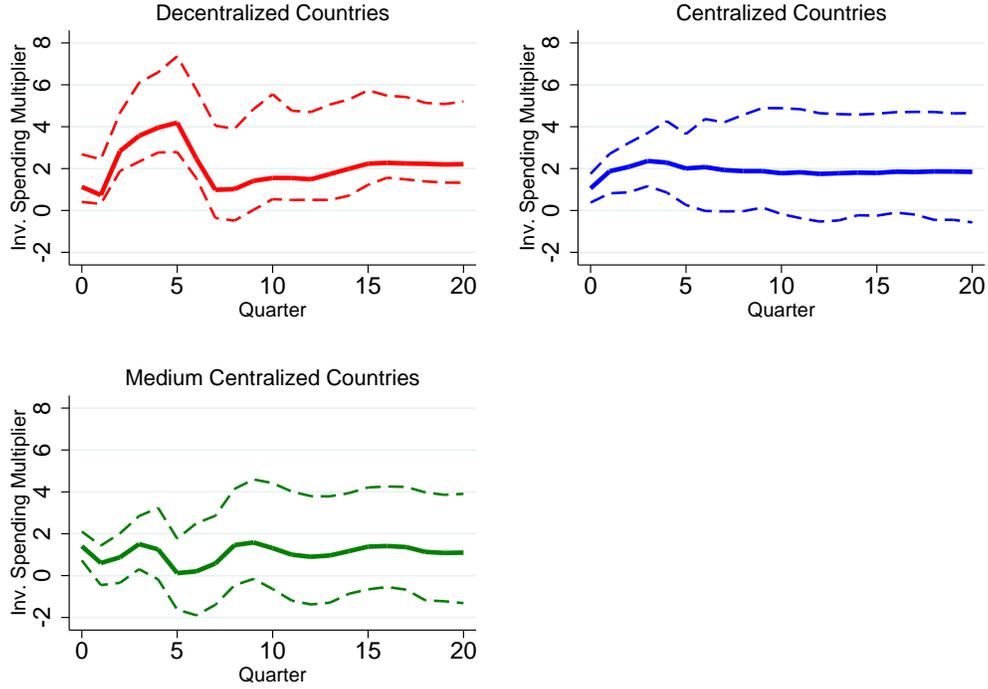


Figure 2.4: Cumulative government investment multipliers, average across country group. Point estimates with 84% and 16% bootstrap percentiles.

advantage of using bivariate models is that the calculation of the cumulative multipliers from the VAR system described below is not sensitive to the persistence of the fiscal shocks, whereas for larger systems, this is generally not the case (Giordano et al. 2007). We consider the vectors  $X_t^1$ ,  $X_t^2$ , referring to the models with government spending and with government revenue, respectively,

$$X_t^1 = (g_t, y_t)', \quad X_t^2 = (y_t, r_t)', \quad (2.5)$$

and estimate the reduced form models with the same specification as the baseline case. Similar to the baseline model, the identifying assumptions are

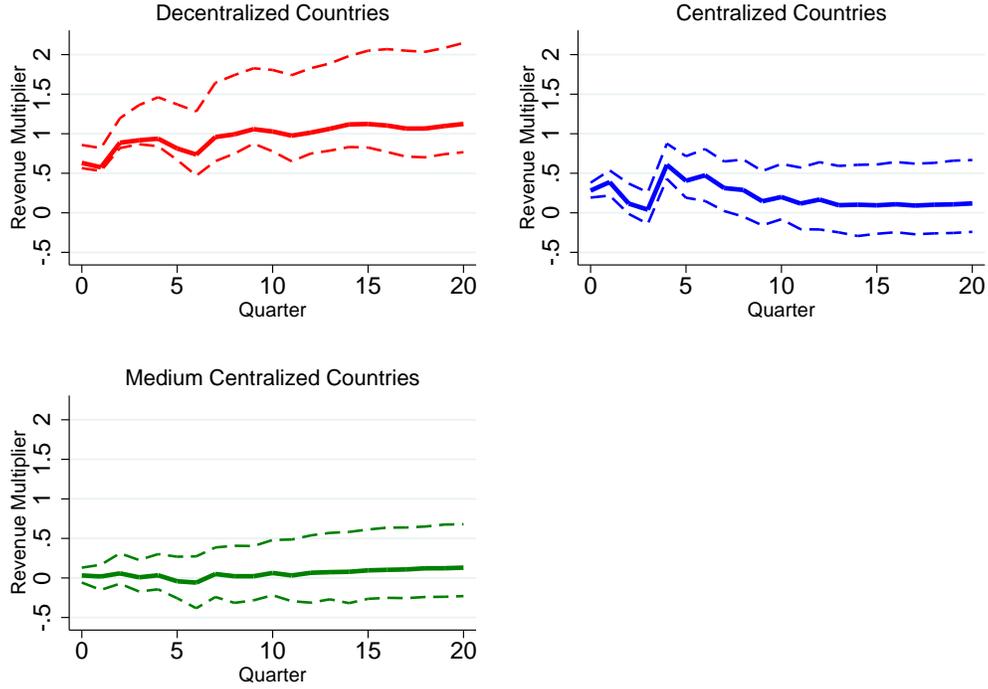


Figure 2.5: Cumulative revenue multipliers, average across country group. The multipliers describe the output response to a negative tax shock. Point estimates with 84% and 16% bootstrap percentiles.

$$\begin{pmatrix} 1 & 0 \\ \alpha_{21} & 1 \end{pmatrix} \begin{pmatrix} e_t^g \\ e_t^y \end{pmatrix} = \begin{pmatrix} \sigma_g^2 & 0 \\ 0 & \sigma_y^2 \end{pmatrix} \begin{pmatrix} u_t^g \\ u_t^y \end{pmatrix}, \quad (2.6)$$

in the case of the model including government spending and

$$\begin{pmatrix} 1 & \alpha_{12} \\ \alpha_{21} & 1 \end{pmatrix} \begin{pmatrix} e_t^y \\ e_t^t \end{pmatrix} = \begin{pmatrix} \sigma_y^2 & 0 \\ 0 & \sigma_t^2 \end{pmatrix} \begin{pmatrix} u_t^y \\ u_t^t \end{pmatrix}, \quad (2.7)$$

in the case of the model including revenues, where  $\alpha_{21}$  is imposed by the output elasticity of revenues. As for the three variable VARs, we choose  $-\alpha_{21} = 1$  for all countries.

Figures 2.17, 2.18, 2.19 and 2.20 in Appendix C depicts the multipliers for total government spending, government revenues, and the disaggregated consumption and investment multipliers respectively, showing almost identical patterns as for the VARs with three variables.

### Comparison with results from other cross-country studies

Our results regarding spending multipliers are supported by the estimates presented in Dellas, Neusser, and Wälti (2005), who investigate the effect economic openness has on the size of fiscal multipliers. The authors' estimates of government consumption multipliers rely on a similar yet substantially larger SVAR system, that includes inflation and interest rates, among others.

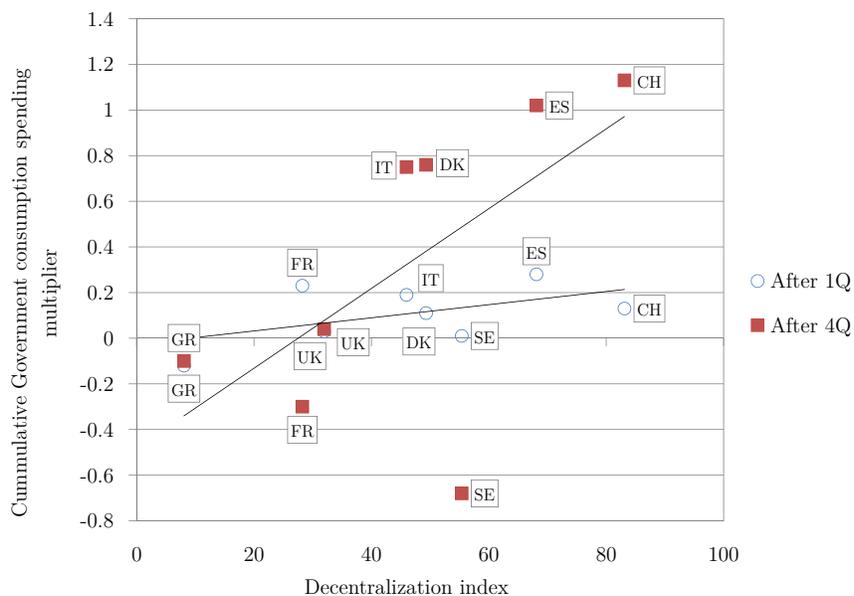


Figure 2.6: Decentralization Index vs. cumulative government consumption spending multipliers reported in Dellas, Neusser, and Wälti (2005).

Figure 2.6 plots, for the countries available, the decentralization index against the estimates obtained by Dellas, Neusser, and Wälti (2005). Supportive of our findings, there is a small, positive relationship between decentralization and government

consumption multipliers on impact, that becomes substantial after 4 quarters.

## 2.3 Intranational evidence from Spain

### 2.3.1 The decentralization process of Spain (1975-2007)

As we have seen on the previous section, the regional decentralization of a country can have a noticeable impact on the effectiveness of its fiscal policy. Allowing the regional governments to carry out a larger share of the total public spending or collect a bigger proportion of taxes appears to affect how the economy in general - and economic growth, in particular - reacts with respect to shocks to the fiscal instruments. In this section, we address some weaknesses of the cross-country approach; namely, our inability to differentiate between central and regional government spending at each point in time, and the potential difficulty to compare international regions that differ vastly in its size.<sup>12</sup> The countries studied on the previous section exhibit a relatively stable regional configuration, as shown by the rather small variation of their decentralization indexes, with one notable exception: Spain. It is exactly this time variation that we exploit in this section in order to address the following question: if decentralization affects fiscal policy, what are the effects from further decentralizing the fiscal policy on economic growth?

Spain offers a unique example of fiscal decentralization due to historical reasons. The dictatorship that ruled the country for almost forty years until 1975 imposed a very centralized fiscal system on a very heterogeneous country. One of the main pillars of the Spanish transition to democracy involved transferring autonomy to the regions. The gradual and asymmetrical nature of the process can be naturally exploited to test the effects of increasing the fiscal competence of the regional governments.

The Spanish Constitution of 1978, on its Title VII, allowed for the concession of

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<sup>12</sup>For example, Germany's largest region Nordrhein-Westfalen is about three times larger than Denmark in terms of population.

extensive prerogatives to the regional governments, called *Comunidades Autónomas*.<sup>13</sup> The process was not immediate, however, to the point that it can still be considered an open issue. Some regions with stronger regional identities moved quickly to approve their regional Constitutions (*Estatutos de Autonomía*) and started the transfer of prerogatives right away while other regions lagged behind and only received these prerogatives after nationwide agreements. The heterogeneity on the timeline and its predominantly political nature offers a natural experiment on fiscal decentralization that we exploit to measure its impact on economic growth.

The analysis of this section is based on the data of the *Comunidades Autónomas*' Budget Series from the General Secretary for Local and Regional Coordination (*Secretaría General de Coordinación Local y Autonómica*). The database offers yearly consolidated series of 9 income categories and 9 expenditure categories from 1984 to 2013 for the 17 main Spanish regions. As in the previous section, we will focus on the 1984-2007 period, as the depth of the current economic crises complicates greatly any analysis of the data from 2008 onwards.

Our analysis will focus on 3 series: direct taxation income, indirect taxation income and spending. The last series is a composite of expenditure on public wages and public consumption. The analysis of these series allows us to identify major transfers of autonomy to the regional governments, its timing and its size as a percentage of regional GDP. Combining the analysis of the series and a narrative approach, we were able to identify five major episodes of fiscal decentralization, where a prerogative was transferred to the regional governments.

Two important points characterize this analysis. First, even though in every episode regional tax income or spending increases, these changes are rather interpreted as decentralization shocks than "classical" tax or spending shocks. We use this interpretation because, in principle, the increase in regional spending and revenue merely offsets the fiscal activity previously carried out by the central government and does not necessarily have to lead to a change in total (local and central) government spending or taxes in the region. To the extent that it does change total government spending or taxes, our analysis provides a measure for the joint effect

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<sup>13</sup>A detailed report on the beginning of the process can be found in Molero (2001).

of a (decentralization induced) change in actual spending or taxes and a change in efficiency of spending and tax collection. In either case the results provide evidence for the effects arising from decentralization through increased fiscal independence of the regions. Second, we provide evidence that the timing of the implementation of regional fiscal policy was largely exogenous to economic conditions in a particular region (or Spain) and primarily politically motivated.<sup>14</sup> This exogenous variation reinforces our identification of the effects arising from decentralization shocks.<sup>15</sup>

### 2.3.2 Episodes of decentralization

Based on a narrative approach to identify discretionary policy measures, we observe five major episodes in the decentralization process of Spain:

1. *The decentralization of health services.* This process spanned over 20 years, with some regions, like Catalonia, gaining the prerogatives on health services as early as 1981 whereas the majority of the regions finally gained the competence in 2001. On average, this transfer of competence resulted on a permanent increase of regional spending of over 3% of regional GDP.
2. *The decentralization of non-tertiary education.* As with the previous case, regions as Catalonia and the Basque Country started handling non-tertiary education as early as 1980. This decentralization process concluded in 1999. The result was an average permanent increase of regional spending of around 2.5% of regional GDP.
3. *First transfer of the Income Tax.* In 1996, regions were allowed to keep up to 15% of all the Income Tax collected on their territory. Five regions stood out of this agreement: on one hand, Navarra and the Basque Country already handled most of their own taxes; on the other hand, Andalucía, Extremadura and Castilla-La Mancha argued that the cession broke the principle of regional

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<sup>14</sup>See, for example, the analysis of Suárez-Pandiello (1999).

<sup>15</sup>One drawback of our approach (which is also the case for the cross-country section) is that we cannot control for the anticipation of these effects.

solidarity and was therefore unconstitutional. These regions appealed the law to the Constitutional Court. The appeal was overturned and these regions finally complied and started collecting their allotted share when the Income Tax was transferred for the second time, as discussed below. On average, this transfer created a permanent increase on direct taxation income of the regions of around 1% of regional GDP.

4. *Second transfer of the Income Tax.* In 2001, the proportion of the Income Tax collected on their territory that regions were allowed to keep raised up to 33 %. This time, only Navarra and the Basque Country were not directly affected. The size of the shock was similar to the first transfer of Income Tax.
5. *Transfer of the Value Added Tax (VAT).* Also in 2001, regions were allowed to keep up to 35% of all the VAT collected on their territory. As before, Navarra and the Basque Country were not directly affected, but neither were the Canary Islands, which have a different indirect taxation regime. The transfer resulted on a permanent increase of indirect taxation income of around 3.7% of regional GDP.

The nature of these series allows us to use an empirical strategy similar to Romer and Romer (2010). The authors introduce what has become known as the “narrative approach” to identify fiscal policy shocks by analyzing a series of exogenous tax changes based on historical records in the US.<sup>16</sup> Similarly, we construct series of exogenous decentralization changes, valued 0 for every  $t$  except where we have identified a decentralization change, in which case the series takes the value of the size of the change in terms of % of regional GDP. In this case, the year of the shock will be the year in which we observe the actual change in the series of the respective fiscal measure, not the year in which the legislation was introduced. Further, we combine the first two episodes into a single “Spending Decentralization” shocks series; episodes three and four are combined into a single “Direct Taxation” shocks series,

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<sup>16</sup>Subsequently these series are employed by the authors to quantify the effect of tax changes on GDP growth.

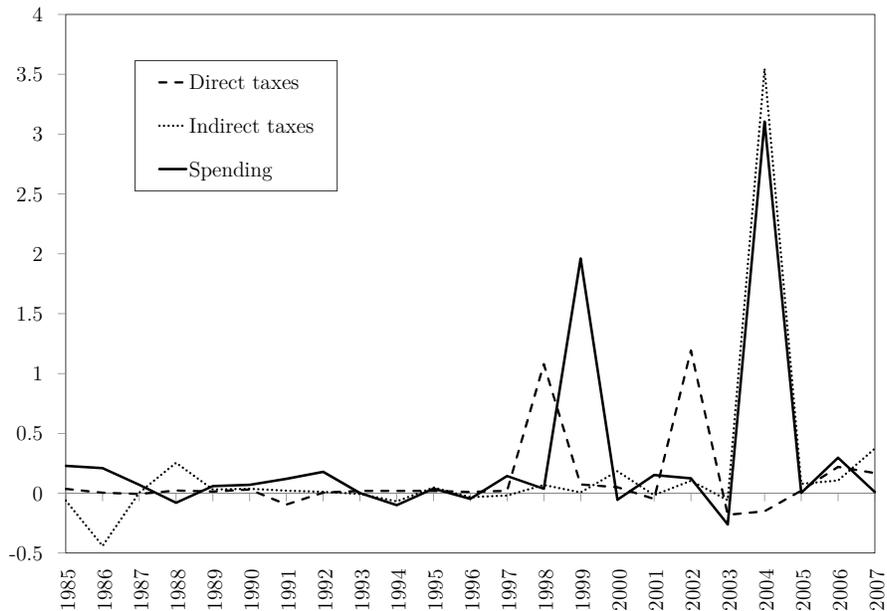


Figure 2.7: First difference of the spending, indirect taxation and direct taxation series for Aragón, measured as % of regional GDP, 1985-2007.

while the last episode defines “Indirect Taxation” shocks. We also define a “Decentralization” shock series, created by combining all shocks. With this definition, we aim at capturing the effect of the change when it is effectively introduced. Given that our series on decentralization changes are the reflection of a political process, we expect no systematic correlation between these changes and other determinants of output growth. Evidence in favor of this hypothesis is presented in the next section.

We explain our approach to identifying decentralization shocks via the example of the region of Aragón. Figure 2.7 shows the first difference of the three aforementioned series measured as percentage of regional GDP. It shows clearly the five episodes of decentralization. The transfer of non-tertiary education appears as an increase on spending of almost 2% of regional GDP in 1999, whereas the transfer of health services is captured by the jump on spending of more than a 3% of regional GDP during 2004. The increased cession of the Income Tax appears as spikes in Direct Taxation of around 1% of GDP during 1998 and then 2002. Finally, the cession

	Full sample		Early adopters		Late adopters	
	Mean	(SD)	Mean	(SD)	Mean	(SD)
Avg Population	2335.5	(2071.7)	3467.6	(2432.4)	1542.9	(1410.9)
Avg. GDP per capita	12821.7	(2639.7)	13172.8	(2585.0)	12575.9	(2787.5)
Avg. real GDP growth	3.71	(0.58)	3.70	(0.56)	3.74	(0.63)

Table 2.4: Descriptive statistics for Early adopters and Late adopters. Population is measured in thousands, GDP in Euros and growth rates are computed year-on-year. Standard deviation in parenthesis. Years 1984-2007.

of part of the Value Added Tax creates a spike on Indirect Taxation of 3.5% of regional GDP during 2004. Notice also that figure 2.7 presents the first difference of the relative fiscal variable and hence all episodes represent permanent shocks as the prerogative is transferred to the region on a permanent basis.

### 2.3.3 Justification of the narrative approach

In order to identify the effect of decentralization on output, it is crucial that the timing of the policy measures is not driven systematically by economic conditions.<sup>17</sup> As we have discussed previously, the decentralization process in Spain is interesting in this sense: because the timing of the implementation was brought about by the political process, the shocks can be reasonably thought of as variations in fiscal policy that are exogenous to economic conditions. In this section, we investigate the claim of exogeneity in two ways.

As a first approximation, we divide the regions into early and late adopters to see if we observe systematic differences between these groups. We classify as early adopters to those regions that took the initiative to decentralize competences and, therefore, got these competences early; and as late adopters the regions that only received competences on the framework of nationwide agreements, where the central government took the initiative. The sorting - motivated by the historical accounts of the decentralization process provided in the previous section - is displayed in table ?? in Appendix D. The differences in terms of the timing of decentralization are indeed

<sup>17</sup>If, for example, the implementation is carried out during episodes of (non-) favorable economic forecasts, we might find a spurious positive (negative) effect from decentralization to output growth.

substantial: for example, the average year in which the decentralization of health services occurred was 1988 for the early adopters and 2000 for the late adopters. Table 2.4 shows that while early adopters are larger regions in terms of population, there appears to be no systematic differences in GDP per capita or growth rates for our sample period.

To further justify our narrative approach - in particular to exclude economic conditions as a cause for the introduction of decentralization - we perform four predictive regressions of the following form: as independent variable, we defined dummy variables (one for each of the three types of decentralization shocks and another one picking up any decentralization shock) with value 1 on the years where we have identified a decentralization shock in our series and 0 otherwise. As dependent variables we use lags of real regional GDP annual growth. Due to the nature of our data, we use a panel data regression with fixed effects in a linear probability framework. The results of this exercise can be seen in table 2.5.

As can be seen, we fail to observe any consistent and significant impact from past GDP growth on the timing of the decentralization shocks. The largest and only significant coefficient corresponds to the *contemporaneous* relationship between decentralization and growth and plausibly - in particular due to the absence of any effects from lagged output growth - captures the effect from decentralization on growth. Both pieces of evidence reinforce our interpretation that the timing of the decentralization episodes were mostly politically motivated and hence exogenous to current output growth, justifying the use of the narrative approach as outlined in the next section.

### 2.3.4 Empirical framework

The empirical specification extends the regression framework proposed by Romer and Romer (2010) to panel data: we employ fixed effects regressions (i.e. including region-specific intercepts) with real regional output growth as the dependent variable.

The regressors include the series of decentralization shocks, including lags, as well as a lag of output growth. More specifically, denoting by  $dir_t$ ,  $ind_t$  and  $spe_t$

	Direct taxation	Indirect taxation	Spending	Any shock
$\Delta Y$	1.533 (0.93)	0.877 (0.69)	0.956 (0.86)	2.703* (1.40)
$\Delta Y(-1)$	0.607 (0.92)	-0.338 (0.68)	-0.072 (0.85)	-0.032 (1.38)
$\Delta Y(-2)$	-0.931 (0.87)	-0.077 (0.64)	0.351 (0.80)	-0.381 (1.30)
$\Delta Y(-3)$	0.402 (0.75)	0.874 (0.56)	0.316 (0.70)	1.164 (1.13)
$\Delta Y(-4)$	-0.041 (0.67)	0.537 (0.50)	-0.297 (0.62)	-0.017 (1.01)
Constant	0.031 (0.05)	-0.021 (0.03)	0.028 (0.04)	0.049 (0.07)
R-squared	0.018	0.021	0.010	0.020
No. of obs.	323	323	323	323

Table 2.5: Regression results for the effects of past GDP growth on the probability of implementing a decentralization measure. The dependent variable is a dummy that takes on the value 1 in the years when reforms were implemented.

Standard errors are reported in parenthesis

\*, \*\* and \*\*\* indicate significance at the .90, .95 and .99 level, respectively

our series of Direct Taxation shocks, Indirect Taxation shocks and Spending shocks respectively, the regression framework is

$$\Delta Y_{i,t} = a_i + \rho \Delta Y_{i,t-1} + \sum_{j=0}^M b_j D_{i,t-j} + e_{i,t}, \quad (2.8)$$

where  $Y_{i,t}$  is the logarithm of real regional output in region  $i$  at time  $t$  and  $D = \{dir, ind, spe\}$  is our measure of decentralization. Estimations are carried out for the joint set of fiscal policy shocks series, as well as for the individual and the aggregate (sum of the three single series) series. In order to allow for a lag in the output reaction to decentralization, we include five lags of the fiscal policy shocks, i.e.  $M = 5$ , and one lag of GDP growth, to control for the usual autoregressive dynamics of GDP growth.

We measure output using nominal series of regional GDP deflated by an annual average price index for every region.  $D = \{dir, ind, spe\}$  is our measure of changes in decentralization as a % of regional GDP. The data is yearly, the period of analysis is 1985-2007 and the cross-sectional units are the 17 Comunidades Autónomas.

### 2.3.5 Results

This section presents and discusses the estimation results for the effects of the different type of decentralization shocks. Table 2.9 in Appendix D presents the results for the regressions of equation 2.8. Then, following Romer and Romer (2010), we compute the dynamic multiplier, taking into account the implied changes in the path of GDP:

$$\text{Dynamic multiplier } (m) \equiv \delta_m = b_m + \rho \delta_{m-1} \quad (2.9)$$

where  $m = \{1, 5\}$  and  $\delta_0 = b_0$ . The standard errors are computed by taking 10,000 draws of the coefficient vector from a multivariate normal distribution with mean and variance-covariance matrix equal to the point estimates and variance-covariance matrix of the regression coefficients.

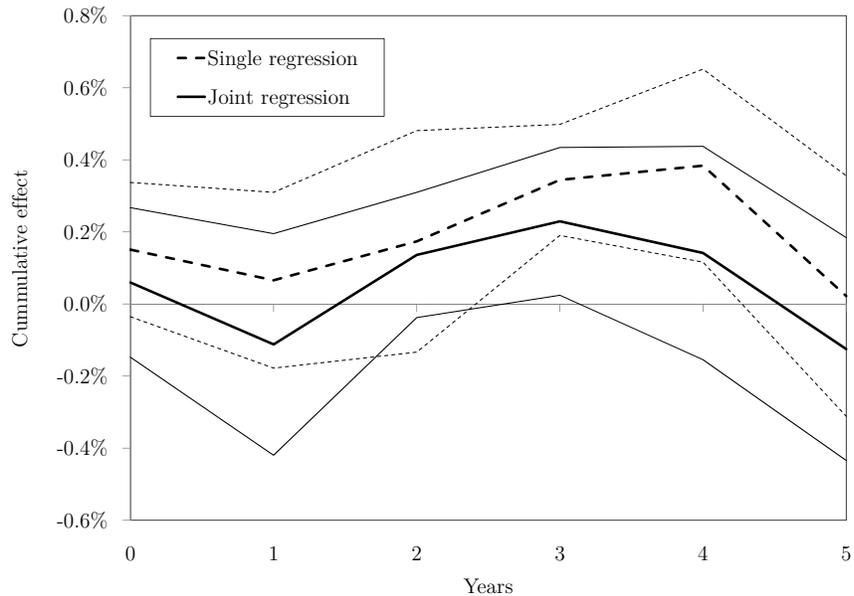


Figure 2.8: Estimated dynamic impact of an spending decentralization shock, single and joint regressions. Thinner lines represent the 95% confidence interval.

### Spending decentralization

The decentralization of spending categories like health care and non-tertiary education were some of the largest, in terms of regional GDP, transfers of competences registered in our database. However, we find only a small effect (if at all) of these transfers on regional growth.

On the individual regression, without the other two shocks included, a transfer of spending competences equivalent to 1% of GDP would achieve its maximum effect 4 years after the shock, adding less than 0.4 percentage points to regional GDP on that period, although for most periods the effect is not significant at the 95% confidence level. When we introduce the other two shocks in the regression, the spending decentralization shocks are no longer significant and the size of their effect is smaller.

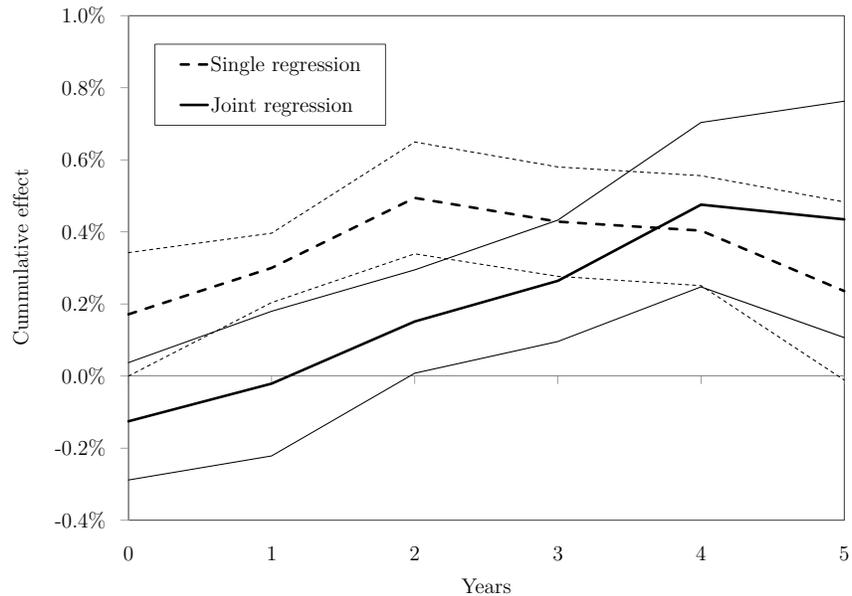


Figure 2.9: Estimated dynamic impact of an indirect taxation decentralization shock, single and joint regressions. Thinner lines represent the 95% confidence interval.

### Indirect taxation decentralization

In the case of the decentralization of indirect taxation competences, we find a somewhat larger effect that is, however, only significant in the long term (after 3 years) in the joint regression. On the single regression, a decentralization of indirect taxation equivalent to 1% of regional GDP would add a maximum of around 0.5 percentage points to regional growth after 2 years. However, after controlling for the other shocks, this decentralization shock only gains significance after 3 years and the size of the effect is similar, peaking at 0.48 percentage points after 4 years.

To put this result in perspective, during the sample period of 1984-2007, the Spanish regions grew an average of 3.71% yearly. The average indirect taxation decentralization shock amounted to 3.70% of regional GDP which, multiplied by the dynamic effect computed before, implies an increase of 1.76 percentage points 4 years after the introduction of the shock, when the peak effect is registered. This number amounts to a 47% bump on the average regional growth rate. Over five years, a

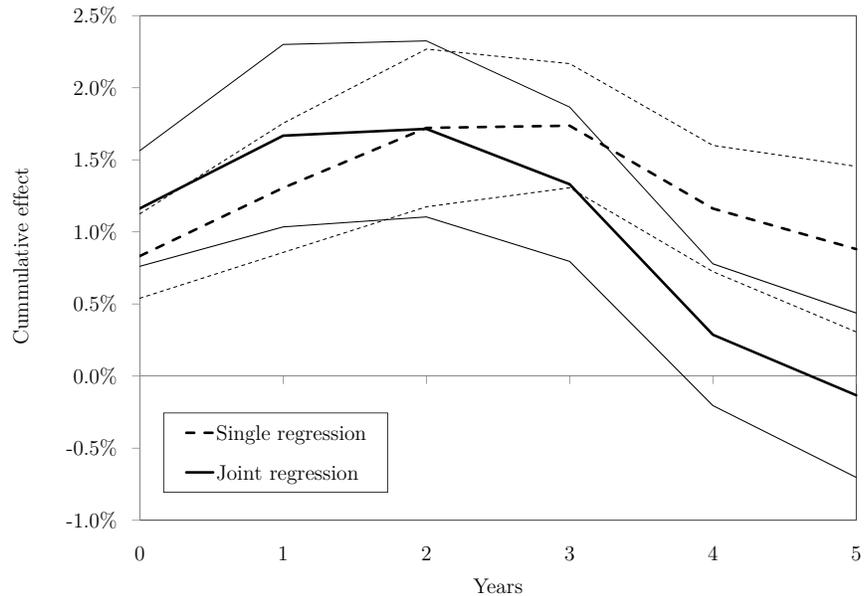


Figure 2.10: Estimated dynamic impact of a direct taxation decentralization shock, single and joint regressions. Thinner lines represent the 95% confidence interval.

region would have grown 24.43% on average over the course of five years. After the introduction of the decentralization shock, taking into account the dynamic effect on every period, the accumulated growth would be of 29.73 per cent.

### Direct taxation decentralization

The decentralization of direct taxation registers the largest effects on regional GDP growth despite being, on average, the smaller of the three shocks considered. Furthermore, the decentralization of direct taxation is the only one whose effect is positive and statistically significant for any number of lags considered. When the direct taxation shocks are included as regressors individually, the maximum estimated dynamic effect of decentralizing direct taxation by a quantity equivalent to 1% of regional GDP would be to add 1.73 percentage points to regional GDP after 3 years. When all decentralization shocks series are included in the regression, the maximum effect peaks after 2 years at around 1.71 percentage points.

Similar to the case of the decentralization of indirect taxation, we can put this number into perspective. In this case, the average direct decentralization shock amounted to around 1.06% of regional GDP, so the comparison is more straightforward. With an average growth of 3.71% yearly, the average region would have added 1.81 percentage point to their growth two years after the decentralization, or an increase of a 49 per cent. The accumulated growth of an average region on the five years following the decentralization shock would be a 32.25%, versus a 24.43% without the shock.

### **Aggregate decentralization shock**

Finally, for reference, we consider an aggregate decentralization shock, constructed simply by adding together the series of the three individual shocks. Doing so, we observe how this aggregate shock is positive and statistically significant from impact, peaking after 2 years with a dynamic effect of around 0.28 extra percentage points added of regional GDP growth.

In our data, the average aggregate decentralization shock amounts to 2.90% of regional GDP which, multiplied by the accumulated effect computed before, implies adding 0.82 percentage points to GDP growth on the second year after the shock. Over 5 years, the total accumulated GDP growth would be of 28.27%, an increase of 3.8 percentage points over the baseline.

### **2.3.6 Discussion**

For an interpretation of these results, it is useful to place them in their historical context. Furthermore, the results we have obtained in the previous section allow us to connect with the prevailing theories of fiscal federalism.

First, the changes on spending decentralization involved mainly the transfer of the competences on Health Care and Education to the regions. Since all regions already had functioning sanitary and educative sectors, the margin for fiscal maneuver was limited: collective agreements with the workers had to be honored and standards were set so as to ensure that every citizen in the country had access to a similar

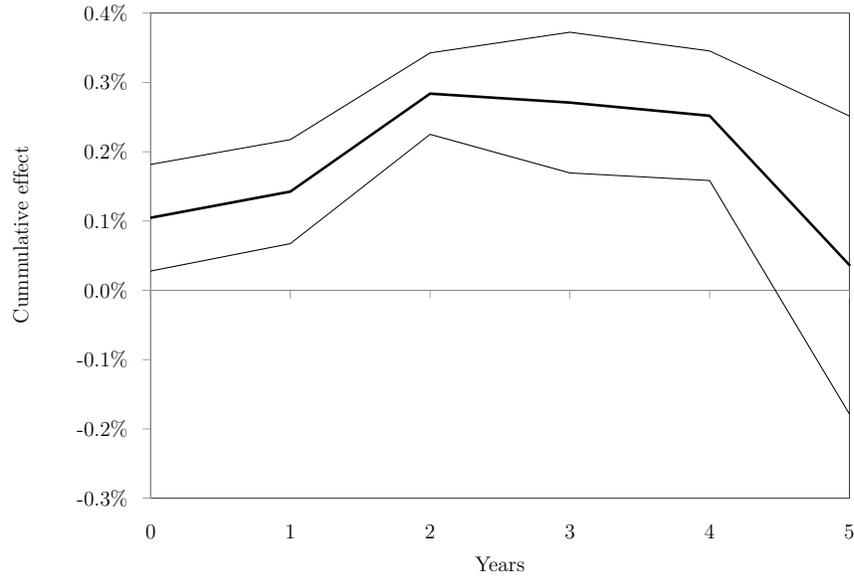


Figure 2.11: Estimated dynamic impact of an aggregate decentralization shock. Thinner lines represent the 95% confidence interval.

level of services, for example. Therefore, it is to be expected that the spending decentralization shocks studied here will have a small effect on the economic output of the regions, if at all.

Second, the changes in indirect taxation consisted typically in an increase of the proportion of taxes collected on the region that the regional governments could hold on to. On the one hand, these changes were usually matched with corresponding reductions on the amount of transfers received from the central government. Furthermore, the tax rates for the VAT are decided at the central level and are the same for all regions. On the other hand, decentralizing the collection of indirect taxation can in principle induce the regional governments to foster economic growth, as it expands the tax base and so increases their income. This idea follows the arguments developed in the so-called “Second generation fiscal federalism”, that emphasizes the importance of fiscal incentives for producing local economic prosperity.<sup>18</sup> The lower

<sup>18</sup>For a survey in the topic, see for example Weingast (2009).

reliance on transfers and higher reliance on own resources could nudge the regions into introducing measures destined to expand their tax base and create economic growth. In principle, this mechanism would explain the fact that the decentralization of indirect taxation only turns significant after some years, as the potential changes introduced by the regions to foster growth and so reap the benefits of an increased tax base would take time to materialize.

Finally, the decentralization of direct taxation registers a significant, positive effect on regional income growth. The key in this case is that the decentralization of the income tax included the possibility for regional government to modify legislative aspects, such as tax rates, brackets and deductions, affecting their tax scheme design as well as total taxes collected. Therefore, the decentralization of direct taxation implied not only a change in the way a region finances itself, as the decentralization of indirect taxation, but also opened up the possibility for the regions to conduct fiscal policy.

On top of the possible effect on the incentives to increase the tax base, the decentralization of direct taxation plus giving legislative powers on taxation to the regions opened a new channel of influence of decentralization on growth: tax competition. Allowing regional governments to (partially) set the tax rates can promote tax competition between jurisdictions, resulting in lower tax rate and promoting growth. A modified version of this theory can be traced back to the work of Brennan and Buchanan (1980), where the authors used the tax competition argument to partly construct the “Leviathan hypothesis”: more-decentralized government structures should be smaller, in terms of government spending, relative to the size of the economy.

In fact, we find some evidence of tax competition, as can be seen in figure 2.12. The average effective tax rate naturally grows over time as the nominal tax base grows and workers move into higher brackets. There are two big drops in the average effective tax rate that match exactly the years were the income tax was reformed to allow the regions to keep part of the tax collected on their territory. Unfortunately, the available data does not allow us to disentangle the part of the drop in the average effective tax rate due to the decrease in the tax rate induced by the central

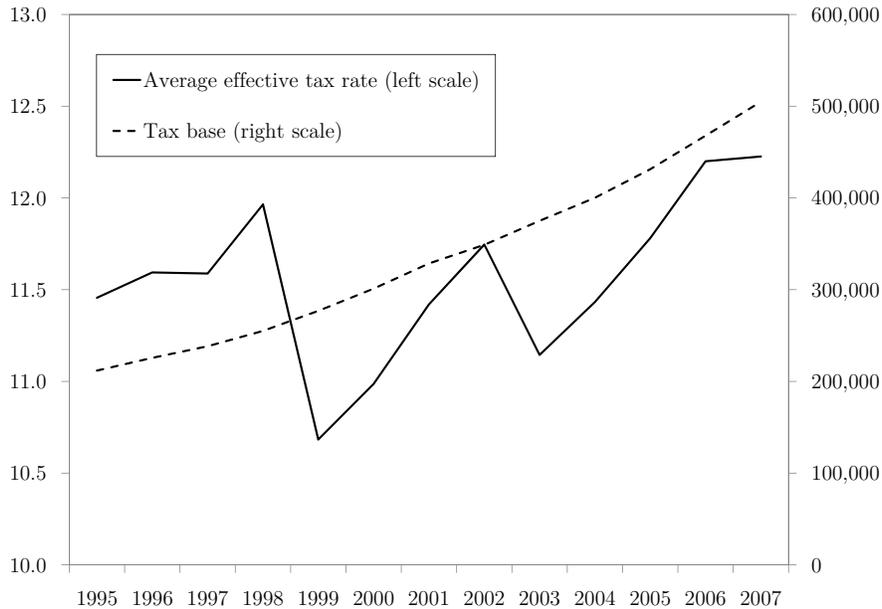


Figure 2.12: Average effective tax rate and tax base (in millions of euros) for the labor income tax. Spain 1995-2007. Source: Agencia Tributaria.

government from the part induced by the regional governments.

The results discussed here also tie nicely with the analysis in the previous section. In the first part we saw how more decentralized countries tend to have larger multipliers corresponding to their fiscal policy. Similarly, the second part showed how moving into more decentralized political structures produces a positive effect on the economic growth of the regions involved. The main conclusion from the paper is, therefore, in line with the classical theory of fiscal decentralization: fiscal policy becomes more effective when it allows the regions to design policies better tailored to their citizens. At the same time, it is important to notice that the focus of this study were the short term dynamics and transition mechanisms for fiscal policy. Potential long run effects that include a more detailed investigation of regional debt dynamics, for example, are left for further research.

## 2.4 Conclusion

This paper evaluates empirically the effects from decentralizing fiscal policy. The first section comprises a cross-country analysis of 11 European countries that differ substantially in their degree of decentralization. We find that more decentralized countries, i.e. countries in which regions have larger fiscal competences relative to the central government, tend to have larger fiscal multipliers. We interpret this result as evidence of favorable gains from regionally tailored fiscal policy.

We also provide evidence from a case study of Spain, where we exploit time variation in its decentralization process. These decentralization changes were orthogonal to economic conditions, and can therefore be used to measure the direct impact of decentralization on output growth. We find economically large and statistically significant positive effects from the decentralization of direct taxation, and, to a lesser extent, from indirect taxation and government spending on GDP growth. Part of the positive effect on output growth can be attributed to a reduction in taxes rates, and is likely to be attributed to tax competition between provinces. In line with our cross-country analysis, the results from the case study of Spain reinforce the evidence for the existence of efficiency gains through (regionally) tailored fiscal policy.

# Appendix

## C Decentralization measures and cross-country comparison

### Alternative measures of decentralization

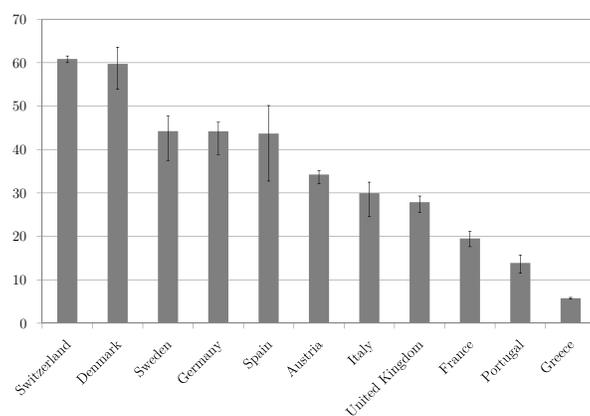


Figure 2.13: Decentralization index: regional share of spending including transfers in %, 1996-2011. Averages along with highest and lowest observation.

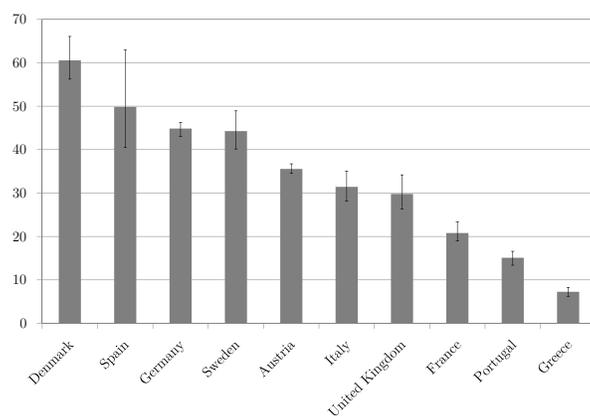


Figure 2.14: Decentralization index: regional share of taxation including transfers in %, 1996-2011. Averages along with highest and lowest observation.

## Decentralization and key economic variables

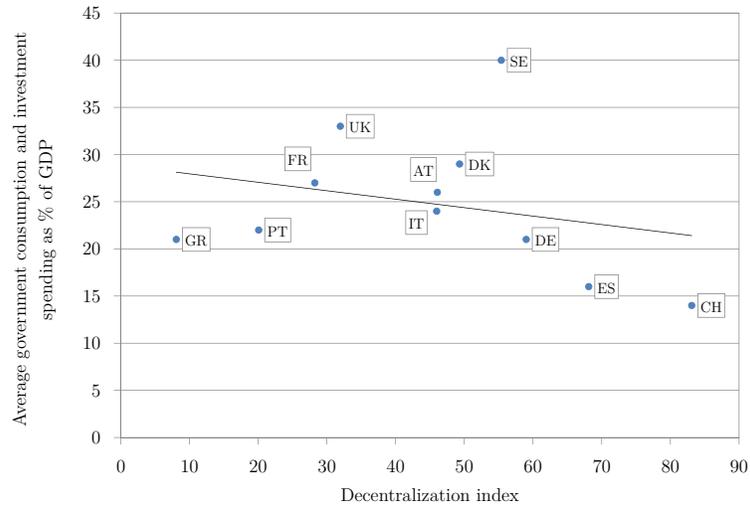


Figure 2.15: Decentralization index vs. size of government spending.

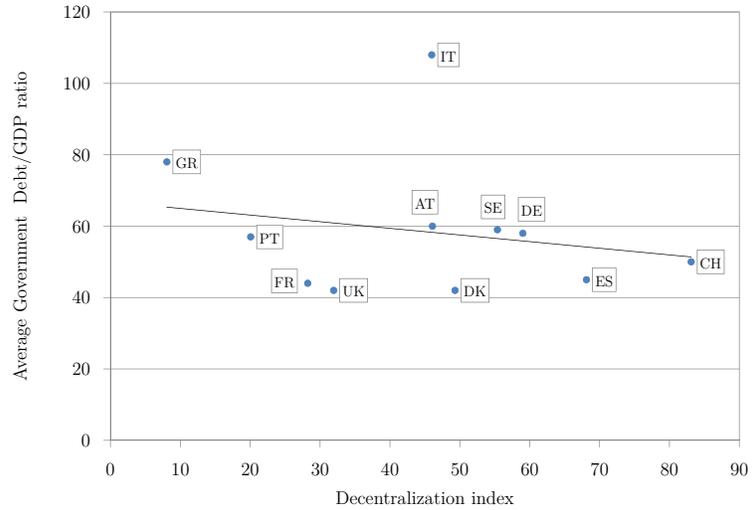


Figure 2.16: Decentralization index vs. government debt

	Spending	Con. Spending	Inv. Spending	Revenues
Austria	0.233 (0.0193)	0.209 (0.0111)	0.0247 (0.00907)	0.500 (0.0268)
Denmark	0.288 (0.0121)	0.251 (0.00754)	0.0371 (0.00792)	0.541 (0.0180)
France	0.282 (0.0109)	0.240 (0.00938)	0.0425 (0.00265)	0.487 (0.0123)
Germany	0.216 (0.0116)	0.192 (0.0103)	0.0241 (0.00304)	0.413 (0.0270)
Greece	0.234 (0.00743)	0.206 (0.0106)	0.0321 (0.00468)	0.352 (0.0669)
Italy	0.232 (0.0161)	0.208 (0.0134)	0.0246 (0.00328)	0.421 (0.0367)
Portugal	0.226 (0.0122)	0.183 (0.0128)	0.0432 (0.00566)	0.345 (0.0901)
Spain	0.197 (0.0190)	0.159 (0.0124)	0.0384 (0.00813)	0.361 (0.0289)
Sweden	0.366 (0.0347)	0.322 (0.0323)	0.0435 (0.00474)	0.581 (0.0248)
Switzerland	0.148 (0.00816)	0.115 (0.00604)	0.0327 (0.00321)	0.327 (0.0290)
UK	0.239 (0.0202)	0.221 (0.0227)	0.0174 (0.00393)	0.374 (0.0309)

Table 2.6: Spending and Revenues over GDP by country. Spending denotes the sum of government consumption and investment expenditure; Cons. and Inv. Spending stand for consumption and investment spending, respectively. Standard deviations in parenthesis. Quarterly observations, 1980-2007.

	GDP growth	(X+IM)/GDP	Population	Gross debt/GDP
Austria	1.946 (1.154)	2.951 (0.626)	7.853 (0.252)	63.27 (4.403)
Denmark	1.961 (1.656)	2.444 (0.261)	5.232 (0.117)	54.88 (15.43)
France	1.656 (1.177)	1.821 (0.258)	57.46 (2.302)	46.07 (15.77)
Germany	1.705 (1.487)	2.304 (0.451)	80.11 (2.450)	56.35 (8.688)
Greece	1.704 (2.528)	1.417 (0.133)	10.46 (0.494)	72.77 (27.80)
Italy	1.665 (1.262)	1.782 (0.252)	56.91 (0.464)	101.9 (9.609)
Portugal	2.557 (2.439)	2.348 (0.195)	10.14 (0.219)	55.73 (5.078)
Spain	2.380 (1.769)	1.620 (0.338)	39.88 (2.046)	44.95 (13.16)
Sweden	2.094 (1.776)	2.332 (0.421)	8.699 (0.276)	56.87 (11.20)
Switzerland	1.199 (1.796)	2.618 (0.315)	6.883 (0.383)	48.63 (12.81)
United Kingdom	2.412 (1.602)	1.785 (0.103)	57.99 (1.404)	41.72 (4.876)

Table 2.7: Descriptive statistics for additional determinants of fiscal multipliers by country, yearly observations 1980-2007. Population is in millions. Standard deviations in parenthesis. Source: International Monetary Fund, World Economic Outlook Database and eLibrary.

## Bootstrap algorithm for averaged multipliers

This section describes the bootstrap algorithm used for obtaining the confidence bands for the average multiplier across a specific country group.

1. Draw  $n$  nonparametric impulse responses (IRFs) for each country individually. Each of the  $n$  IRFs is obtained by bootstrapping the residuals and reestimating the VAR. In each replication, the residuals drawn have the same time index  $t$  for each country in a respective group.
2. Standardize each impulse response by dividing by the size of the fiscal shock and the average fiscal variable to GDP ratio.
3. Draw (with replacement) one impulse response function for each country in the respective group. These draws are not independent across countries, but ensure that the impulse response function of each country are based on the same time index  $t$  residuals. Then compute the average impulse response for each horizon.
4. Repeat step 3  $m$  times.
5. Compute Hall (2013)-percentiles from  $m$  draws obtained above (as described e.g. in Lütkepohl 2005).

## Robustness: Results from 2-variable VARs

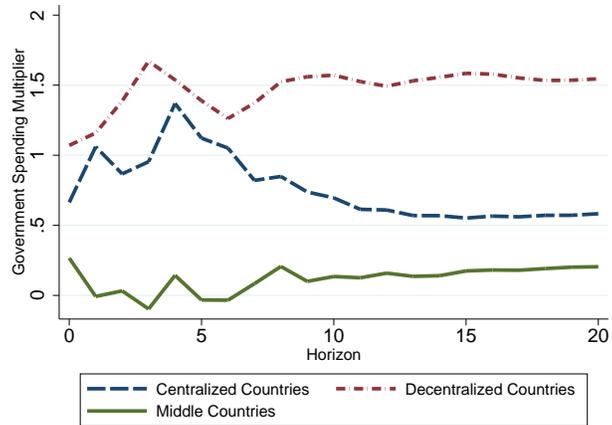


Figure 2.17: Cummulative spending multipliers, average across country group. The multipliers describe the output response to a positive spending shock. Estimates are based on a 2-variable VAR including output and government spending.

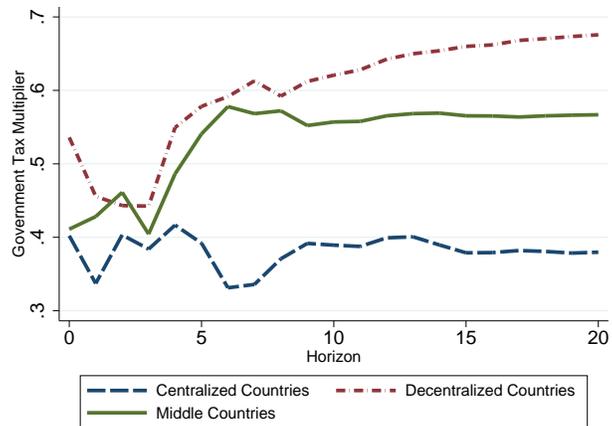


Figure 2.18: Cummulative revenue multipliers, average across country group. The multipliers describe the output response to a negative tax shock. Estimates are based on a 2-variable VAR including output and government revenues.

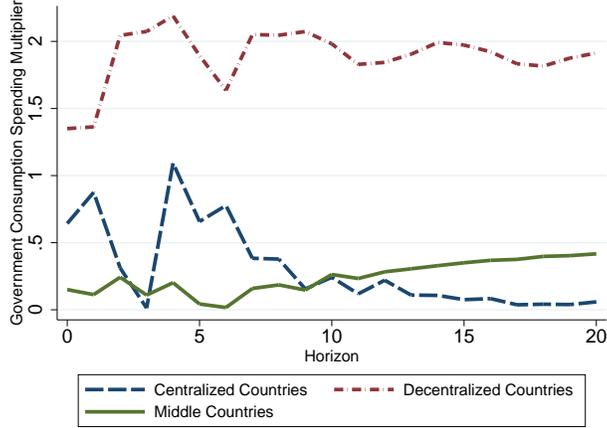


Figure 2.19: Cummulative spending multipliers, average across country group. The multipliers describe the output response to a positive government consumption shock. Estimates are based on a 2-variable VAR including output and government consumption spending.

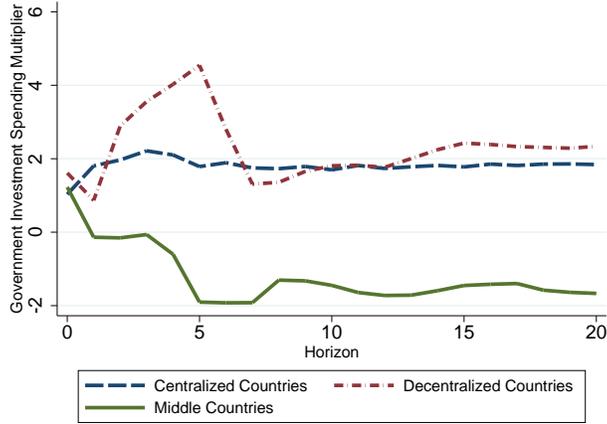


Figure 2.20: Cummulative spending multipliers, average across country group. The multipliers describe the output response to a positive government investment shock. Estimates are based on a 2-variable VAR including output and government investment spending.

## D Intranational evidence

### Justification of the narrative approach

Early adopters	Late adopters
Andalucía	Aragón
Canarias	Asturias
Catalunya	Islas Baleares
Galicia	Castilla-La Mancha
Navarra	Cantabria
País Vasco	Castilla y León
Comunitat Valenciana	Extremadura
	Comunidad de Madrid
	Murcia
	La Rioja

Table 2.8: Early-late adopters list

## Regression results

	A	B	C	D
$\Delta Y(-1)$	0.3512*** (0.05866)	0.4205*** (0.05685)	0.4315*** (0.04804)	0.3196*** (0.07006)
Direct taxation	0.0083*** (0.00149)			0.0116*** (0.00205)
L.Direct taxation	0.0102*** (0.00228)			0.0129*** (0.00320)
L2.Direct taxation	0.0126*** (0.00280)			0.0118*** (0.00310)
L3.Direct taxation	0.0113*** (0.00218)			0.0078** (0.00273)
L4.Direct taxation	0.0055** (0.00221)			-0.0014 (0.00254)
L5.Direct taxation	0.0047 (0.00290)			-0.0023 (0.00295)
Indirect taxation		0.0017* (0.00086)		-0.0012 (0.00083)
L.Indirect taxation		0.0023*** (0.00049)		0.0002 (0.00103)
L2.Indirect taxation		0.0037*** (0.00078)		0.0016** (0.00073)
L3.Indirect taxation		0.0022** (0.00077)		0.0022** (0.00086)
L4.Indirect taxation		0.0022** (0.00077)		0.0039*** (0.00117)
L5.Indirect taxation		0.0007 (0.00127)		0.0028 (0.00168)
Spending			0.0015 (0.00095)	0.0006 (0.00106)
L.Spending			-0.0000 (0.00125)	-0.0013 (0.00157)
L2.Spending			0.0014 (0.00157)	0.0017* (0.00089)
L3.Spending			0.0027*** (0.00079)	0.0018* (0.00104)
L4.Spending			0.0023 (0.00136)	0.0007 (0.00150)
L5.Spending			-0.0014 (0.00171)	-0.0017 (0.00157)
Constant	0.0163*** (0.00132)	0.0172*** (0.00154)	0.0173*** (0.00137)	0.0166*** (0.00142)
R-squared	0.3151	0.2745	0.2441	0.3443
No. of obs.	267	261	306	260

Table 2.9: Regressions results for the effect of a decentralization shock on  $\Delta Y$ , the (log) growth rate of regional GDP

Standard errors are reported in parenthesis

\*, \*\* and \*\*\* indicate significance at the .90, .95 and .99 level, respectively

## Chapter 3

# Regional decentralization and National debt: some lessons for the European Project

### 3.1 Introduction

Public debt, and how to control it, has been on the spotlight during the current economic crisis. The levels of national debt have been increasing steadily since 2007 and the efforts to curb this tendency are now a priority for most European countries.

On the policy debate about how to control national debt and, particularly, on how to reduce government spending, regional governments are receiving a great deal of attention. To name just a few examples, there are debates in Spain about the elimination of the provinces (tier 2 regional government) or the devolution of some responsibilities, like health care and education, back to the central government. The debate is also present in a federal country like Austria, where the existence of 10 regional parliaments has been criticized for, according to their detractors, leading to wasteful expending. This consideration of some levels of government as unnecessary expenditure appears in the austerity plans outlined by some European countries. In Italy, after years of debate, finally the decree “Salva Italia”, the Italian austerity

plan, includes the elimination of the provinces, a regional government tier between the region and the municipality.<sup>1</sup> In Portugal, the bailout accord, called “Memorandum of understanding on specific economic policy conditionality”, includes an article about reducing the number of municipalities.<sup>2</sup> Greece introduced in 2010 the Kallikrátis Plan, aimed at reducing the number of municipalities by 2/3, while at the same time also reducing some of the duties of the lower tiers of government. Even a country that has not been hit as hard by the current crisis, France, introduced during the summer of 2014 a plan to reduce the number of Regions (tier 2 regional governments) from 22 to 14. Proposals to limit public spending by consolidating regional governments have extended outside the Euro Area: the Danish Municipal Reform of 2007 divided the country into 5 Regions, replacing the existing 17 Counties and the number of municipalities was cut from 270 to 98; likewise, Sweden is studying a proposal to reduce the number of Counties from the existing 21 to 6 or 9.

The importance of regional governments on controlling government spending is obvious, for two reasons: first, government spending is not carried away completely by the central government in any country in Europe. In some European countries, regional governments are responsible for more than half of the total government spending. Second, controlling spending can be potentially problematic when part of it is carried away by the regional governments, which can have different goals, agendas or electoral interests than the central government. The problem for the central government then is not only to decide on the reduction of government spending, but also to enforce fiscal consolidation through the regional governments. Because of these two reasons, regional governments, especially in those countries with highly decentralized structures, are considered a key factor for controlling debt. In some cases, regions have even being considered the origin of the debt problem, blamed for creating a duplication of public services, over-spending or free riding the central

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<sup>1</sup>Decreto-legge 6/12/2011 n201, art.23

<sup>2</sup>Article 3.43 reads: “[...] There are currently around 308 municipalities and 4,259 parishes. By July 2012, the government will develop a consolidation plan to reorganize and significantly reduce the number of such entities. The Government will implement these plans based on agreement with EC and IMF staff. These changes, which will come into effect by the beginning of the next local election cycle, will enhance service delivery, improve efficiency, and reduce costs.”

government.

However, is there any evidence supporting that decentralized regional structures affect negatively the level of debt of a country? Does giving more power to the regions make them overspend? This paper addresses these questions both theoretically and empirically. First, I present a theoretical two period model with a central government and a set of regional governments as strategic players that reverses the standard result on the literature of a positive relation between decentralization and debt. In the model, all tiers of governments can tax, spend and issue debt, so as to replicate the setup of most European countries. Initially, free-riding on the part of the regions could arise because of a common-pool problem: as taxation is costly in terms of utility, the regional governments will try to spread the burden by issuing debt, knowing that the central government will have the incentives to bail them out in the end, in order to avoid a default. However, as observed on the data, regional governments depend economically on the transfers received from the central government. This dependence can be used as leverage by the latter to eliminate the free riding incentives of the regions. I show that the central government can credibly threaten the regions with cutting back the transfer they receive, and so the regions curb their spending.

Then, using panel data for a sample of 31 European countries over the last 18 years, I examine the relationship between government decentralization and the level of debt. The empirical evidence does not support the hypothesis of a positive relation between decentralization and debt. Instead, the relation between both variables is insignificant, as predicted by the theoretical model.

The next section reviews the existing literature on the topic. Section 3 builds a theoretical model that reverses the standard results of the literature, section 4 explores the empirical relation between fiscal decentralization and debt, based on the hypothesis derived from the theoretical model, and, finally, Section 5 concludes and offers some relation between the main results of the paper and some current policy issues in the Euro Area.

## 3.2 Literature review

The debate on the advantages and disadvantages, from a theoretical standpoint, of fiscal decentralization goes way back in time; for example, Tiebout (1952) and Oates et al. (1972) claimed that the decentralized provision of public goods enhances economic efficiency because of the informational advantages, thanks to being closer to their electorate, of regional governments with respect to the central government. On a similar note, Brennan and Buchanan (1980) explained how tax competition between jurisdictions, resulting in lower tax rates, restrains the growth of local governments and improve economic performance in general, whereas in Mello (2000) fiscal decentralization also strengthens the accountability of subnational governments towards their electorate.

On the other hand, papers like Rodden (2002) or Bordignon (2006) focus on one of the main problems of fiscal decentralization: the common pool problem, where subnational governments receive funds from a central common pool and fail to fully internalize the costs of public funding. On a similar note, Goodspeed (2002) establishes how, in a dynamic setting, the accumulated subnational debt will feed the demand for a bailout by the central government through increased transfers, since the increase in taxation will be shared by all jurisdictions.

Relatedly, Cooper, Kempf, and Peled (2008) highlights the relation between a country's decentralized or federal structure and a subsequent tendency to over-accumulate debt. They characterize the conditions under which bailouts within a fiscal union can take place. In their paper, the first best allocation is achieved via ex-ante federalism, so that the distortionary taxes can be better spread among a larger group of agents. However, to support this allocation, the central government needs commitment power; ex-post, the central government may not be able to commit to its policies. Depending on the spending of the regions, the central government may have incentives to bailout their debt. In such case, regions can and will take advantage of the situation by running higher deficits. See also Chari and Kehoe (1998) and Sanguinetti and Tommasi (2004) for further studies dealing with commitment and debt. Lack of commitment, however, is not the only explanation in the literature

for the apparent excess of debt issued by regional governments. García-Milá and McGuire (2007) blame the positive correlation between debt and decentralization on a timing issue: in the case of Spain, the decentralization of spending was made before the decentralization of taxation.

A related strand of the literature has looked at the effect of different political configurations on debt. The standard conclusion of this literature is that more divided governments tend to accumulate more debt and/or run higher deficits; see for example, Roubini et al. (1989), Volkerink and Haan (2001) or Perotti and Kontopoulos (2002). These papers, however, deal with political fragmentation, be it on the composition of the government or the number of members of its cabinet and, therefore, do not relate exactly to the topic of regional fragmentation and debt accumulation discussed on this paper.

Empirically, the closest paper to this one is Rompuy (2012). His analysis concludes that higher vertical expenditure redistribution did not weaken subnational fiscal discipline, whereas revenue decentralization contributed positively to better aggregate budgetary outcomes of the lower level governments. In addition to subnational tax autonomy, balanced budget requirements sustained fiscal discipline. Tax sharing arrangements and intergovernmental grants also enhanced the positive impact of own taxes on subnational fiscal balances. Also similar, although using a measure of tax decentralization, Asatryan, Feld, and Geys (2012) find supportive evidence for the idea that higher revenue decentralization (measured as the subnational governments share of own source tax revenues) is associated with improved sub-national government budget balances.

The model of this paper places particular emphasis on the role of transfers to mitigate the common pool problem. In this respect, Mello (2000) finds that the transfer dependency of the subnational governments improves the budgetary performance on OECD countries. On the contrary, Rodden (2002) concludes that as countries rely more on intergovernmental transfers over time, both their national and subnational fiscal performance decline. However, borrowing restrictions or a high degree of taxing autonomy contribute to mitigate the problem for the subnational governments. Finally, Plekhanov and Singh (2006) document how centrally imposed fiscal rules (and

cooperative agreements) have a favorable impact on subnational deficits, particularly when lower level governments are strongly dependent on vertical transfers.

### 3.3 A basic model of fiscal unions

In what follows, I build a basic model of a fiscal union capable of reversing the standard result on the literature of a positive relationship between decentralization and debt.

#### Basic features

The basic model draws from Cooper, Kempf, and Peled (2008). I use a two-period real economy without money. The main actors in this economy are a number  $n$  of regional governments and a central government that monitors them. All fiscal entities have full fiscal independence, being able to levy taxes, spend on public goods and issue debt. The setup of the aforementioned paper had just two regional governments with more limited functions. This way, this model is able to reflect better on the problematic of a federal state, the goal of this paper.

Agents live for two periods. On each period they supply labor and consume the single good of the economy. Each unit of labor produces one unit of the final good; the production of the good can be consumed or stored. Agents have access to a storage technology with an exogenous return of  $R$ . The possibility of regional mobility is excluded.<sup>3</sup>

The representative agent in region  $i$  solves

$$\max_{n_1, n_2, s^i} u \left( g_1 + e + n_1(1 - \tau_1) - \frac{n_1^{1+\gamma}}{1 + \gamma} - s^i \right) + \beta \left( g_2 + n_2(1 - \tau_2) - \frac{n_2^{1+\gamma}}{1 + \gamma} + s^i R \right) \quad (3.1)$$

where  $u(\cdot)$  and is strictly increasing and concave.  $\tau_1$  and  $\tau_2$  represent the taxes

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<sup>3</sup>According to the Special Eurobarometer 337 only 10% of Europeans have ever lived and worked abroad. The reasons alleged for not moving are easily applicable to the national case; therefore, excluding regional mobility does not appear to be an extreme assumption.

faced by the agent on each period. Hence,  $n_i(1 - \tau_i)$  is the labor income after taxes and  $\frac{n_i^{1+\gamma}}{1+\gamma}$  is the disutility from working.

Public spending per capita enters as a perfect substitute for consumption on both periods. The agent receives this public spending from both the central government and her regional government, distributed according to an exogenous parameter  $\delta$ : on aggregate, the agents receive  $(1 - \delta)g_i$  from the central government and  $\delta g_i$  from the regional government. Therefore, the exogenous parameter  $\delta$  mimics the decentralization measure used in the following section and is therefore a key element of the analysis. Public spending is random, so  $g_i$  is composed out of the realized values of a random variable  $G$ , with a known distribution, from where the central and the regional governments draw.

Throughout the paper, taxation is collected by the regional governments in the first period and by the central government in the second period. With this timing for taxation, I intend to represent the dependence of the regions on the central government, a stylized fact explained on the next section. Because taxation is distortionary, the regions are not able to raise enough income in the first period so as to finance their spending in both periods. Therefore, on the second period, the regions will depend on a transfer from the central government to finance the spending they have to carry out and the debt they have to repay. As we will see, this modified timing does not affect the incentives of the regions to free ride the central government, but it opens the possibility of the central government to use coercive measures.

In any period, and for any prevailing tax rate in that period, the first order condition for labor is

$$(1 - \tau)^{\frac{1}{\gamma}} = n \tag{3.2}$$

Call this labor relationship  $n(\tau)$ . Further, call  $I(\tau) \equiv \tau n(\tau)^4$  to the level of tax revenue for any given tax level and  $Z(\tau) \equiv (1 - \tau)n(\tau) - \frac{n(\tau)^{1+\gamma}}{1+\gamma}$  to the total contribution to consumption from work, net of the disutility it creates. The problem

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<sup>4</sup>Throughout the paper, it will be assumed that we are in the upward part of the Laffer curve, so that if there are multiple levels of  $\tau$  so that  $I(\tau) = X$ , I select the lowest value of  $\tau$ .

then becomes

$$W(\tau_1, \tau_2 \mid g_1, g_2) = \max_s u(g_1 + e + Z(\tau_1) - s) + \beta(g_2 + Z(\tau_2) + sR) \quad (3.3)$$

The agent can save either through storage or government bonds, with the same return in equilibrium. The endowment  $e$  is assumed to be large enough so that the non-negativity constraint is fulfilled. The first order condition of the problem is

$$u'(c_1) = R\beta \quad (3.4)$$

## First best solution

To obtain the first best solution, there is a central planning entity, setting taxes on both periods. To allow for comparability, the regions collect taxes on the first period, so there might be a different tax rate for every region, and the central government on the second, so that the tax rate is common. The optimal tax policy solves

$$\max_{\tau_1^i, \tau_2} \sum_{i=1}^n \Delta^i W(\tau_1^i, \tau_2 \mid g_1, g_2) \quad (3.5)$$

subject to the intertemporal budget constraint

$$g_1 + \frac{g_2}{R} = \sum_{i=1}^n \Delta^i I(\tau_1^i) + \frac{1}{R} \left[ \sum_{i=1}^n \Delta^i I(\tau_2) \right] \quad (3.6)$$

where  $\Delta^i$  is the share of the population in region  $i$ .

**Proposition 1.** The solution to the optimal tax policy problem entails taxation smoothing over all regions and all periods, so that  $\tau_1^i = \tau_1^* \forall i$  and  $\tau_1^* = \tau_2^* = \tau^*$ .

**Proof** The first order conditions with respect to  $\tau_1^i, \tau_2$  of the problem are

$$u'(c_1^i) Z'(\tau_1^i) = \lambda I'(\tau_1^i) \quad (3.7)$$

$$\beta Z'(\tau_2) = \frac{\lambda}{R} I'(\tau_2) \quad (3.8)$$

where  $\lambda$  is the Lagrange multiplier of the restriction. Combining both and using the household's first order condition (3.4)

$$\frac{Z'(\tau_1^i)}{I'(\tau_1^i)} = \frac{Z'(\tau_2)}{I'(\tau_2)} \quad (3.9)$$

Let  $\xi(\tau)$  be the elasticity of labor supply with respect to the tax rate. Then, from the first order condition for labor  $\xi(\tau) = -\frac{\tau}{\gamma(1-\tau)}$ , monotonically decreasing in  $\tau$ . By definition,  $\frac{Z'(\tau_1^i)}{I'(\tau_1^i)} = -\frac{1}{1+\xi(\tau)}$ , also monotone in  $\tau$ . Therefore, as  $\tau_2$  is common for all regions, then  $\tau_1^i = \tau_1^* \forall i$  and  $\tau_1^* = \tau_2^* = \tau^*$ . ■

In this first best scenario, the central planning authority uses its power to perfectly smooth taxation across all regions and all periods. Since, in most countries of the sample, the central authority retains the power to set the tax rates, this result is generally observed in the data. Even in countries that let their regions set some tax rates, like Spain, the regional differences are small. The only exception is Switzerland, where the difference in some tax rates among regions is up to 20 points.<sup>5</sup>

The debt level of this economy and, in fact, of any economy throughout the paper, is the combination of the central government's and regional debt

$$B = B^c + \sum_{i=1}^n \Delta^i B^i = (1 - \delta)g_1 + \left[ \delta g_1 - \sum_{i=1}^n \Delta^i I(\tau_1^*) \right] = g_1 - I(\tau_1^*) \quad (3.10)$$

The level of debt of the economy will be a function of the tax rate during the first period, but it is independent of the level of decentralization of the economy  $\delta$ . However, there is an important underlying assumption: this allocation can be supported because the planning authority has perfect commitment power. In the next subsection I discuss the case where the central government and the regions take decisions independently.

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<sup>5</sup>Source: Office fédéral de la statistique.

## Decentralized equilibrium

In the decentralized equilibrium, all strategic players on the model are autonomous and they interact between them. As is standard in this kind of models, the central government tries to maximize the welfare of all agents, whereas the regional governments only care about their own agents. The timing of the game played between the economic agents in the economy, both strategic and competitive, is as follows:

- Period 1
  - Nature selects  $g_1, g_2, \delta$
  - Regional governments carry out their spending, so that it adds up to  $\delta g_1$ . Each regional government  $i$  sets  $\tau_1^i$  given spending. If tax revenue is insufficient, they issue debt
  - Central government spends  $(1 - \delta)g_1$ , financed with debt
  - Private agents make their labor and saving decisions taking into account the actions of the governments
  
- Period 2
  - Central government spends  $(1 - \delta)g_2$ , sets  $\tau_2$ , uses the revenue to cover its spending and repay its debt, and distributes the remaining part to the regions
  - Using the transfer from the central government, the regions repay their debt and spend  $\delta g_2$
  - If any government does not fully cover its obligations, there is a default and the affected agents incur a utility loss of  $\epsilon$
  - Private agents make their labor decisions taking into account the actions of the governments

The default cost  $\epsilon$  is big enough so that governments want to avoid a default at all costs; therefore, the penalty is never realized along the equilibrium path.

Consistent with previous literature, in equilibrium, there is a full bailout of regional debt and, in anticipation, regions run excessive debts, creating a welfare reducing distortion of the taxation profile.

**Proposition 2** In the decentralized equilibrium, the central government sets a tax rate  $\tau_2^d$  such that  $I(\tau_2^d) = g_2 + B$  and the regional governments set  $\tau_1^i < \tau_2^d \forall i$ , where welfare is lower than in the first best equilibrium.

**Proof** Looking to avoid a default, the central government will bailout any outstanding debt of the regions. Therefore the central governments sets a tax rate  $\tau_2^d$  high enough so as to cover everything:

$$I(\tau_2^d) = g_2 + B = g_2 + R \left[ B^c + \sum_{i=1}^n \Delta^i B^i \right] \quad (3.11)$$

Denote  $\sigma(g_2, B^c, B^i)$  the smallest value of  $\tau_2^d$  satisfying (3.11). By the implicit function theorem:

$$\sigma_i(g_2, B^c, B^i) = \frac{\partial \sigma}{\partial B^i} = \frac{\Delta^i R}{I'(\tau_2^d)} \quad (3.12)$$

Knowing this, each region solves its problem in period 1

$$\max_{\tau_1^i} u(g_1 + e + Z(\tau_1^i) - s) + \beta (g_2 + Z(\sigma(g_2, B^c, B^i)) + R s^i) \quad (3.13)$$

Using  $B^i = g^i - I(\tau_1^i)$ , the first order condition of the households and  $\sigma_i(g_2, B^c, B^i)$  from above, the first order condition is

$$\frac{Z'(\tau_1^i)}{I'(\tau_1^i)} = \Delta^i \frac{Z'(\tau_2^d)}{I'(\tau_2^d)} \quad (3.14)$$

As  $\Delta^i < 1$ , following a reasoning similar than in Proposition 1,  $\tau_1^i < \tau_2^d \forall i$ . Furthermore, we can conclude that welfare on the decentralization equilibrium is lower, as the solution was feasible when computing the first best and the tax rates are different than in the first best solution. ■

The conclusion from Proposition 2 is that, even with the modified timing, the regions still have incentives to free ride on the central government. Anticipating the desire of the central government to avoid a default, and benefiting from the lack of commitment of the central authority, the regions collect fewer taxes than in the first best equilibrium, reducing welfare.

In terms of debt, looking at (3.10), for any level of  $\delta$ , debt on the decentralized equilibrium will be higher than under the first best, as  $\tau_1^i < \tau_1^* \forall i$ . Hence, I obtain the result expected on the current literature, where a decentralized system accumulates more debt than a centralized one and regions free-ride the central government.

The question then is, why would the central government allow the existence of regional governments? In the next subsection I present an example of strategy that the central government can follow to come back to the original first best solution.

## Equilibrium with coercion

In the sample we explore on the next section, regions within a given country always depend economically on the transfers from the central government to balance their budgets. In this model, taxation is distortionary and the regions cannot raise enough income in the first period to cover all their spending in the second period, so that regions need the transfer of the central government. This hierarchical relation is the main difference between regional and central governments, as they can otherwise dispose of every fiscal instrument.

Therefore, it is not far-fetched to imagine that the central government can use this dependence as leverage, steering the regions towards its desired result. With the timing of the game I am developing, and always looking for sub-game perfect Nash equilibria, this leverage can take the form of credible threats. In this framework, for a threat to be credible, the welfare of the agents when the threat is realized must be larger than when it is not. For example, threatening with cutting the transfer completely is not credible: the regions will have to default on their debt, with a huge utility cost, so the central government will never implement the threat.

The desire of the central government to avoid a default guarantees the repayment

of the regional debt. Thus, any threat has to deal with the part of the transfer allocated to pay the regional spending that the regions have to carry out during the second period.

**Proposition 3.** The central government can credibly threaten the regional government to reduce their transfer to  $T^i = B^i$  if  $\tau_1^i < \tau_1^*$  so that the economy ends up in the first best equilibrium where  $\tau_1^i = \tau_1^* = \tau_2^* = \tau^*$

**Proof** The threat of the central government is to reduce the transfer to the regions at the beginning of period 2 to  $T^i = B^i$  if  $\tau_1^i < \tau_1^*$ , so that agents will receive only  $(1 - \delta)g_2$  in the second period. If the threat is realized, the regional governments will not change their tax rate in the first period with respect to what they would do if the threat was not realized. The reason is that government spending enters the utility function of the agents in a lump-sum way. Therefore, the regions set the same tax rate  $\tau_1^i$ , computed in Proposition 2, irrespective of the threat being realized or not.

The threat of the central government will only be credible if welfare when the threat is realized,  $W^t$ , is bigger than the welfare when is not,  $W^d$ . In both situations, as we have seen, the tax rate on the first period will be the one computed in Proposition 2,  $\tau_1^i$ , with the same level of regional debt  $B^i$ . The central government, however, will be able to lower its tax rate, as now it has to finance less spending, such that

$$I(\tau_2^t) = (1 - \delta)g_2 + B = (1 - \delta)g_2 + R \left[ B^c + \sum_{i=1}^n \Delta^i B^i \right] \quad (3.15)$$

subtracting (13) then

$$I(\tau_2^t) - I(\tau_2^d) = -\delta g_2 \quad (3.16)$$

That implies that  $\tau_2^t < \tau_2^d$ . The comparison of welfare, given that utility is lineal in the second period, is just the comparison of what the agents gain, less distortionary taxation, with what the agents lose, less government spending

$$W^t - W^d = Z(\tau_2^t) - Z(\tau_2^d) - \delta g_2 = [I(\tau_2^t) + Z(\tau_2^t)] - [I(\tau_2^d) + Z(\tau_2^d)] \quad (3.17)$$

where the last equality comes from substituting (3.16). Using the definitions of  $I(\tau)$ ,  $Z(\tau)$  and the first order condition of labor

$$I(\tau) + Z(\tau) = \tau n(\tau) + \left[ n(\tau)(1 - \tau) - \frac{n(\tau)^{1+\gamma}}{1 + \gamma} \right] = (1 - \tau)^{\frac{1}{\gamma}} - \frac{(1 - \tau)^{\frac{1+\gamma}{\gamma}}}{1 + \gamma} \quad (3.18)$$

Thus

$$\frac{\partial [I(\tau) + Z(\tau)]}{\partial \tau} = \frac{1}{\gamma}(1 - \tau)^{\frac{1}{\gamma}} \left( -\frac{\tau}{1 - \tau} \right) < 0 \quad (3.19)$$

So if  $\tau_2^t < \tau_2^d$ , then  $[I(\tau_2^t) + Z(\tau_2^t)] - [I(\tau_2^d) + Z(\tau_2^d)] > 0$  and finally  $W^t > W^d$ : the threat is credible.

As the threat is credible, in the first period, the regional governments compare between choosing  $\tau_1^*$  with a welfare  $W^*$  or  $\tau_1^i$  with welfare  $W^t$ , where clearly the welfare under first best is higher. Therefore, the regions choose  $\tau_1^*$  and we end up in first best. ■

Proposition 3 shows that the central government can use its dominant position, based on the economic dependence of the regions from its transfer, to steer the regions into the first best equilibrium. The threat is an off-equilibrium event and so it is never realized.

Hence, the model predicts no relation between decentralization and debt, as opposed to the positive relation usually described in the literature. This result is achieved through the coercive ability of the central government. The model, therefore, establishes some hypothesis that I will test empirically on the next section: a lack of correlation between fiscal decentralization and debt, a positive relation between fiscal regional autonomy (implying a lower reliance on transfers from the central government) and debt, and a lack of relation between setting borrowing limits for the regions (as they play no role in the model) and debt accumulation.

### 3.4 Empirical analysis

In the following section, I test some of the hypothesis established by the theoretical model described on the previous section, together with the replication of some papers

on the literature that describe similar hypotheses.

### **3.4.1 Measuring decentralization: quantitative measures**

Before looking for an empirical relation between decentralization and debt, we have to deal with a key issue: while measuring the level of debt of a country is straightforward, how can we measure its degree of decentralization?

The choice is not obvious. As explained in the survey of Sharma (2006), the literature is mainly split in two strands when it comes to measuring decentralization, with those focusing in fiscal policy, and the relation between expenditures and allocations, and those focusing in the nature of the intergovernmental relations and its regulation.

In this paper, I will focus on the first approach, as it provides clearer measures and data. In particular, the main measure I will focus on is defined as sub-national (regional) spending as a percentage of total public spending. Sharma (2006) concludes that when it comes to the measurement of fiscal decentralization “the share of sub-national expenditures and revenues” is considered the best indicator. The reason is that fiscal instruments are easier to measure while regulatory and financial instruments are extremely complex and difficult to measure statistically because transfers seldom remain strictly confined to their technical objectives.

Reducing the degree of decentralization to a single dimension is not devoid of problems. The potential costs come from the fact that, ignoring the regulatory component, it is impossible to know if the regional spending was actually carried away in an autonomous manner or if it was part of a central government’s mandate.

However, this type of decentralization measure is widely used in the literature (see, e.g., Davoodi and Zou (1998), on economic growth; Oates (1985), on government size; or Mello (2001), on fiscal balance). Even the critics of the regional share of spending as a measure for decentralization, like Ebel and Yilmaz (2002), concede that the measure is probably adequate for developed countries, which are not so affected by issues of institutional quality and where local officers are elected democratically.

In this paper, I will further refine this measure by excluding part of the public

spending from the computations. The data on public spending available on Eurostat is categorized under the COFOG (Classification of the Functions of Government) created by the United Nations.<sup>6</sup> In the subsequent analysis, I will not include the spending under the category CF01 *General Public Services*, whose main element are interest payments on government debt and that also includes transfers between different levels of government. By excluding this component, I can solve two problems: first, preventing some composition effect whereas a movement on interest payments would appear as a change on decentralization, as such expenditures are always carried out by the central government; and, second, excluding transfers between level of governments to avoid accounting twice for some spending.

As I am going to focus the analysis on the regional spending share, it is worth checking some descriptive statistics of the available data. The average of the decentralization measure for the period and countries considered is 27.6%, implying that a bit more than a quarter of total spending is carried out at the sub-national level. There is a high degree of variability between countries, as can be observed in figure 3.1, with values as low as 0.5% for Malta and as high as 66.8% for Denmark.

Within countries, it is easy to observe in the time series level changes on the decentralization measure for some countries, usually linked to a legislative change. It is the case of the re-centralization of Health services in Ireland during 2004, the creation of the *Samosprávne Kraje* (self-governing regions) in 2002 in Slovakia or the progressive decentralization process carried out in Spain.

As a robustness check, I consider other dimensions of public finances, like tax income. In a way similar to spending, the available data allows us to compute the share of tax revenue collected at the regional level. Here we find countries with a very centralized tax collection, despite allowing for some degree of spending autonomy. For example, looking at the average for 1995-2007, the tax income regional share of The Netherlands, Great Britain and Ireland is 4.85%, 4.78% and 3.62%, respectively, when their spending share is 37.06%, 29.44% and 37.26%, respectively. This measure will also be included in the empirical analysis.

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<sup>6</sup>The detailed structure and explanatory notes can be found at <http://unstats.un.org/unsd/cr/registry/regcst.asp?Cl=4>

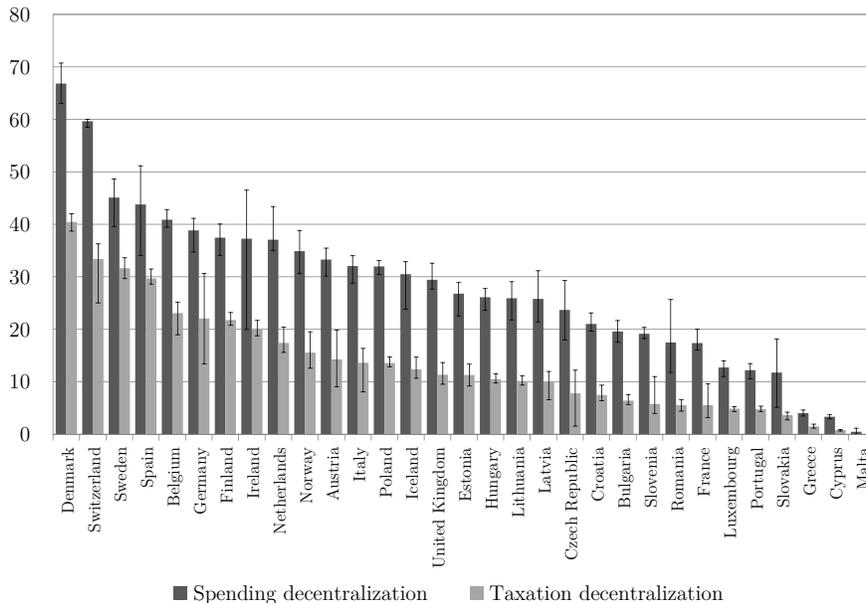


Figure 3.1: Regional share of spending and taxation income. Average 1995-2007. Error bars show the max and min for the historical series.

In the next section I will add robustness to the selected decentralization measure, by comparing it with a well-known qualitative index.

### 3.4.2 Measuring decentralization: a qualitative measure

In this section, I compare the regional share of government spending with a qualitative index of decentralization. The potential shortcoming of my proposed measure of decentralization is that it completely ignores the regulatory component of decentralization; this is exactly the component that a qualitative measure tries to capture.

I consider the qualitative measure proposed by Christine Kearney. It is widely used in the literature, especially but not exclusively on development economics. The Kearney Index measures decentralization as the assignment of fiscal, political, and administrative responsibilities to lower levels of government and it comprises nine dimensions, designed to capture decentralization’s functional complexity.

Formally, this index is created by the analysis of 9 dimensions of decentralization,

which are valued from 0 (less decentralization) to a maximum of 4 points (more decentralization) and then aggregated, for a maximum theoretical value of 36. The nine dimensions, explained briefly here, are the following:

1. Government structure, with 4 points assigned to the country that has a federal constitution.
2. Selection of regional executive: this category assigns 4 points if the citizens of the country get to elect their regional executives.
3. Selection of local executive: same as 2 but for local executives.
4. Override authority: 4 points are assigned to the country in which the central government does not have the right to override the decisions of the regional governments, without a due process.
5. Revenue raising authority: in this category, 4 points are assigned if both the local and the regional governments have the formal authority to raise revenue through taxation, 2 points if one but not both sub-national entities are entitled to tax and 0 otherwise.
6. Revenue sharing: if both levels of sub-national government regularly and unconditionally receive a share of national taxes, then the country receives a score of 4 points. If there is no regular revenue sharing with either level of sub-national government, or if both subnational governments receive funds, but neither has any discretion over how they are spent, then the country receives a score of 0 points. Any intermediate situation is given 2 points.
7. Authority on Education: if authority resides solely with the central government, the country receives a score of 0 points. If authority is shared between the central and regional governments, the score is 1 point. If authority is held solely by the regional level of government, or is shared between the central and local governments, the score is 2 points. If responsibility is shared between the regional and local governments, the country is assigned 3 points. Finally, if

authority resides solely at the local level of government, the country receives a score of 4.

8. Authority on Infrastructure: same as 7 for infrastructure authority.

9. Authority on Policing: same as 7 for policing authority.

Evaluating each country according to these criteria we obtain a measure of decentralization based on functional complexity, legal aspects and regional autonomy. Such measure complements quantitative decentralization measures such as the spending share described before.

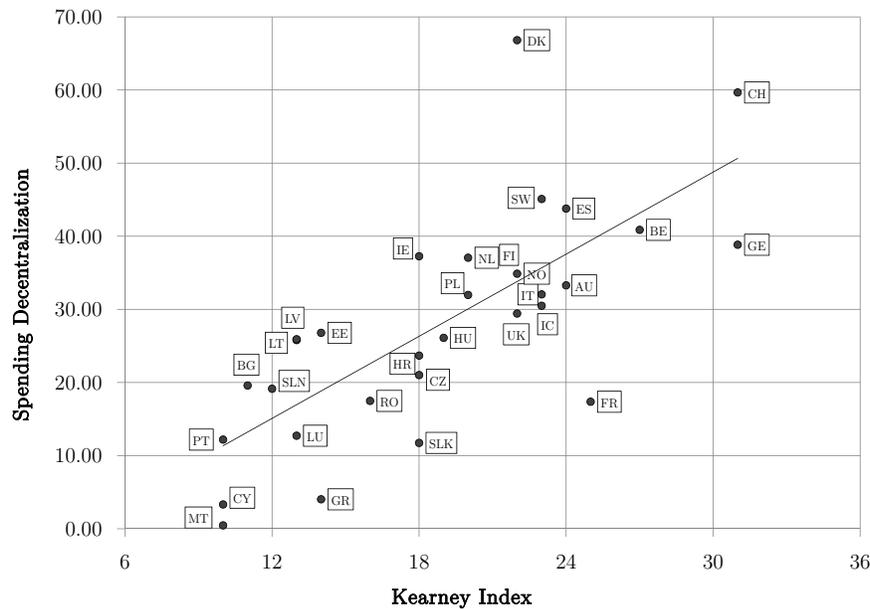


Figure 3.2: Kearney index vs Average spending share, 1995-2007.

A comparison between the two measures will allow us to check how far away from each other these two approaches are. Figure 3.2 shows the relation between the Kearney index for the 31 countries of the sample and the average for the sample period of the regional spending share. The correlation index between both measures is 0.7711 and significant at 1% confidence level.

The findings in figure 3.2 suggest that both measures offer a similar picture of how decentralized is a given country, at least on average in the sample. Therefore, since the Kearney index is time invariant I will use the regional spending share (and the regional tax income share as an alternative) as the decentralization measure in the empirical exercise that follows.

### 3.4.3 Data and methodology

The analysis on this section is based on a sample of 31 European countries: all EU countries plus Iceland, Norway and Switzerland. Due to data availability, my analysis covers the 1995-2007 period. The main data sources are Eurostat and the World Economic Outlook of the International Monetary Fund. A complete list with the sources and definitions of the data and some descriptive statistics can be found in the Appendix on tables 3.5 and 3.6.

The main dependent variable, as explained before, will be the percentage of total public spending carried out by sub-national governments out of total public spending. The main independent variable, capturing the indebtedness of a country, will be gross total public debt as a percentage of GDP. Some controls include: the current account balance, GDP per capita, the unemployment rate or the median age of the population, just to name a few.

A preliminary analysis of the data reveals that some issues need to be addressed. First, the dependent variables tend to present a high degree of persistence, making the use of a dynamic panel data model necessary. The regressions will include the lag of the dependent variable as a regressor to capture persistence and also potential mean-reverting dynamics. Second, simple LM-tests point towards the existence of heteroskedasticity. To address this issue, I will implement estimations of the variance-covariance matrix robust to this problem, by clustering at the country level.

Finally, to address the problem of endogeneity between dependent and independent variables, likely to arise in this setup, together with the aforementioned issues, I would make use the Arellano-Bond (GMM) estimator. This estimator takes first differences in the data to remove any unobserved time-invariant country-specific effect,

and then instruments the right hand side variables in the first-differences equation with lags of the series, under the assumption that the time-variant disturbances in the original series are not serially correlated. In this cases where this assumption is likely not true, the independent variable will be determined to be endogenous and excluded from instrumentation.

### **3.4.4 Autonomy, borrowing limits and replications**

In the following subsection, I test some of the hypothesis derived from the theoretical model and try to replicate the results of two closely related papers with my dataset.

#### **Transfers and autonomy**

With the available data, I can check the government balance of the regions of a country as a whole, just by subtracting the total regional government spending from the regional total tax income. This exercise shows that regions have a negative balance for every country of the sample and for every year. In the end, regions always depend on government transfers to operate. This dependence is a very important fact of the relation between the central government and the regions. As fiscal entities, both the central government and the regions are capable of taxing, spending and (in most countries) borrowing. Therefore, I claim that the main difference is the existence of an economic dependence of the regions from the central government.

To test this hypothesis, I construct a measure of the tax autonomy of the regions, simply dividing the total tax income by the total spending of the regions; a higher number represents more tax autonomy (regions cover a higher percentage of their spending with own taxes) and less dependence from central government's transfers and vice versa. Then, in a manner similar to the empirical analysis below, I construct a series of regressions between total government debt and tax autonomy. According to our hypothesis, a higher degree of tax autonomy should lead to more debt, as the central government has less leverage to impose its desired fiscal policy from the regions.

The results of this exercise can be checked in table 3.1. The table shows the results

	GMM	OLS	FE	No small
<b>Tax autonomy(-1)</b>	0.025 (0.02)	0.044** (0.02)	0.025 (0.02)	0.015 (0.02)
Debt (-1)	0.821*** (0.04)	0.973*** (0.01)	0.861*** (0.02)	0.822*** (0.04)
Gov. balance	-0.622*** (0.16)	-0.415** (0.20)	-0.767*** (0.13)	-0.673*** (0.16)
Unemployment rate	0.200 (0.13)	-0.109 (0.07)	0.072 (0.14)	0.210 (0.14)
Current account	-0.023 (0.15)	0.077 (0.10)	-0.018 (0.13)	-0.102 (0.15)
Oil price	0.312 (0.74)	0.574 (0.58)	0.751 (0.82)	0.756 (0.82)
Median age	-18.229 (14.01)	-7.913 (5.73)	-17.831 (15.01)	-21.519 (16.39)
Net exports	0.031 (0.09)	-0.007 (0.05)	0.035 (0.09)	0.118 (0.13)
Constant	69.976 (50.10)	26.002 (19.99)	65.860 (53.56)	80.654 (59.21)
R-squared		0.987	0.912	
N of obs.	267	298	298	243

Table 3.1: Regressions results for debt-to-GDP ratio as a function of tax autonomy

Standard errors are reported in parenthesis

\*, \*\* and \*\*\* indicate significance at the .90, .95 and .99 level, respectively

of a series of regressions using total debt as a percentage of GDP as dependent variable and the lag of the tax autonomy measure and a number of controls as regressors. All regressions include an estimation of the variance-covariance matrix

robust to heteroskedasticity, by clustering at the country level. The benchmark regression uses the Arellano-Bond (GMM) estimator, whereas the regressions using pooled OLS and fixed effects regressions are included for reference. The last column restricts the sample of the benchmark regression to exclude countries under 1 million inhabitants. The regressions show some support to the initial hypothesis: more tax autonomy, hence less dependence on transfers, for the regions tend to increase the amount of debt that a country accumulates. It should be noted that this result have a small degree of significance and is not robust to sample changes; further research is required, but this rough analysis offers a good starting point.

### **The effect of borrowing limits**

An important mechanism that could have a big effect on how the degree of decentralization affects the level of total debt is the existence of borrowing limits on the regions. By borrowing limits I refer to legislation that prevents the regions from borrowing.

To measure the impact of this kind of regional borrowing limits on the debt level of a country, first I construct a regional borrowing index, based on the database of Qualitative Decentralization Indicators published by the World Bank.

This index goes from 0 (more limits on borrowing on the regions) to 10 (less limits) and is constructed as follows: first, every country receives a base score. There are four possible base scores: 0 points if the country does not allow the regions to borrow, 4 points if there is a quantitative limit on the amount of debt the regions can issue, 7 points if the limit is qualitative (for example, regions can only borrow to build infrastructure) but not quantitative and 10 points if regions are allowed to borrow freely. Second, points are deducted if the central government must approve the decision of the regions to issue debt. In particular, 2 points are deducted if the central government must approve any decision and 1 point is deducted if the central government must be consulted only when borrowing from abroad.

Doing this for every country of the sample with available information (no data for Cyprus, Luxemburg, Malta and Slovakia is available), I use this index to check

the effects of this kind of limits on total debt. The correlation between the index and total debt is 0.2576, were we cannot reject the null hypothesis of the correlation being statistically different from zero. Unfortunately, the time invariant nature of this measure prevents its inclusion in the empirical analysis of the next section.

The conclusion is that limits on the amount of borrowing of the regions have little effect on the total amount of debt of a country. Therefore, there is no need to consider this aspect when constructing the theoretical model.

## Replication

As a final preliminary exercise, I replicate the results of two of the aforementioned papers that make a similar analysis of decentralization as this paper: Asatryan, Feld, and Geys (2012) and Rompuy (2012). Due to data availability, but keeping with the spirit of these papers, I will use taxation decentralization as the decentralization measure and introduce controls in line with those used in the next section.

Asatryan, Feld, and Geys (2012) studies, among other things, the effect of fiscal decentralization on debt accumulation. It uses a sample of sample of 23 OECD countries over the 1975-2000 period and concludes that there is no relation between tax decentralization and general government debt. This paper uses first differences to test the relation between the general government debt ratio and taxation autonomy, measured as income from own and shared taxes as percentage of general government revenue. On the other hand, Rompuy (2012) analyzes the effect of decentralization on the fiscal balance, with a sample of 28 OECD countries over the period 1995-2008. This paper concludes that tax revenue decentralization did not deteriorate the budgetary outcomes of the central government; on the contrary, the relation is positive, although with a 10% significance. In this case, the general government balance as percentage of GDP is used as independent variable and the the sum of the subcentral government's own tax revenue and of the shared taxes expressed as a percentage of the general government's total tax revenue as the main regressor.

The replications can be seen in table 3.2. The first three columns correspond to the replication of Rompuy (2012), so that the dependent variable is the general

	van Rompuy (2012)			Asatryan et al. (2012)		
	OLS	FE	GMM	FD	FE	GMM
<b>Decentralization</b>	0.026*	0.043	-0.098	0.008	-0.053	-0.027
	(0.01)	(0.04)	(0.08)	(0.15)	(0.12)	(0.11)
Dep. variable(-1)	0.808***	0.368***	0.347***	-0.029**	0.841***	0.812***
	(0.07)	(0.06)	(0.09)	(0.01)	(0.03)	(0.04)
Unemployment	-0.033	-0.186***	-0.168**	-0.007	0.409***	0.427***
	(0.03)	(0.04)	(0.07)	(0.09)	(0.12)	(0.12)
Population	-0.006*	-0.303	-0.062	0.024*	0.562	0.597
	(0.00)	(0.23)	(0.37)	(0.01)	(0.54)	(0.61)
Median age	-1.971	7.371**	9.230	-4.834	-19.159*	-23.405**
	(1.64)	(3.12)	(5.86)	(8.19)	(10.40)	(11.93)
Constant	7.296	-21.097*	-30.475	17.806	64.071*	79.824**
	(5.86)	(11.24)	(19.28)	(30.09)	(35.93)	(40.02)
R-squared	0.763	0.359		0.067	0.881	
N of obs.	319	319	288	322	322	291

Table 3.2: Regressions results for government balance (A-C) and debt ratio (D-F)

Standard errors are reported in parenthesis

\*, \*\* and \*\*\* indicate significance at the .90, .95 and .99 level, respectively

government balance as percentage of GDP and the next three columns correspond to the replication of Asatryan, Feld, and Geys (2012), so that the dependent variable is the general government debt to GDP ratio. All regressions include an estimation of the variance-covariance matrix robust to heteroskedasticity, by clustering at the country level. The first column presents a simple OLS regression, the second column a fixed effects panel regression and the third column uses the Arellano-Bond (GMM) estimator. Then, the fourth column shows results of a first-differences regression, the fifth column of a fixed effect panel regression and the last column the Arellano-Bond (GMM) estimator.

The results of table 3.2 show that, as in Asatryan, Feld, and Geys (2012), there

is no significant relation between decentralization and government debt. In the case of the replication of Rompuy (2012), the regression finds no significant effect of decentralization on the fiscal position of the central government. This results contrasts with that of Rompuy (2012), although is worth mentioning again that the significance of the results in the paper was low.

### **3.4.5 The relation between decentralization and debt**

The focus of my analysis is on the relation between the degree of decentralization of an economy and its outstanding national debt. The latter will be the dependent variable and it is measured by the ratio between total national public debt and gross domestic product. In the benchmark model, the choice for the degree of decentralization is the regional share of total public spending, with the regional share of total tax income as alternative measure. I use the general government balance as a percentage of GDP, unemployment rate, current account balance as a percentage of GDP, oil price, average age and net exports as a percentage of GDP as controls in the benchmark regression.

The results are in the first column of table 3.3. The general government balance is defined as endogenous and excluded for instrumentation, as the time-variant disturbances in the original series are likely serially correlated with this variable. As a matter of comparison, I also include the results for the pooled OLS estimator (second column) and the simple fixed effect estimator (third column), that are bound to be affected by the problems mentioned before, but that nonetheless offer a measuring stick about the importance of these issues. I perform some additional robustness checks, like using an alternative measure of decentralization, the regional share of tax income (fourth column) or excluding small countries, those under 1 million inhabitants (fifth column). The data rejects the common wisdom that higher debt levels are associated with more decentralized governments. The results are robust to changes in the decentralization measure and the sample used.

	GMM	OLS	FE	Tax decen.	No small
<b>Decentralization</b>	-0.008 (0.05)	-0.053* (0.03)	-0.072 (0.05)	0.084 (0.08)	-0.028 (0.05)
Debt-to-GDP(-1)	0.828*** (0.04)	0.969*** (0.01)	0.857*** (0.03)	0.821*** (0.04)	0.824*** (0.04)
Gov. balance	-0.612*** (0.15)	-0.303 (0.22)	-0.732*** (0.14)	-0.625*** (0.15)	-0.663*** (0.16)
Unemployment rate	0.237* (0.13)	-0.044 (0.08)	0.071 (0.13)	0.302** (0.12)	0.216 (0.14)
Current account	-0.019 (0.15)	0.045 (0.09)	-0.031 (0.13)	-0.070 (0.13)	-0.095 (0.14)
Oil price	0.360 (0.70)	-0.067 (0.58)	0.699 (0.83)	0.186 (0.64)	0.848 (0.75)
Median age	-13.983 (13.74)	1.460 (6.28)	-16.485 (14.20)	-11.039 (13.27)	-20.326 (14.99)
Net exports	0.052 (0.09)	0.033 (0.06)	0.066 (0.09)	0.054 (0.10)	0.136 (0.14)
Constant	54.835 (49.16)	-2.961 (21.91)	64.325 (49.85)	43.148 (47.54)	77.285 (54.38)
R-squared		0.987	0.912		
N of obs.	272	303	303	289	246

Table 3.3: Regressions results for debt-to-GDP ratio as a function of fiscal decentralization

Standard errors are reported in parenthesis

\*, \*\* and \*\*\* indicate significance at the .90, .95 and .99 level, respectively

### 3.4.6 Further analysis

As we have seen on the empirical analysis above, the level of fiscal decentralization of a country has no effect on the amount of debt it accumulates. In any case, the result

obtained can be explored further. Even if there is no relation between decentralization and debt, is there a relation between decentralization and the elements that determine a country's fiscal position and, in turn, its debt accumulation (government spending, taxation income and interest payments)?

The answer for this question can be observed on table 3.4. In this table are shown the results of regressing government spending (measured as Total government spending as a percentage of GDP), income (measured as Total taxation income as a percentage of GDP) and interest payments (measured as Net total interest payments as percentage of GDP) on decentralization (measured as the share of Total public spending carried by non-central governments excluding GF01) and a number of controls taken from the literature. As before, I am using data from 31 European countries between 1995 and 2007. Two types of regressions are included for each dependent variable: one using the Arellano-Bond (GMM) estimator and the other using fixed effects, for comparison. On the GMM estimation, the variables for the Unemployment rate and GDP per capita (plus Debt ratio in the case of the regression for interest payments) are defined as endogenous, limiting their use as instruments.

As can be seen on table 3.4, fiscal decentralization has a negative and significant effect on all the elements that influence the fiscal position of a country and its level of debt. Keeping everything else equal, a country where the regional governments carry out a larger share of total spending will observe lower levels of government spending, tax income and interest payments as a percentage of GDP. Still, this result is consistent with those of the previous section or the replication of Rompuy (2012): even though more decentralized states tend to have smaller government sizes (in terms of their fiscal components), these states do not accumulate more debt or register higher levels of fiscal deficit because all the fiscal elements are negatively affected.

On the other hand, these results offer some support to the "Leviathan hypothesis", first posted by Brennan and Buchanan (1980), who claimed that tax competition would limit government spending in decentralized countries, leading to smaller governments in such states. We actually observe, according to the regressions, how more decentralized countries tend to have, keeping everything else equal, smaller

	Spending to GDP		Tax income to GDP		Interest payments to GDP	
	GMM	FE	GMM	FE	GMM	FE
<b>Decentralization</b>	-0.158** (0.08)	-0.152** (0.07)	-0.046*** (0.02)	-0.048*** (0.01)	-0.023*** (0.01)	-0.028*** (0.01)
Dep. variable(-1)	0.444*** (0.07)	0.448*** (0.07)	0.701*** (0.08)	0.735*** (0.06)	0.716*** (0.04)	0.678*** (0.07)
Unemployment rate	0.031 (0.09)	0.131 (0.08)	-0.085 (0.05)	-0.066 (0.05)	-0.030* (0.02)	-0.033* (0.02)
GDP per capita	0.280 (1.24)	0.727 (0.85)	0.335 (0.52)	0.409 (0.48)	-0.208 (0.17)	-0.343 (0.27)
Median age	-9.281 (9.70)	-10.832 (6.69)	-5.565 (5.64)	-5.808 (4.26)	-3.797** (1.54)	-3.533* (2.02)
Debt	0.057** (0.02)	0.040** (0.02)	0.024** (0.01)	0.014 (0.01)	0.018*** (0.00)	0.021*** (0.00)
Population	0.574* (0.30)	0.526** (0.24)	0.126 (0.18)	0.113 (0.15)	0.098*** (0.03)	0.087** (0.03)
Current account	-0.056 (0.08)	-0.117* (0.06)	-0.051 (0.03)	-0.044 (0.03)	0.017 (0.01)	0.011 (0.01)
Constant	48.484 (30.83)	53.404** (22.67)	29.182 (19.78)	29.169* (14.50)	13.167** (5.43)	12.955* (7.10)
R-squared		0.590		0.594		0.910
N of obs.	276	307	276	307	249	276

Table 3.4: Regressions results for different elements of public finances

Standard errors are reported in parenthesis

\*, \*\* and \*\*\* indicate significance at the .90, .95 and .99 level, respectively

governments (measured by the spending-to-GDP ratio), and the lower tax collection could be a sign of tax competition. It should be noted, however, that the litera-

ture that has studied the Leviathan hypothesis has usually focused on measures of taxation decentralization. When re-running the regressions with taxation decentralization instead of spending decentralization the significance disappears. Exploring the relation between spending decentralization and government size is therefore an interesting starting point for future research.

### 3.5 Conclusions

The goal of this paper was to answer the following question: does the level of regional decentralization of a country affect their level of national debt? I answered this question empirically by using a panel of 31 European countries in the last 18 years. Contrary to the common wisdom and existing theoretical predictions, the data suggest no relation between decentralization and the level of debt.

Using an existing model by Cooper, Kempf, and Peled (2008), but modifying it to include more strategic players and a different timing, both to capture better the characteristics of European states and to accommodate empirical facts of the data, I test the common wisdom theoretically.

In this model, the first best allocation consist in full taxation smoothing across regions and time. On the other hand, and consistently with Cooper, Kempf, and Peled (2008), the decentralized equilibrium creates free-riding on the part of the regions. This result comes from the inability of the central government to commit to the first best allocation, together with its desire to avoid a default. Anticipating this, the model predicts a common-pool problem: as taxation is costly in terms of utility, the regional governments will try to spread the burden by issuing debt, knowing that the central government will have the incentives to bail them out in the end. The regions spend more and accumulate an excessive amount of debt, relative to the first best allocation.

However, the central government has some leverage: the regions are economically dependent of the transfer they receive from the central government. This dependency arises from the fact that taxation is distortionary, and so the regions cannot raise enough taxes in the first period to finance all their spending in the second period.

Knowing this, the central government can credibly threaten the regions with cutting part of their transfer if they do not control their spending. Because the threat is credible, the regions react as the central government wants and the first best allocation is achieved. The coercive ability of the central government leads to the result observed in the empirical data of no relation between regional decentralization and national debt.

The realization of the threat is an off-equilibrium event and so is never realized; there would be no historical examples of it. We do have examples of central governments threatening their regions, like the examples in Spain presented in the introduction or the current situation in Bremerhaven, Germany. This city, a part of the city-state of Bremen with its own Constitution and authority on policing and education, has received pressure from the central government to curb its spending or else lose some of its independence. It seems clear that central governments in decentralized countries use their economic leverage to try to control the spending decisions of the regions even if the threat is never realized, as the model suggests.

Furthermore, the basic principles of this situation have emerged during the ongoing crisis in the Euro Area. The coercive mechanism has been particularly evident in the negotiations for the bail-out packages of countries with financial troubles. These negotiations have usually involved the adoption of an adjustment program in the receiving countries (akin to the increased taxation from the regions in the model) in exchange for the bail-out package (the transfer from the central government).

The nature of these negotiations reflects the imperfection of the Euro Area on the fiscal side. The early literature on the creation of the Euro Area recognized the necessity of fiscal transfers in order to cope with asymmetric crises of the kind we are witnessing; see for example Wyplosz (1991) or Sala-i-Martí and Sachs (1992). As we have seen, the transfers are happening, in the form of bail-out packages, but only after grueling negotiations. These processes generate uncertainty and delays which, together with the successive failures of the Stability and Growth Pact, would suggest moving the Euro Area further down the road of fiscal integration.

The main results of this paper support this idea. I have shown how, in the context of a fiscal union, the central authority has the necessary instruments, in the form

of coercion, to enforce an equilibrium in which the regions commit to a sustainable path of taxation and debt, as long as the regions depend on transfers from the central authority to meet their ends. In the context of the Euro Area, achieving this configuration would imply a massive transfer of taxation and spending prerogatives from the respective countries to the European authorities.

Obviously, the current political and economic context makes this kind of Euro Area reform impossible. However, the creation of such a European Fiscal Union would, in light of the results of this paper, solve the aforementioned policy problems: on one hand, giving coercive power to the European authorities would help control spending and debt on the member countries, something that the Stability and Growth Pact has failed to do; on the other hand, the permanent nature of this fiscal structure would eliminate the delays and uncertainty associated with the ad-hoc, case by case nature of the current transfers scheme.

# Appendix

## E Data and sources

	Standard Deviation						
	Mean	Overall	Btwn	Within	Min	Max	Obs
Current account	-0.48	5.88	5.30	2.59	-24.00	16.40	394
Debt-to-GDP	49.07	27.45	25.87	8.72	3.70	130.20	378
Decentralization	27.78	14.43	14.21	2.96	1.20	65.89	396
GDP per capita	2.61	0.95	0.91	0.30	-0.17	4.37	399
Gov. balance	-1.74	3.85	3.82	2.16	-12.80	18.50	372
Gov. size	44.29	6.65	6.08	2.78	31.10	64.90	396
Median age	3.62	0.06	0.06	0.03	3.43	3.76	397
Net exports	-0.07	8.10	7.68	3.08	-21.60	32.30	398
Oil price	3.21	0.49	-	0.49	2.43	3.97	403
Population	16.17	21.32	21.64	0.49	0.27	82.54	403
Unemployment rate	8.03	4.05	3.68	2.04	1.90	20.70	351
Urban population	72.52	12.70	12.84	1.13	50.46	98.09	403

Table 3.5: Descriptive statistics

Variable	Description	Source
Current account	Current account surplus (+) or deficit (-) as a percentage of GDP	World Economic Outlook, IMF
Debt	Gross total debt as a percentage of GDP	Eurostat, European Commission
Decentralization	Subnational government spending as a percentage of total government spending	Eurostat, European Commission
GDP per capita	Real gross domestic product in euros per capita, in logs	Eurostat, European Commission
Gov. Balance	General government surplus (+) or deficit (-) as a percentage of GDP	World Economic Outlook, IMF
Gov. Size	General government total spending as a percentage of GDP	World Economic Outlook, IMF
Median age	Average age in years, in logs	Eurostat, European Commission
Net exports	Trade surplus (+) or deficit (-) as a percentage of GDP	Eurostat, European Commission
Oil price	Europe Brent Spot Price FOB in dollars per barrel, in logs	U.S. Energy Information Administration
Population	Total population in millions, in logs	Eurostat, European Commission
Unemployment rate	Unemployed population as a percentage of total labor force	Eurostat, European Commission and World Economic Outlook, IMF
Urban population	Urban population as a percentage of total population	United Nations Population Division

Table 3.6: Data and sources

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