# Sub-central government borrowing and regional development differentials under alternative fiscal frameworks [1]

## Salvador Barrios * and Diego Martínez *, **

\* European Commission, Joint Research Centre, IPTS
\*\* Department of Economics, Universidad Pablo de Olavide Seville

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## Abstract

This paper analyses the link between regional development differentials and public borrowing. The main question considered is whether regional development differentials which determine either directly or indirectly the degree of regional tax revenue redistribution, eventually compromises regional governments´ budget balances through permanent fiscal transfers. In order to analyse the main mechanisms at hand we build a simple model of fiscal federalism where both the central and regional government can borrow in financial markets to fill budgetary gaps and where the central government redistributes part of the tax revenues between regions. We show how the regional income redistribution modifies the intertemporal budget constraint of the regions and under which conditions regional governments may possibly incur into higher or lower borrowing as a result. We build on these ideas to test econometrically the link between regional government primary surpluses and the level of GDP per capita in Canada, Germany and Spain, i.e. three counties with notoriously decentralised fiscal policy. Our econometric analysis shows that this relationship can be either positive (as in the German case) or negative (as in the Canadian and Spanish cases), thus suggesting that either poor or rich regions can display higher public borrowing. The differences in cross-country results can be linked, to some extent, to the differences in fiscal frameworks and to the country-specific design of intergovernmental transfers. The link between the GDP per capita level and the regional primary surplus becomes significant only when intergovernment grants are removed from the government revenues, however. Therefore we conclude that intergovernment grants tend to make regions´ fiscal policy more similar, at least in the cases considered here.

# Content

## 1. Introduction

Sub-central government public finances have deteriorated sharply in a number of developed economies since the start of the global financial crisis, see European Commission (2012) and Ter-Minassian and Fedelino (2010). Existing sub-national borrowing rules and other fiscal restraints might have played a role in limiting budgetary slippages in some cases, suggesting that the trend toward more decentralised fiscal policy might also call for a reinforced control and better coordination of sub-central and national fiscal policies, see Foremny and von Hagen (2012) and Blöchliger et al. (2010). Importantly, however, the effective contribution of sub-central governments towards national fiscal consolidation objectives might be severely constrained for at least two major reasons. First, regions usually have only a loose control over their own fiscal policy. In some cases a large share of their revenues stems from central-governments, either through grants or shared taxes upon which they usually have little control. The degree of flexibility in public spending is also limited given that spending attributions are often only delegated from the central governments. Second, regions often face long-lasting economic development differentials which make some of them dependent on intergovernmental transfers to maintain a sufficient access to public goods and services according to nationally-set standards. These development differentials can be directly linked to differences in productivity and competitiveness levels which are arguably unlikely to vanish in the medium-run and, in many instances, even the long-run, see Barrios and Strobl (2009).

The specific constraints faced by sub-central governments also make them particularly interesting case-studies for analysing the conduct of fiscal policy when monetary policy and the exchange rate are set exogenously but when fiscal policy is both highly decentralised and constrained, see Von Hagen and Eichengreen (1996). In particular, the global financial and euro crises have evidenced the risks associated with diverging competitiveness performances in an integrated monetary area. One important lesson from the euro crisis in this respect is that the massive deterioration of government budget balances in the peripheral euro area countries can be traced back to pre-crisis divergence in productivity (and competitiveness) levels, see Lane (2012). Baring country-specific circumstances, productivity divergence can have a protracted effect on public debt and deficit given that incentives to undertake structural reforms tend to be lower in currency unions, see Duval and Elmeskov (2006). The latter raises the likelihood of temporary inter-government transfers to become permanent and possibly to alter

the conduct of fiscal policies. Factual evidence suggests the latter is more likely if similar levels of public services are expected across constituencies with large differences in GDP per capita and if the fiscal framework does not provide appropriate mechanisms to deter and/or to reduce excessive fiscal imbalances, see in particular Rodden (2006). The extent to which these permanent redistribution schemes may face the opposition of richer (i.e., net creditor) regions (or countries) and/or may compromise the conduct of national fiscal policies remains an open source of discussion, however.

The analysis of the determinant of public borrowing in federal or quasi-federal systems provides a natural experiment for the study of the impact of intergovernmental transfers in presence of long-lasting differences in income per capita within monetary unions. In order to identify the basic mechanisms at stake we first sketch out a simple model considering the case of a closed economy with two regions where fiscal policy is determined at both the national and regional level. We show that the regional income redistribution modifies the intertemporal budget constraint of the regions, which may incur into higher or lower indebtedness depending of the expected tax revenues redistributed through central government grants and the policy choices regarding the degree of tax revenues harmonisation and equalisation of fiscal capacities within the country. The policy choices regarding these elements prove instrumental in determining whether rich and/or poor regions will tend to increase their borrowing to smooth their intertemporal consumption level in presence of intergovernmental transfers.

We use these theoretical findings to motivate our empirical analysis on Canada, Germany and Spain. All these countries have experienced substantial decentralisation of public finances either on the spending side, tax revenues side or both.[1] The general government public finances of these countries have also reacted differently to adverse macroeconomic shocks and, in some cases, regional budgetary slippages have played a significant role in these evolutions, especially since the onset of the current financial crisis, see Canuto and Liu (2010). Our econometric results suggest that in Germany poorer regions tend to run higher primary deficits while in the Canadian and Spanish case the opposite happens. We link these cross-country divergences in results to the distinct fiscal frameworks and design

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1       Local and state government public represented more than 40% of general government expenditure and revenues in these countries in 2010, Sources: IMF, World Bank and OECD.

of intergovernmental transfers in these three countries. Interestingly, however, we find that the differences between poor and rich regions in terms of fiscal behaviour become statistically significant when the intergovernmental grants are removed from the definition of the primary surplus. Intergovernmental grants would thus tend to make regional fiscal policies more similar, suggesting that these transfers can prove instrumental in promoting the coordination of sub-central fiscal policies with national fiscal objectives. Our results have also a country-level reading, especially when considering fiscal policy making in monetary areas where permanent differences in productivity and competitiveness levels raise the risk of temporary intergovernmental transfers becoming permanent. We show in particular that intergovernmental transfers, even when permanent or quasi-permanent, tend to smooth out differences in terms of public borrowing behaviour within monetary unions with highly decentralised fiscal policies. The fiscal deficit of net creditor or net debtor countries (or regions) will depend on the targets set with regard to the expected fiscal effort, the degree of equalisation in tax revenue and tax capacity, which ultimately reflect policy choices and equity concerns regarding the access to public goods and services. However, our results suggest that even when intergovernmental transfers follow different rules and design, these transfers tend to make fiscal policies more homogeneous.

The rest of the paper is organised as follows. In Section 2 we sketch out a simple model of fiscal decentralisation using as benchmark the case of a unitary state and comparing the corresponding level of public borrowing when regional equalisation grants are introduced in the model. In Section 3 we provide a description of Canada, Germany and Spain fiscal frameworks in order to illustrate the main features identified in the model which are likely to influence the relationship between income per capita and regional public borrowing. In Section 4 we undertake an econometric analysis of the link between these two variables. Finally, Section 5 concludes.

**2. A simple model of fiscal decentralisation with unequal regional development levels**

From a theoretical perspective, the main reason why one would expect regional government borrowing to differ from national government borrowing behaviour is that regional governments are usually net receiver (or net payer) of fiscal equalisation transfers. These transfers in turn directly affect their intertemporal budget constraint and possibly their borrowing behaviour. In order to illustrate the basic

mechanisms at play we build a simple model to analyse the way these intergovernmental transfers may affect regional borrowing by modifying the intertemporal budget constraint of the regions. We consider the effect of alternative fiscal arrangements in a decentralised economy taking into account the interactions between the different government levels stemming from tax-sharing arrangements and in the presence of persisting differences in development levels. In the sequel we describe the model structure and the case of a unitary government which is used as benchmark to determine the change in government debt (our main variable of interest) compared to the case where regional fiscal equalisation is introduced in the model. [2]

## 2.1 Model structure

Let consider a two-period model where economic agents work, produce and consume in period 1 (the present) and only consume in period 2 (the future). Let a country made of two regions (A and B), with each administrative level being potentially embodied with its own government.[3] Technology in region $j$ ($j$=A, B) is given by the production function $y_1^j = f^j(l,k)$, where $y_1^j$ is the output in the period 1, $l$ labour and $k$ private capital. Output $y$ can be used interchangeably as private good (that includes labour and capital as well) or public good. The regional production functions differ between regions in the productivity level only (with $y_1^A > y_1^B$).[4] It is also assumed that labour is immobile across regions while private capital is perfectly mobile both internally and abroad. Therefore the representative household will enjoy a higher wage rate $w$ in the most productive region (say region A) whereas the return of capital $r$ will be the same across the federation thanks to cross-regional capital flows.

The preferences of the representative household are identical in both region A and B, and given by the following utility function:

$$\text{\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,\,}$$  (1)

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3   Regions are assumed to be of equal size. By assuming equal size we avoid dealing with market size effect on income levels, which are assumed to be entirely driven by productivity levels.

4   The production function and total factor productivity parameters are left unspecified in order to simplify the presentation.

where, for the region $j$ and period $t$, $x_t^j$ is the level of consumption of private good, $g_t^j$ is the consumption of public good $g$, $L$ the total endowment of time by the household in period 1, $\gamma$ and $\eta$ are parameters of the utility function measuring the preferences for leisure and public goods, respectively, and $\beta$ is the discount factor denoting the relative preference for current vs. future consumption. The budget constraints of the household in periods 1 and 2 are given by:

$$x_1^j = w^j l (1-\tau_l) - S^j \tag{2}$$

$$x_2^j = S^j(1+r(1-\tau_s)) \tag{3}$$

where $S^j$ is the level of saving and $\tau_S$ and $\tau_l$ ($0\leq\tau_S\leq 1, 0\leq\tau_l\leq 1$) are the tax rates on saving income and labour income, respectively. Standard optimization implies to maximize (1) subject to (2) and (3), and the optimal values of $x_1^j$, $x_2^j$, $l$ and, residually, $S^j$ are obtained.

## 2.2 The case of a unitary government

As usual in the literature, the case of unitary government is first considered as benchmark to assess the efficiency of equilibrium when decentralisation of public spending and public revenue is introduced in the model. The central government maximizes the following social welfare function:

$$W = \delta U^A + (1-\delta) U^B \tag{4}$$

where $\delta$ is the weight of region A's utility over the national utility, reflecting the degree of inequality aversion of the government. The public budget constraints at national level in each period are:

$$g_1^A + g_1^B = \tau_l (w^A l^A + w^B l^B) + D \tag{5}$$

$$r(S^A + S^B)\tau_S + g_2^A + g_2^B = (1+r)D \tag{6}$$

where $D$ is government debt. After deriving the first order conditions for the decision variables, we obtain the optimal values for $\left(g_1^A\right)^*$, $\left(g_2^A\right)^*$, $\left(g_1^B\right)^*$, $\left(g_2^B\right)^*$, $\tau_l$, $\tau_S$, and $D^*$, which is reported next:

$$D^* = \frac{K(v^A + w_1^B)\beta}{(1+\beta)(1+r)}$$ (7)

From equation (7) one can see that in the unitary government case, the sign of $D^*$ is unambiguously negative. The main reason for this relates to the distinctive distortionary nature of capital vs. labour taxation. The optimal tax rate on capital income is zero since capital taxation is more distortionary than labour taxation. It follows that labour is the only production factor that is taxed in this model. As a consequence, no tax revenues are expected in the second period such that the unitary government must save in the first period in order to obtain resources to finance the public goods $g$ in the second period. In the sequel we analyse the borrowing behaviour of regional government when these are introduced in the model. For a more complete analysis of the borrowing behaviour of unitary government the interested reader can refer to the Appendix.

### 2.3 Regional borrowing with equalisation in the Federation

We now compare the optimal public debt level obtained in the case of unitary government with the one when financial transfers are operated between the central government and the two regions A and B. Both levels of government share the labour income tax (at rates $t_l^j$ and $T_l^j$ chosen, respectively, by the regional and the central government with $0 \leq t_l^j \leq 1$ and $0 \leq T_l^j \leq 1$). Regions are also allowed to borrow from financial markets. The main difference with respect to the case of a unitary government is that regional governments are now exclusively responsible for providing $g_1^j$ and $g_2^j$. In order to finance the provision of the public good, regional governments also benefit from fiscal equalisation grants transferred from the central government. Fiscal equalisation is indirectly used to equalise the fiscal capacity of regions given that the tax bases on labour income are inherently unequal due to differences in productivity levels between the two regions (since we assume that both regions are of equal size). The equalisation of tax revenues takes place only during the second period only.

The optimization problems of each subnational government can be solved simultaneously using the regional budget constraint in each period as by:

$$g_1^j - t_l^j v_l^j l - D^j \leq 0$$ (8)

$$g \cdots Z^j \cdots (9)$$

(9)

where $Z^j$ is an equalisation transfer from the federal to the regional government of region $j$. The role of $Z^j$ is central in our discussion. Following the existing literature, $Z^j$ can be defined as in equation (10) below:

$$Z^j = \alpha \left( \bar{w}\bar{t}_l - \bar{w}\bar{t}_l \right)$$

(10)

where $\alpha$ is the degree (if partial or total) of fiscal equalisation, $\bar{t}_l$ the normative income tax rate at regional level ($0 < \bar{t}_l < 1$), and $\bar{w}$ the normative wage rate at regional level. Both $\bar{t}_l$ and $\bar{w}$ can be thought as representing the level of fiscal effort and fiscal capacity, respectively, which the central government sets as benchmark. According to (10) the effect of grant $Z^j$ is to equalize in a proportion $\alpha$ the extent of resources from the labour tax available to each regional government with respect to a given (normative) level of fiscal capacity in labour taxation[5]. Ultimately, therefore, the degree of fiscal equalisation will depend on the extent to which the central government is seeking to equalise the level of public goods available in each region, given existing difference in income per capita which determine ex-ante (i.e. before equalisation transfers) the fiscal capacities of each region. Note that the labour income is the only tax base available to the regions whereas the federal government can levy capital income as well. In this context, the benchmark wage rate used in the equalization $\bar{w}$ can be (although not usual in the real world) even higher than that of the richer region as long as the federal government has resources coming from the federal labour income tax and saving taxation to fund redistribution transfers.[6]

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5    Alternative approaches to equalisation have been also studied (and available upon request). For instance, we also assumed that there could be a benchmark value for labour $\bar{l}$ in the definition of the tax base $wl$ (assuming of course differences in labour supply across regions) or alternatively that only labour supply entered in the equalisation formula, instead of the tax base $wl$ used here. These other alternative cases did not alter the general conclusions from our theoretical analysis, however.

6    The appendix provides insights on the federal optimization problem.

Each regional government therefore maximizes (1) subject to (8) and (9). Optimization gives the values of $\left(g_1^j\right)^*$, $\left(g_2^j\right)^*$, $\left(t_l^j\right)^*$ and $\left(D^j\right)^*$ chosen by the regions. In particular, the value of the optimal regional debt $\left(D^j\right)^*$ level is given by the following expression:

$$\left(D^j\right)^* = \frac{\ldots}{\ldots}, \tag{11}$$

where $\psi = \bar{\alpha}\left(1+\beta+\bar{t}_l\right)$. By contrast to the unitary case described in sub-Section 2.1, it is no longer straightforward to determine the sign of regional borrowing given that this sign depends on the consumer preference parameters, the interest rate as well other exogenous variables determined at federal level (such a $T_l^j$) and the scope of equalisation determined by the equation (10). In such framework rich regions must save in the first period in order to face expenses related to regional solidarity in the second period while poor regions borrowing behaviour will depend on a number of factors. Poor regions benefit from equalisation transfers in the second period which in turn modifies the role to be played by the interest rate in the determination of their public borrowing. The sign and magnitude of regional borrowing will depend on the interaction between the three institutional components of the fiscal equalisation function ($\alpha$, $\bar{t}_l$ and $\bar{w}$) and on the actual regional wage (or income per capita) differentials.

Simple comparative statics (shown in the appendix) show that more redistribution through the equalisation system (via higher values of $\alpha$, $\bar{t}_l$ or $\bar{w}$) would lead to more regional borrowing from the poor regions and for high enough values of the benchmark wage $\bar{w}$. The underlying rationale is that a bigger redistribution effort implies a transfer of additional resources from the rich to the poor region in the second period. The poor region has thus incentives for increasing its provision of public spending in the first period thanks to higher borrowing given that it will benefit from larger grants in the second period allowing a higher level of public goods in both periods.

Things become more intricate when rich regions are considered, however. Indeed, as long as the degree of equalisation ($\alpha$) or the tax rate used as benchmark ($\bar{t}_l$) are high enough, the rich regions face higher negative transfers (in absolute terms) to fund regional grants. Rich regions will reduce their borrowing (or will increase their saving) in order to shift resources from the first to the second period, which is when interregional transfers are effectively used to finance public goods. However, when the third component of regional redistribution (the wage used as benchmark $\bar{w}$) increases, that is, when the central government sets up a higher standard for fiscal capacity, the impact on the regional public debt is the opposite: more redistribution (i.e. higher $\bar{w}$) leads to higher borrowing (or less saving) in the rich regions as well. This occurs as result of the specification of interregional solidarity mechanism. Whereas a rise in the degree of equalisation and the benchmark fiscal effort unambiguously boost transfers towards poor regions, the equalisation formula may well result in positive federal transfers also for the rich regions when $\bar{w}$ reaches high enough values (or equivalenty a lower payment from the rich region to the equalisation system); in this context, rich regions receiving positive transfers in the second period may behave as poor regions: they would smooth their consumption over time by increasing their borrowing in the first period to increase their consumption in the second period in order to match the higher level of consumption obtained thanks to the intergovernmental transfer in the second period. This explanation remains unchanged when we discuss changes in the magnitude of saving of regional governments, instead of changes in the sign of this variable. Our model thus shows under which conditions regional differentials in productivity (and related wage levels) may or may not affect changes in regional public borrowing. It can easily be shown that the changes in the regional public debt as result of modifying redistribution parameters are functions of the difference between the regional wage rate (or fiscal capacity) and the benchmark one (or standard fiscal capacity).[7]

In sum, our theoretical model provides two types of results. Firstly, those concerning the optimal values of endogenous variables, especially regional public debt. And secondly, the exercises of comparative statics regarding how changes in the equalisation parameters affect borrowing decisions of regional

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7   See equations (A28)-(A29) in the appendix for more details on this point.

governments. The latter are those we will focus on as long as they contain more intuitive results which be more easily related to the empirical analysis.

However, the model leaves two relevant questions unanswered. On the one hand the significance in the relationship between regional productivity differentials and regional public borrowing is left undetermined. While we have explained the mechanism underlying this relationship, we do not know whether these are strong enough to influence regional fiscal behaviour in a significant way. On the other hand, the degree of homogeneity in regional fiscal behaviours given the equalization system in place is also left unanswered. It is therefore necessary to deal with these questions empirically. However, one must admit that, in the real world, the link between the debt level and regional differences in income per capita is more complex than the situations described in our model. An important reason for this is that the normative parameters setting regional financial transfers are either not clearly stated, potentially left open to (varying) political discretionary choices or both.

The relationship between regional income differences and public debt is therefore largely conditioned by the practical implementation of the fiscal equalisation schemes. In addition, a number of other arguably important elements have not been considered in our theoretical analysis. For instance richer regions could be inclined to have higher borrowing assuming that they have better access to credit, either through financial markets or directly to private banks. This possibility has not been contemplated here as the interest rate on borrowing was assumed to be exogenous. Our model could however be easily modified to account for endogenous interest rate as well. Given the wide variety of possible relationship between public borrowing and the level of GDP per capita it is therefore reasonable to investigate these issues empirically given that countries with a federal or quasi-federal political system are likely to provide different case-studies which themselves can allow to say something about the way the practical working of fiscal equalisation schemes may or may not lead to different relationships between regional public borrowing and regional differences in GDP per capita.

**3. Fiscal policy, regional fiscal framework and regional development differentials in Canada, Germany and Spain**

In this section we provide a summary of the regional fiscal frameworks in Canada, Germany and Spain and their impact on regions´ public finances. In the sequel we describe fiscal rules and the access to financial markets.

**3.1  Fiscal decentralisation and regional fiscal frameworks.**

Table 1 aims to provide a synthetic view on the different elements which, according to our previous theoretical analysis, are likely to influence the relationship between public borrowing and regional income differences. Canada, Germany and Spain seem to be at first sight rather different in terms of fiscal equalisation grants, tax and expenditure decentralisation. The first salient difference concerns the degree of tax revenues decentralisation. Considering 2010 figures, Canada stands out as the country where regions have the highest level of tax revenues in relation to the total revenues of the general government and where the degree of tax autonomy is also the most developed. By opposition German and Spanish regions have a significantly lower degree of tax autonomy and tax revenues in relation to the general government total tax revenues. Spanish and German regions on the contrary have also less leeway in the determination of tax rates or tax bases.

Considering the evolution of tax revenues decentralisation between 1995 and 2010, Spain clearly stands out as the country where the amount of tax revenues devoted to the regions as well as the degree of tax autonomy has increased most intensively. Regional tax revenues in this country represented only 4.8% of total general government tax revenues in 1995. This percentage rose up to 18.24% in 2010 in parallel with the increase in regional public expenditure that have increased from 21.60% to 34.42% during the same period. Despite these evolutions the gap between the regional governments´ revenues and expenditure was still the highest in Spain compared to Canada and Germany. Total expenditure represented 4.5 times total tax revenues in Spain 1995. Still in 2010 total regional expenditure were covered only by about half of total regional tax revenues in this country. The situation in Canada and Germany appears to be much more balanced with a nearly exact matching between the regional tax revenues and expenditure throughout the period 1995-2010.

As a consequence of the above features, the importance of inter-governmental transfer revenues in the total revenues available to regions to finance their public spending is also markedly different between Canada and Germany on the one hand, and Spain on the other hand. This is shown in Column 3 of Table 1. In Canada and Germany the share of regional revenues stemming from federal grants represented between 17% and 21% of total revenues over the period. These shares were also rather stable suggesting that the cross-regional fiscal equalisation remained relatively identical during the period 1995-2010. In Spain, on the contrary, the share of total revenues stemming from central government grants was largely dominant in 1995, representing 73.3% of total regional revenues, and still substantial in 2010 at 49.9%.

There figures important differences between these three countries in terms of implementation of intergovernment transfers which, as discussed in the previous section, are also likely to influence the link between public borrowing and regional income differential. In Canada, these transfers are formula-based grants from the federal government which are set according to the differences in fiscal capacities, see Bird and Tassonyi (2003). In addition to these vertical transfers, Canadian provinces receive substantial funds to ensure the provision of healthcare and social services which considered together represent around 65% of total transfers to the provinces, see Dahlby (2008).

In Germany fiscal equalisation takes place after the splitting of the revenues from shared taxes between the federal and Länder level and in three successive stages. The redistribution criteria depend on the tax capacities and financial needs of the Lander. Horizontal redistribution is topped up by vertical redistribution from the federal state to further smooth per capita tax revenues between regions. These vertical grants became especially relevant as of 1995, when East German Länder (as well as for some small Western länder) were entitled to receive these resources. In the case of East German States, this financial support followed the transitory post-reunification specific funds.

In Spain the regional financing is essentially vertical through central government grants. Following the 1978 Constitution, the Spanish regional financing system main principle has been to guarantee the financing of the public services at a level comparable to the one prior decentralization.[8] From the early

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8   The exceptions to this system are the Basque Country and Navarre who have a chartered regime. These regions hold large autonomy in terms of tax collection (apart from customs tariffs) and send to the central government a pre-arranged amount (*cupo*) in proportion to their relative income and population. This transfer evolving in line with the observed

90s onwards, the implicit criterion has evolved towards providing similar per capita financing across regions through a myriad of funds.[9]. Overall the Spanish regional financing system has moved towards more financial autonomy through a greater regional share of tax revenues and spending competences (most notably in the area of education and health) which de facto translated into a greater dependence of Spanish autonomous communities towards vertically redistributed funds. The complexity of the calculation of vertical transfers and the delay in the final settlement of net transfers (which normally takes place after two years of the budget execution) created significant uncertainty to the whole budgetary process planning. Overall the regional financing system has been characterised by a high degree of arbitrariness in terms of intergovernmental transfers, evolving towards a strategic game between the different administrative levels.[10] As a result, the imbalance between the regional expenditure attributions and the financial means allocated for this purpose has tended to widen, see Vallés and Zárate (2004).

Given the above evidence one would expect that possible changes in the inter-governmental transfers to have a substantial impact in Spain compared to Canada and Germany. Figure 1 suggests indeed that, both the size and variability of financial transfers to the regions have been higher in Spain compared to Canada and Germany. In all these countries the financial crisis has also had a significant impact on regional borrowing, especially so in Canada and Spain, see Figure 2. In the Spanish case this illustrates the successive periods of tax revenues windfalls and shortfall linked to the housing boom that impacted more specifically Spanish regions´ public finances, see Barrios and Rizza (2010). In the Canadian case this was mainly due to increased financing of current expenditure through regional borrowing, see Guillemette (2010).

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growth rate of the Central Government's tax revenues according to an agreement re-negotiated every five years. As a consequence, these two regions do not participate to the fiscal equalisation process which takes place among the central government and the rest of autonomous regions (see Ruiz-Huerta and Herrero, 2008).

9    Only customs tariffs remain within the remit of the central government.

10  See Colomer (1998) for an analysis of the strategic political bargaining game between the Spanish regions and the central government.

## 3.2 Fiscal rules and access to financial markets.

A large degree of tax and expenditure autonomy might lead to very different fiscal outcome and public borrowing depending on the degree of central and regional government budgetary monitoring and fiscal rules. The degree of access to financial markets and private bank credits might also impinge on the true fiscal autonomy of the regions.

Budgetary control imposes no balanced budget rule in Canada. Canadian provinces can borrow money without no others restrain than market discipline while there is no balanced budget rules apart from a limited number of provinces-specific institutional reforms undertaken in the early 1990, see Dahlby (2008). The experience of the early 1970s and more recently in the aftermath of the financial crisis have seen a number of provinces increase their borrowing without restraint to fund social rather than capital expenses, leading to a significant rise in public indebtedness, see Guillemette (2010). At first sight regional budgetary control is more stringent in Germany and Spain although it is only through recent reforms that such control has been made in principle more binding. During most of the period covered by our empirical study either no specific rule were in place or could be considered as being effective in both Germany and Spain, however. In Germany, the constitutional constraint to public borrowing at federal and state level was guided by the "golden rule" while borrowing for non-investment expenditures was in principle not permitted.[11] However, Länder were allowed to make largely autonomous decisions in terms of borrowing which in certain cases increased sharply, especially since the onset of the financial crisis, see Zipfel (2011). The German Länder also benefited from joint liability and a bail-out guarantee which make their bond issuance de facto backed by the federal government while the Constitution did not foresee financial sanctions in case of budgetary slippages.[12] In 1988 two German Länder, Bremen and Saarland turned to the Federal Constitutional Court asking for financial support to cope with high debt burden. In 1992 the Court decided that financial assistance should be provided to these two Länder. Several decisions were later on taken by the Constitutional Court in 1992

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11 Recent reforms in line with the Constitutional Amendment aimed at strengthening budgetary control and introducing a constitutionally binding deficit and debt ceiling have taken place, implying compulsory balanced budget rules as well. But they are not discussed in this paper as the period concerned is not covered by the empirical analysis.

12  The debt brake enshrined in the Constitution will only apply from 2020 onwards.

and 2005 reinforcing the legal implications of these bail-outs and de facto lowered the financing cost of those Länder with high deficit and interest burden.[13]

Regarding the Spanish case, regional fiscal rules aimed in principle at ensuring sustainability. In reality, however, these were insufficient to prevent excessive and pro-cyclical public spending. Existing evidence suggests that while the decentralisation process took place rapidly on the expenditure side, such process has not been matched by corresponding rise in regional tax revenues and failed to provide incentives and effective rules for tighter financing constraints, see Balassone et al. (2002). The Spanish regions have also had the possibility to meet their short-term liquidity or long-term financing through direct bank loans which in some instance proved instrumental to circumvent central government oversight. [14] Following the adoption of the EU Stability and Growth Pact in 1997 and its subsequent amendment, Spain adopted a number of laws and regulations which were aimed to set the Spanish fiscal framework in line with the EU fiscal objectives. The regions were deemed to be an integral participant to the fiscal objectives through the adoption of the Law of Budget Stability in 2002 and its successive reforms of 2007 and 2012, setting region-specific balanced budget objectives over a three year horizon as in the EU fiscal framework. However, the loose application of borrowing rules, even during good times, led regions to incur into additional debt in order to cover their current expenditure needs, see Argimon and Herandez de Cos (2012). In addition, while a no bail-out rule was either explicitly or implicitly in force during the 1990s and the 2000s, in practice the vertical equalisation system amounted to and implicit and quasi-permanent bail-out of the regions, see Sorribas (2011).

### 3.3 Regional fiscal equalisation, public borrowing and regional income differentials.

The regional fiscal framework and fiscal policy in Canada, Germany and Spain can be thought as being rather different as shown in the previous sub-section. Of course this is unsurprising since these three countries have different institutional and historical specific backdrops. Whether or not the resulting

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13 See Heppke-Falk and Wolff (2007).

14 Short-term credit operations must be implemented only to cover transitory liquidity needs while long-term credit operations must be used for investment spending. For investment-related bond issuance an additional pre-requisite is that the sum of debt amortization and interest payments must remain below 25% of current income of each region.

differences in regional financing systems may eventually lead to a different relationship between regional income inequalities and regional public borrowing remains unclear, however. According to our simple model, it would be reasonable to expect that the intensity of the regional redistribution effort will depend on the extent of regional income inequalities and the fiscal framework in place. The political choices made regarding the desired level of regional redistribution and the application of normative redistribution criteria introduces a high degree of uncertainty regarding the possible borrowing behaviour of relatively rich vs. poor regions, however. The previous sub-section tends to suggest that these choices and frameworks are rather heterogeneous between Canada, Germany and Spain which translated into rather different size of intergovernmental transfers. In fact, the evidence provided below suggests the contrary, i.e., the redistributive patterns of the inter-governmental redistribution schemes appear to be rather similar across these three countries. This is illustrated in Figure 3 displaying the relationship between the amount of intergovernmental grants (measured in per capita terms) and the level of GDP per capita in the regions of these three countries. Baring the national difference in GDP per capita levels, it is rather remarkable to observe that, despite country-specific features, the relationship between the degree of regional income redistribution and the regional level of GDP per capita in these three countries is rather similar at least when considering the last two decades. Some regions could be considered as specific cases such as for instance the two Canadian provinces of Newfoundland and Labrador and Alberta which benefit from large tax revenues (royalties) thanks to abundant natural resources (mainly oil and gas). The Spanish Navarre and Basque country regions or the German city-states of Hamburg, Bremen and Berlin could equally be considered as specific cases. However, omitting these regions would further reinforce the similarity of the link between federal grants and differences in GDP per capita between Canada, Germany and Spain. Simple OLS regressions between the (log) level of grant per capita and the (log) GDP per capita indicate that the redistributive effect of inter-governmental grants tends to be similar in Germany and Spain where a decrease in the level of GDP per capita of 10% entails a reduction of 40% and 38% of the inter-governmental grant per capita, respectively. In Canada this fall is about half these figures at about 22%.[15]

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15  The result for Germany has been obtained including the city states of Berlin, Bremen and Hamburg. When excluding these City States the redistributive nature of the German system appears slightly more pronounced going from 40% to 54%.

According to our theoretical analysis the existence of large fiscal equalisation grants in presence of large regional differences in income per capita and a generous redistribution system is likely to increase regional public borrowing in poor regions or even more so in rich regions depending on the nation-wide fiscal policy objectives. Figures 3-5 partly illustrate this by considering the link between the GDP per capita and the change in public debt over 1995- 2010 for Germany, Canada and Spain (for this country the data available ends in 2009). In Canada and Spain the relationship between the regional GDP per capita and change in public debt appears at first sight positive, i.e. suggesting that richer regions tend to have experienced higher increase in public borrowing during this period. On the contrary in the German case no specific pattern emerges. It is of course very premature to draw conclusions from this evidence, given the influence of a number of factors not accounted for such as for instance, the starting level of debt or the influence of the business cycle, which may well condition the relationship between indebtedness and regional income per capita differences.

## 4. Econometric analysis of the link between regional government borrowing and development differentials in presence of equalisation grants.

To analyse the link between development differentials and regional borrowing we adopt the approach now widely used in the literature which, following Bohn (1998), specifies an econometric model where regional borrowing represented by the primary balance (i.e. net lending minus interest payment expressed in percent GDP) is a function of past borrowing, the debt level and cyclical developments. The equation to be estimated can be written as follows:

$$\text{(E1)}$$

where the indices indicate the region ($i$) and the year ($t$), the dependent variable is the primary balance, which is regressed on its past level at *t-1*, *D* is the debt level, *OG* is the output gap and *Ycap* is the regional GDP per capita while $\varepsilon$ is a time and region-specific error component. Usually the main parameter of interest in such fiscal reaction function is the coefficient $\beta_2$ which is expected to be positive indicating that fiscal policy is deemed to be sustainable. The output gap captures the impact of the business cycle on fiscal policy and is indirectly intended to reflect the size of automatic stabilizers.

The output gap has been obtained here for each region using the Hodrick-Prescott filter with a smoothing parameter λ=1600, as suggested by Hodrick and Prescott (1997). We used the nominal GDP to build this indicator such that the output gap also includes the effect of inflation (and therefore include the effect of seigniorage revenues). The main coefficient of interest in equation (E1) is $\beta_5$ which is expected to be either positive or negative depending on whether poor or rich regions (i.e. regions with a low or high value of $Ycap$ ) tend to incur into higher net borrowing respectively. The time period available for each of the variables listed above differs across countries. We avail of data for 1985-2011 for Germany, for 1994-2009 for Spain and 1982-2008 for Canada. In order to be able to compare results across countries more accurately we will focus on the post 1994 period and leave regressions including more years for robustness checks. In the sequel we present result of the estimations of equation (E1) by country, pooling all regions and years together. The estimation method used to plays an important role in such context. When dealing with such pooled data it is natural to pay specific attention to the error in term $\varepsilon_{i,t}$ of equation (E1). In a panel data context this term can be considered as being made of two components, an *i.i.d.* term $\phi_{i,t}$ with the classical statistical properties ensuring that equation (E1) is correctly estimated and a panel-specific (or fixed) effect such as $\mu_i$ which is assumed to be region-specific and invariant such that:

$$\varepsilon_{i,t} = \phi_{i,t} + \mu_i$$

The parameter $\mu_i$ includes region-specific effect which, when not properly accounted for, can lead to biased estimates. In our context the region-specific parameter plays a specific role since it represents the potential elements specific to a given region $i$ that do not vary across time but might bias the estimated relationship between regional borrowing and the level of economic development. This could be the case for regions with a special status for instance city-states in Germany or overseas regions entitled to specific grants such as the Canary Island in Spain. It is therefore necessary to account for these region-specific effects in order deal with these unobserved elements. However the country-specific features regarding regional fiscal policy cannot be accounted for in these region-specific effects given that they are common to all regions in a given country. Notwithstanding, a comparison of results across countries can tell us whether regional fiscal policy and the determination of country-specific

intergovernmental transfers can influence the relationship between public borrowing and development differentials.

Given the above arguments we will proceed first with a simple OLS. We then estimate (E1) by controlling for region-specific effects with a panel fixed effect estimation removing the potential influence of region-specific unobserved parameters $\mu_i$. Given the potential endogeneity bias (e.g. between the dependent variable and its lagged value or the level of debt), we use a bias corrected least-square dummy variable dynamic panel data estimator based on Blundell and Bond (1998) system estimator which allows us to account for both endogeneity and region-specific fixed effects, while correcting the standard errors based on Kiviet (1995) methodology.[16]

## 4.1 Main results

Our main results are reported in Tables 3-5. Specific attention is paid to the results when using the fixed-effects estimator and the LSDV estimator in Column (1) to (4). The OLS results are reported for information only in Columns (5) and (6) but are not commented further. The relationship between the regional GDP per capita and fiscal behaviour (measured as primary surplus in our econometric analysis) displays different signs across countries. The results indicate that while in Spain and Canada the richer regions tend to have higher borrowing. This relationship is never significant, however. The results for Germany go in the opposite direction: the poorer Lander tend to have higher deficits. In this case also, the coefficient obtained is not significant. These findings are consistent with previous works. Lago (2005) for instance obtains a similar result for the Spanish regions over the period 1984-1999.[17] For Germany, Schuknecht et al (2009) obtain a similar results showing that the poorer Länder also net-recipients of intergovernmental transfers, have experienced a softer budget discipline from financial markets and, tended to run higher budget deficits than richer regions. Canada, indeed, shows a similar pattern as long as financial markets have imposed a strong financial discipline at provincial level (Schuknecht et al, 2009) although the results differ from those of Germany. The federal government in

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16 See Celasun and Kang (2006) for a discussion of the advantages of the LSDV estimator over other panel-estimators in when estimating a fiscal reaction function.

17 Lago (2005) considers in addition a variable measuring the spending responsibilities of Spanish regions, which were rather different across regions during the period covered by this author.

Canada is principle not allowed to bail-out its provinces while the German recent experience suggests that such bail-out can formally happen as shown in the case of Bremen and Saarland and the recent Constitutional Court decisions.[18] The evidence reported by Heppke-Falk and Wolff (2007) indeed suggests that after these Constitutional court decisions favouring a bail-out of the Bremen and Saarland, Landers with a high interest debt burden tend to have lower risk premia.

Columns (2) and (4) of Tables 3-5 deal specifically with the impact equalisation transfers on the regional primary surplus. To do so we re-estimate the regressions reported in Column (1) and (4) by removing the federal grants received from the regional primary surplus. The sign of the coefficient obtained previously still holds despite removing the effect of federal grants on the primary surplus while the coefficient. It is interesting to observe however that now the coefficients estimated for the GDP per capita are significant (at 1%) in the German and Spanish cases. For Germany, this result suggests that in absence of federal grants poorer regions tend to have higher borrowing. The size of the coefficient also rises markedly in both cases such that the estimated coefficient is also economically significant. For instance a German Länder with a GDP per capita greater by 10% than the average Länder will have a primary budget balance of 0.361pp higher than the average. In the Spanish case, the result suggests on the contrary that richer regions would incur into higher borrowing in absence of intergovernmental transfers. The coefficient is also economically significant in the Spanish case since regions with an average GDP per capita of 10% higher than the average will also have on average a -0.245 pp lower primary surplus. Overall these results suggest that intergovernmental transfers tend to smooth out regional differences in fiscal behaviour, i.e., regions tend to be more similar when intergovernmental grants are in operation.

How do the above results fit with our theoretical analysis? Let consider first the Spanish case. On the basis of the equalisation formula (10), the theoretical model suggests that with a low values of the equalisation rate ($\alpha$) and/or the benchmark tax rate ($\bar{t_l}$), and with high enough tax capacity benchmark ($\bar{w}$), richer regions will have higher borrowing (or less saving). Under such conditions, the

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18 The Saskatchewan and Alberta provinces were the only to be bailed-out, although these bails-out took place in the 1930s and 1940s respectively, see Bird and Tassonyi (2003).

redistribution effort made by relatively rich regions is not very intense and these regions will not make large redistribution payments towards poor regions. Rich regions can even become net recipients of such as equalisation grants provided that $\bar{w}$ is high enough, i.e. that the central government sets the targeted fiscal capacity relatively high.

In fact, these results reflect rather well the existence evidence in the Spanish case with a number of nuances, however. Ruiz-Huerta and Herrero (2008) show in particular that the Spanish equalisation system is especially focussed on spending needs, that is, on the regional population levels. Precisely due to this fact, we can infer that the fiscal equalisation rate (i.e. $\alpha$) only plays a minor role in the Spanish fiscal equalisation system, see Herrero (2005). The benchmark fiscal effort used in the Spanish system is also low while the benchmark wage rate are relatively high compared to the actual average, see Ruiz-Huerta and Herrero (2008). An indication of the latter point comes from the fact that vertical grants are still relatively high in Spain, indicating that federal government must complement substantially the regional resources beyond their own tax revenues. The model presented in Section 3 would predict in such context that richer regions would tend to borrow more when the redistribution level in terms of fiscal capacities gets lower which is consistent with the evidence obtained previously in the descriptive analysis (see Column 3 in Table 1) for Spain. The econometric result suggests in addition that, in such system, rich regions tend to borrow more than the poor ones, although not significantly so.

We now consider the German case. As before with the Spanish case, there is an explicit (and strongly stated by in the Federal Constitution) aim of providing enough resources to guarantee a certain level of public services to the citizens regardless of their place of residence. As discussed earlier the German federal government uses not only the standard horizontal equalisation system but also the so-called supplementary (vertical) transfers in favour of financially weak states. Furthermore, despite the fact that fiscal equalisation is topped-up, as opposed to the Spanish case, the German territorial financing system is based on a strong horizontal redistribution of tax revenues, especially through the redistribution of the VAT tax revenues such that no single regional government will have less than the 95% of the average per capita budgetary resources. This means that the parameter $\alpha$ can be thought of being

relatively high in the German case.. There is no explicit benchmark tax rate for the equalisation as *de facto* the regional governments in Germany enjoy very little tax autonomy, such that little can be said on the influence of ($\bar{t_l}$ ).The German fiscal equalisation is also very much focused on fiscal capacities and thus implicitly on differences in the tax bases, see Federal Ministry of Finances (2009). This suggests that the gap between *w* and $\bar{w}$ (which proxy differences in fiscal capacities) plays an important role in the German system and that $\bar{w}$ is set at relatively high level (vs. *w*) which in a sense is unsurprising given the high level of regional inequalities in this country, especially since the reunification in 1991. Our result indicate however that the normative gap in fiscal capacities might not be high enough given that our econometric result suggest that poor regions tend to incur into higher borrowing compared to the rich ones, although not in a significant manner. However, another reason that could explain this result could be that relatively poor regions´ financing conditions might have been significantly influenced by the bail-out decisions of 1988 as mentioned earlier. The possibility of a bail-out would thus tend to lower the interest rate paid by poor regions while we assume that the interest rate is exogenous and identical across regions. This question is considered more closely in next Section.

Things become even more complex when considering the econometric results for Canada. The Canadian equalisation system is in principle close to the standard approach followed in the theoretical model: it is clearly focused on equalisation of fiscal capacities (i.e. *α* in our model) without apparently giving much importance to differences in spending needs across provinces. However, a large share of intergovernmental transfers is represented by the two programmes devoted to Health and Education issues and these have a clear link with fiscal needs. In addition the scope of the intergovernmental grants is not general as in the German and the Spanish cases as only about one third of the Canadian population lives in net recipient provinces and a number of provinces do not benefit from these grants.[19] The intensity of redistribution is also not very high given that the richer regions are not equalized down (Dahlby, 2008). Concerning the fiscal effort (i.e. the $\bar{t_l}$ variable) tax policy in Canada

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19  Data for 2007/2008, source: Dahlby (2008).

is highly decentralised and provinces have large tax autonomy such that this variable cannot be in principle considered as relevant for intergovernmental transfers. Finally the role played by the difference between the benchmark fiscal capacity and the actual one (i.e. the difference between $w$ and $\bar{w}$) remains nuclear given the characteristics of the Canadian fiscal equalisation system which combines generic and programme-oriented grants. Finally, since the mid nineties, the standard parameters of fiscal capacity is not computed over the all the Canadian provinces but excludes the richest one and the five poorest, which makes the system more unclear. Our econometric analysis would tend to suggest that richer regions would tend to borrow relatively more, although this relationship is not fundamentally modified once intergovernmental transfers are removed from the dependent variable.

Finally we need to comment also on the sign of the coefficient on the past debt level, i..e., the elasticity $\beta_3$ in equation (E1) although the main focus has not been on this variable. The coefficient estimated for this variable with the fixed-effect and LSDV methods are in most cases negative.[20] This result would suggest that regional fiscal policies in these three countries have not been sustainable, although the coefficient obtained is in most cases insignificant apart for the Spanish regions in the fixed-effect estimations.

## 4.2 Robustness checks

A number of robustness checks were conducted in order to check whether our result hold whenever specific regions were removed from the estimations or when different time periods were considered.

In the Spanish cases the only alternative considered was removing the two regions with a specific fiscal regime, namely Navarre and the Basque Country. Our result did not vary significantly in this case as indicated in Table 8. For instance considering the specification reported in Column (2) and (4), the elasticity obtained with the fixed effect was -0.0245 in the fixed effect estimation and -0.0180 when using the LSDV estimation. These results are very close to the ones reported in Table 5 and were also highly significant (at 1% level).

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20  The only exception is Germany in the LSDV estimation reported in Column (4).

The robustness check are maybe more relevant in the German case, in particular regarding the importance of the bail-out decisions and the reunification process. The longer time series available for this country (from 1986 to 2011) also allow us to estimate a number of alternative specifications. These results are reported in Table 6. Column (1) of Table 6 first considers all Länder including city states during the period 1994-2011 period. The result concerning the coefficient on the GDP per capita remains very similar to the general results presented in Table 4. This variable displays a positive and significant (at 1%) coefficient when excluding the regional grants from the definition of the dependent variable. The most relevant robustness check to be performed for Germany concerns the Constitutional Court decision of 1992 and the reunification, however. In order to capture the influence of the 1992 Constitutional Court decision we have multiplied the GDP per capita variable with a dummy variable equal to one for the year starting from 1992 and equal to zero for the years before 1992.[21] The results of this estimation are reported in Column (2) of Table 6. A positive and significant coefficient is still obtained for the level of GDP per capita variable as in the main results reported in Table 4. In this case however the coefficient obtained is much lower than in the main result: the elasticity falls from 0.0273 to 0.0078, i.e. almost a 70% drop in the estimated effect of the GDP per capita on regional borrowing. Coming back to our earlier discussion, in the German case the poor region tend to display higher budget deficit. This suggests that the regional financing system influences these regions´ intertemporal budget constraint such that relatively poor regions use intergovernmental grants and higher public borrowing to smooth their consumption of public goods and services over time. This feature of the German system seems to have been significantly amplified by the 1992 Court ruling. This result is however not surprising given that the Constitutional Court decision concerned two regions with relatively high (Bremen) and medium (Saarland) GDP per capita thus suggesting that the potential influence of the Constitutional Court decision might in fact have little to do with the relative wealth of German regions and is more related to political considerations. The last robustness check for Germany concerns the effect of the German reunification. To do this we have considered the sample of Western Länder and interacted our GDP per capita variable with a dummy variable equal to one for the years starting from 1991 onward. The results of this estimation are reported in Column (4) of Table 6. In this case we

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21  Alternatively we have used the year 1988 as starting point which is when financial assistance by Saarland and Bremen was formulated by these Länder. Results remain practically unchanged.

observe that while the estimated coefficient on the GDP per capita is positive it is no longer significant. The interaction term between the post-reunification dummy variable and the GDP per capita is negative although it also fails to be significant, however. Additional regressions (unreported) suggests in addition that the impact of the German reunification on Western Länder fiscal policy was not significant.

Finally we conducted a number of robustness check in the Canadian case as well. For Canada we avail of longer time series such that our main regression could be estimated over the period 1982-1994. Unreported results suggest that the coefficient estimate was again insignificant although its sign changed being now positive. The low value of this coefficient (0.0036) and its lack of significance suggests however that no fundamental change have taken place during this period compared to the 1994-2008 period in the Canadian case. As additional robustness check we also dropped from our sample the countries abundant in natural resources, which in turn affects significantly their tax revenues through royalties, namely Alberta, British Columbia and Saskatchewan. The coefficient obtained(-0.0122) was very close the one reported in Column (6) of Table 6 thus suggesting that the influence of resources-rich regions does not alter the negative (albeit insignificant statistically) relationship between the GDP per capita and the primary surplus of Canadian provinces.

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## 5. Summary and conclusions

In this paper we have analysed the link between regional development differentials and public borrowing. Ongoing developments in OECD and in particular OECD-EU countries suggest that regional fiscal policy might play a key role in contributing to the fiscal consolidation efforts needed to reduce current public debt levels. The specific constraints faced by sub-central government also make them particularly interesting case-studies for analysing the conduct of fiscal policy when monetary policy and the exchange rate are set exogenously as suggested by Von Hagen and Eichengreen (1996). Using the GDP per capita level as main explanatory variable of interest also allows us to link budget balances with differences in productivity and competitiveness performances which have been shown to play a particularly relevant role in the context of an integrated monetary area where fiscal policy is decentralised.

In order to analyse the main mechanisms at hand we build a simple model of fiscal federalism where both the central and regional government can borrow in financial markets to fill budgetary gaps and where the central government redistribute part of the tax revenues between regions. We show how the regional income redistribution modifies the intertemporal budget constraint of the regions and under which conditions regional governments may incur into higher or lower borrowing as a result. We then test econometrically the link between regional development differential levels and public budget balances in Canada, Germany and Spain, i.e. three counties with notoriously decentralised fiscal policy. Our analysis suggests that the relationship between the regional level of GDP per capita and regional public borrowing can be either positive (as in the German case) or negative (as in the Canadian and Spanish cases) thus suggesting alternatively that rich or poor regions can on average display higher public deficits. However we find that the relationship between regional primary deficit and the level of GDP per capita becomes significant only when intergovernmental grants are removed from regions´ total revenues. Therefore we conclude that the level of GDP per capita does not significantly influences regional public borrowing and that intergovernmental grants tend to make regions´ fiscal policy more similar, at least in the three countries considered here.

Our analysis underlines the significant differences in fiscal behaviour between relatively rich and relatively poor regions in an integrated economic area in absence of intergovernmental transfers. One

can hardly draw any definitive conclusions as to whether poorer or richer regions tend to have higher deficits, in absence of such transfers, however. From a fiscal policy perspective it seems reasonable to think that on average, the conduct of fiscal policy should be independent from the level of GDP per capita (and related differences in competitiveness and productivity levels) However, in practice, differences in GDP per capita are directly linked to the entitlement to intergovernmental grants which, by definition, alter the intertemporal budget constraint and modify cross-regional differences in fiscal behaviour. It is therefore not surprising to find that the GDP per capita can in some cases be a good predictor of public deficits. Importantly however, our different results concerning the sign of this relationship depending on the country considered suggest that this relationship can go both directions (i.e. either positive or negative) depending on the country considered and its specific fiscal framework. We provide a number of insights or federal or quasi-federal fiscal systems that can prove instrumental in reducing cross-regional differences in fiscal balances.

Future research should bring additional insights into the question concerning the interaction between regional income differences and regional borrowing when fiscal policy is highly decentralised while monetary policy is not. Our results are of course subject to further scrutiny and possibly more refinement at the theoretical level, in particular to account for possible endogeneity in the interest rate paid by regions. At the empirical level an analysis including more federal or quasi federal countries would also be warranted. Furthermore we have not considered the importance of tax autonomy in our estimations since these were run on a country basis. The degree of tax autonomy could influence the conduct of fiscal policy if sub-central governments rely less on intergovernmental transfers to achieve budgetary balance providing that budgetary control is also reinforced. These other questions are left for future research.

**Tables**

**Table 1: Fiscal frameworks**

|  | Public expenditure *(% of gov. exp,)* | | Tax revenues *(% of gov. tax rev.)* | | Intergov. Transfer revenues *(% total revenues)* | | Tax autonomy [δ] *(% total revenues)* | |
|---|---|---|---|---|---|---|---|---|
|  | **1995** | **2010** | *1995* | *2010* | *1995* | *2010* | *1995* | *2010* |
| **Canada** | 40.44 | 46.88 | 37.06 | 39.52 | 18.37 | 21.19 | 37.1 | 38.9 |
| **Germany** | 18.74 | 21.41 | 21.64 | 21.16 | 17.20 | 18.05 | 21.6 | 22.9 |
| **Spain** | 21.60 | 34.42 | 4.8 | 18.24 | 73.3 | 49.0 | 4.8 | 22.3 |

Source: OECD

**Table 2: Summary statistics of variables used for the estimation of the regional fiscal reaction functions (1995-2010): average value and standard errors (in parentheses)**

|  | Primary surplus (net of gov. grants) | GDP per capita | Output gap | Public debt (Gross debt, in % GDP) | Intergovernment grants (% GDP) |
|---|---|---|---|---|---|
| **Canada** | -0.0324 (0.0350) | 10.3503 (0.2710) | 0.00005 (0.0020) | 0.5862 (0.1927) | 0.0611 (0.0405) |
| **Germany** | -0.0411 (0.0325) | 10.0279 (0.2395) | 0.00002 (0.00154) | 0.2128 (0.0921) | 0.0198 (0.0251) |
| **Spain** | -0.0533 (0.0427) | 9.7058 (0.3144) | 0.0002 (0.0007) | 0.0529 (0.0234) | 0.0478 (0.0377) |

Source: OECD

**Table 3: Econometric results for Canada**

| VARIABLES | (1) Fixed-effects Incl. grants | (2) Fixed-effects Excl. grants | (3) LSDV Incl. grants | (4) LSDV Excl. grants | (5) OLS Incl. grants | (6) OLS Excl. grants |
|---|---|---|---|---|---|---|
| primary deficit (t-1) | 0.620*** | 0.800*** | 0.799*** | 0.967*** | 0.751*** | 0.940*** |
| | (0.0822) | (0.0822) | (0.0544) | (0.0455) | (0.0657) | (0.0423) |
| log gdp percapita (t-1) | -0.00295 | -0.00493 | -0.00404 | -0.00860 | 0.00242 | 0.00102 |
| | (0.00584) | (0.00664) | (0.00756) | (0.00634) | (0.00479) | (0.00556) |
| output gap (t-1) | -0.662 | -1.263** | -0.719 | -1.350** | -0.680 | -1.522*** |
| | (0.498) | (0.561) | (0.522) | (0.562) | (0.492) | (0.530) |
| gross public debt_% GDP (t-1) | -0.0151 | -0.0258 | -0.0205 | -0.0234 | 0.00725 | -0.00159 |
| | (0.0152) | (0.0162) | (0.0240) | (0.0241) | (0.00702) | (0.00806) |
| | | | | | | |
| Observations | 140 | 140 | 130 | 130 | 140 | 140 |
| R-squared | 0.317 | 0.486 | . | . | 0.531 | 0.881 |
| Number of regions | 10 | 10 | 10 | 10 | | |

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

**Table 3: Econometric results for Germany**

| VARIABLES | (1)<br>Fixed-effects<br>Incl. grants | (2)<br>Fixed-effects<br>Excl. grants | (3)<br>LSDV<br>Incl. grants | (4)<br>LSDV<br>Excl. grants | (5)<br>OLS<br>Incl. grants | (6)<br>OLS<br>Excl. grants |
|---|---|---|---|---|---|---|
| primary deficit (t-1) | 0.649*** | 0.424*** | 0.772*** | 0.572*** | 0.753*** | 0.716*** |
| | (0.0508) | (0.0622) | (0.0480) | (0.0641) | (0.0445) | (0.0434) |
| log gdp percapita (t-1) | 3.98e-06 | 0.0361*** | -0.00198 | 0.0283*** | 0.000895 | 0.0314*** |
| | (0.00600) | (0.00705) | (0.00865) | (0.00925) | (0.00249) | (0.00495) |
| output gap (t-1) | -0.164 | -1.508*** | -0.128 | -1.463*** | -0.595* | -2.365*** |
| | (0.328) | (0.389) | (0.272) | (0.315) | (0.312) | (0.369) |
| gross public debt % GDP (t-1) | 0.0338** | -0.00591 | 0.0284 | -0.00923 | -0.0134** | -0.0242*** |
| | (0.0169) | (0.0193) | (0.0220) | (0.0228) | (0.00591) | (0.00859) |
| | | | | | | |
| Observations | 221 | 221 | 208 | 208 | 221 | 221 |
| R-squared | 0.562 | 0.497 | . | . | 0.748 | 0.941 |
| Number of regions | 13 | 13 | 13 | 13 | | |

Standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 3: Econometric results for Spain**

| VARIABLES | (1) Fixed-effects Incl. grants | (2) Fixed-effects Excl. grants | (3) LSDV Incl. grants | (4) LSDV Excl. grants | (5) OLS Incl. grants | (6) OLS Excl. grants |
|---|---|---|---|---|---|---|
| primary deficit (t-1) | 0.461*** | 0.756*** | 0.581*** | 0.921*** | 0.510*** | 0.971*** |
| | (0.0676) | (0.0633) | (0.0633) | (0.0375) | (0.0622) | (0.0396) |
| log gdp percapita (t-1) | -0.00351 | -0.0245*** | -0.00371 | -0.0180** | -0.00288 | -0.00542 |
| | (0.00291) | (0.00604) | (0.00435) | (0.00771) | (0.00206) | (0.00502) |
| output gap (t-1) | -5.165*** | -7.646*** | -4.802*** | -7.219*** | -5.176*** | -9.391*** |
| | (1.003) | (2.038) | (1.146) | (2.466) | (0.923) | (2.060) |
| gross public debt_% GDP (t-1) | -0.0117 | -0.247** | -0.00295 | -0.169 | -0.0160 | 0.0309 |
| | (0.0519) | (0.106) | (0.0717) | (0.150) | (0.0265) | (0.0579) |
| | | | | | | |
| Observations | 238 | 238 | 238 | 238 | 238 | 238 |
| R-squared | 0.346 | 0.540 | . | . | 0.380 | 0.785 |
| Number of regions | 17 | 17 | 17 | 17 | | |

Standard errors in parentheses; *** $p<0.01$, ** $p<0.05$, * $p<0.1$

**Table 6: Robustness checks for Germany**

| | (1) Western Länder 1986-2011 CC decisions incl. city states | (2) All Länder post 1994 incl. city states | (3) Western Länder 1986-2011, incl. city states | (4) Western Länder 1986-2011 incl. city states reunif. dummy |
|---|---|---|---|---|
| primary deficit (t-1) | 0.469*** | 0.608*** | 0.485*** | 0.476*** |
| | (0.0719) | (0.0792) | (0.0694) | (0.0641) |
| log gdp percapita (t-1) | 0.00780*** | 0.0227** | 0.00544** | 0.00676 |
| | (0.00221) | (0.0114) | (0.00236) | (0.00453) |
| output gap (t-1) | -0.558* | -0.775* | -0.643** | -0.582** |
| | (0.296) | (0.398) | (0.307) | (0.270) |
| gross public debt_% GDP (t-1) | 0.00675 | 0.0281 | 0.00898 | 0.00742 |
| | (0.0141) | (0.0230) | (0.0155) | (0.0167) |
| log gdp percapita (t-1) X CCdecision | -0.000146 | | | |
| | (0.000154) | | | |
| log gdp percapita (t-1) X reunification | | | | -0.000109 |
| | | | | (0.000229) |
| | | | | |
| Observations | 260 | 256 | 260 | 260 |
| Number of regions | 10 | 16 | 10 | 10 |

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

## 6. Figures

**Figure 1: Financial transfers from federal to State governments (percentage of national GDP)**
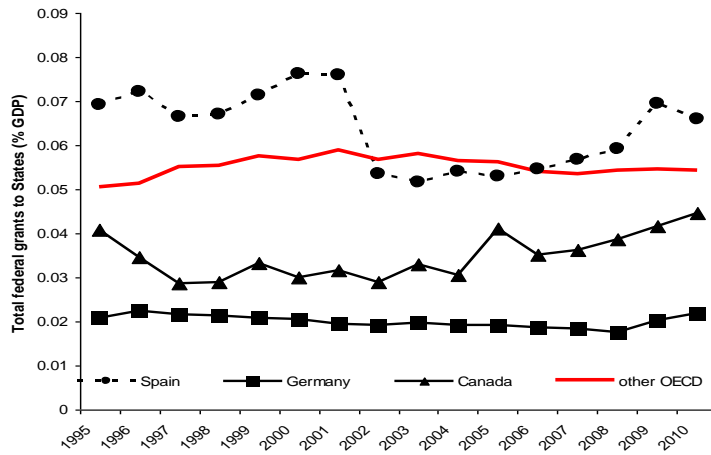


Sources: OECD and authors´ calculations. "Other OECD" is the
simple average figure for the US, Switzerland, Belgium and Austria.

**Figure 2: The evolution of net lending (+)/net borrowing (-)
in Canadian, German and Spanish regions. 1995-2010**
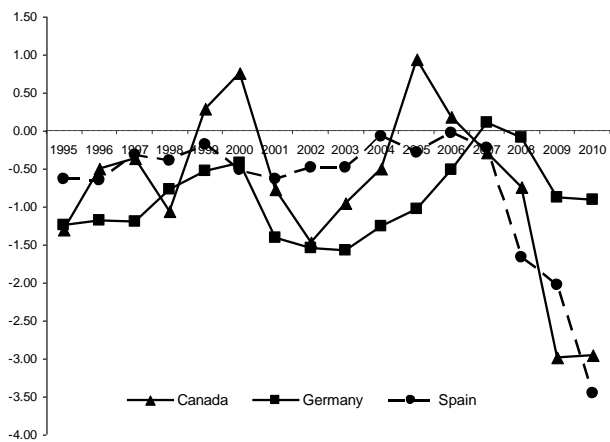


Source: OECD

**Figure 3: Federal grants vs. GDP per capita in Canada, German and Spanish regions**



Note: Average figures for 1995-2009. All monetary values are expressed
in current euros. Values for Canada converted into euros using average
        exchange rate between euro and Canadian dollar during 1995-2009
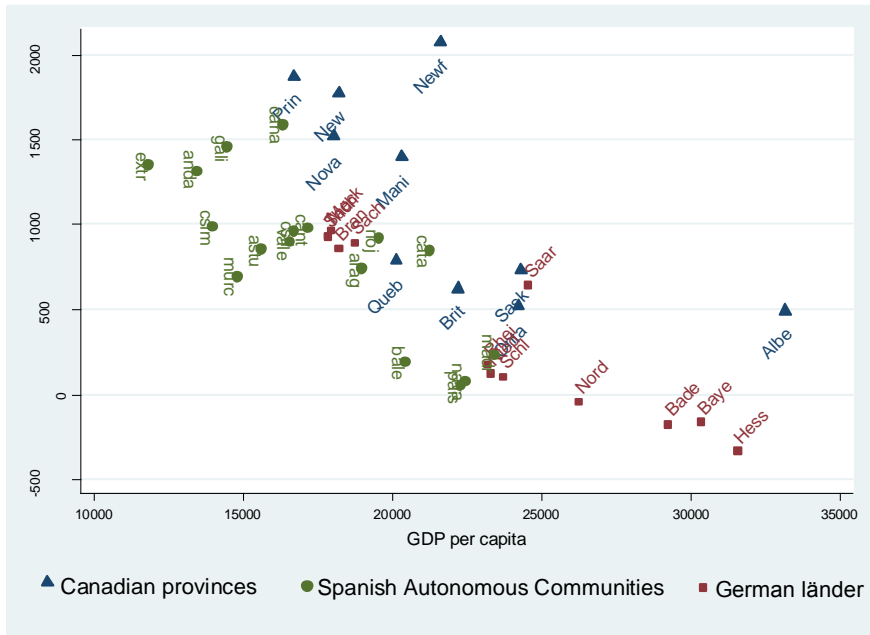
**Figure 4: Regional debt variation between 1995 and 2011 vs. level of GDP per capita in 1995 Canadian provinces***



**Figure 5: Regional debt variation between 1995 and 2011 vs. level of GDP per capita in 1995 German Länder***
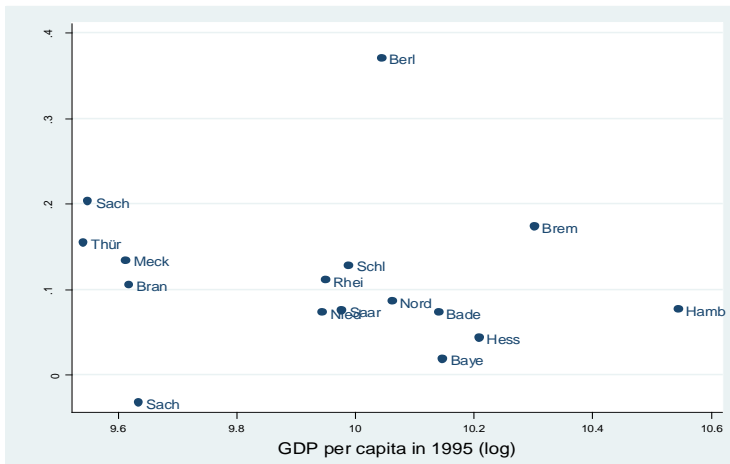
**Figure 6: Regional debt variation between 1995 and 2009 vs. level of GDP per capita in 1995 Spanish Autonomous Communities***
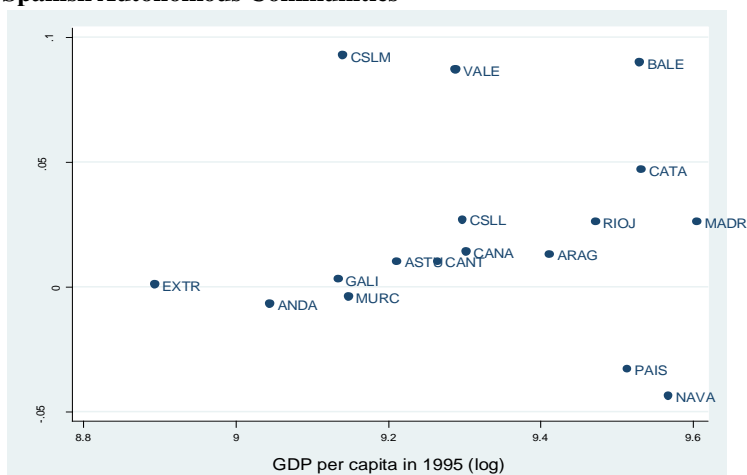
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**Technical appendix on the theoretical model**

The first optimization problem is that of representative household, which consists of maximizing the utility function (1) subject to two budget constraints (2) and (3). The last two expressions can be re-arranged to yield

$$x_1^j + \frac{x_2^j}{1+r(1-\tau)} = vl(1-\tau) \tag{A1}$$

Once the corresponding lagrangian function is built, the first order conditions for the decision variables are obtained:

$$F_{(x_1^j)} : \frac{1}{x_1^j} - \lambda v = 0 \tag{A2}$$

$$F_{(x_2^j)} : \frac{\beta}{x_2^j} - \frac{\lambda}{1+r(1-\tau)} = 0 \tag{A3}$$

$$F_{(l)} : \frac{\gamma}{1-l} - \lambda v(1-\tau) = 0 \tag{A4}$$

$$F_{(\lambda)} : vl(1-\tau) - x_1^j - \frac{x_2^j}{1+r(1-\tau)} = 0 \tag{A5}$$

where $\lambda$ is the Lagrange multiplier. Solving this four-equation system for $x_1^j$, $x_2^j$, $l$ and $\lambda$ as auxiliary variable, the optimal values shown are obtained:

$$\left(x_1^j\right)^* = \frac{v(1-\tau)l}{1+\beta+\gamma} \tag{A6}$$

$$\left(x_2^j\right)^* = \frac{\beta(1+r)v(1-\tau)l}{1+\beta+\gamma} \tag{A7}$$

$$l^* = \frac{l(1+\beta)}{1+\beta+\gamma} \tag{A8}$$

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where the value for $\lambda$ is not reported for brevity. Saving is retrieved from any of the budget constraints:

$$\dot{S} = \frac{\beta i (1-\tau)I}{1+\beta+\gamma}.$$

Optimization problem by the unitary government implies to maximize (4) subject to (5) and (6). Again, on the basis of the lagrangian function, the following first order conditions are derived:

$$\text{(A9)}$$

$$\text{(A10)}$$

$$F(\cdot) = \frac{\delta}{g} - \mu = 0 \tag{A11}$$

$$F(\cdot) = \frac{(1+\delta)\eta}{\beta g} - \mu = 0 \tag{A12}$$

$$F(\cdot) = \frac{\beta \delta \mu \eta}{g} - \mu = 0 \tag{A13}$$

$$F(\cdot) = \frac{(1+\delta)\eta \mu}{g} - \mu = 0 \tag{A14}$$

where we have omitted the corresponding condition for the Lagrange multiplier $\mu$. The optimal values for the decision variables of the unitary government can be derived by solving the above system of equations. This gives us the following solutions:

$$\left(\tau_I\right)^* = \frac{\eta}{1+\eta} \tag{A15}$$

$$\left(\tau_S\right)^* = 0 \tag{A16}$$

$$\left(\frac{}{}\right)^* : \frac{}{} \tag{A17}$$

$$\left(\frac{}{}\right)^* : \frac{}{} \tag{A18}$$

$$\left(\frac{}{}\right)^* : \frac{}{} \tag{A19}$$

$$\left(\frac{}{}\right)^* : \frac{}{} \tag{A20}$$

The optimal public debt in the unitary case, reported as in equation (7) in the main text, is retrieved by using the above values in one of the expressions concerning budget constraints: (5) or (6).

In turn, each regional government maximizes (1) subject to an intertemporal budget constraint obtained as a combination of (8) and (9):

$$\tag{A21}$$

The first order conditions at regional level are as follow:

$$\tag{A22}$$

$$\tag{A23}$$

$$\tag{A24}$$

where the corresponding expression linked to the Lagrange multiplier $\mu$ has again been omitted for simplicity. Solving this equation system we find the optimal values for the regional decision variables:

$$(A25)$$

$$(A26)$$

$$(A27)$$

Regional public debt is again computed on the basis of any of the period budget constraints and shown in the expression (11) of the paper.

Regarding comparative statics for the optimal regional public debt with respect to the parameters involved in the equalization formula (10), we obtain the following derivations:

$$(A28)$$

$$(A29)$$

$$(A30)$$

For a complete characterization of the sub-national equilibrium, the optimization problem of the federal government needs to be solved. To do so it then needs to maximize (4) subject to:

$$(A31)$$

$$(A32)$$

A combination of (A31) and (A32) yields the intertemporal federal budget constraint:

$$(A33)$$

First order conditions derived from this problem are:

$$(A34)$$

$$(A35)$$

$$(A36)$$

where that corresponding to the auxiliary variable of the langrangian has again been omitted. Equation system (A34)-(A36) and the federal budget constraint are then solved for the endogenous variables. After some algebra manipulations, we obtain the following optimal values:

$$(A37)$$

$$(A38)$$

$$\left(\tau_S\right)^* = 0,\qquad(A39)$$

where $x = (1+\tau)(1+t_j)M$, $j$=A, B and equal to the region that the variable refers to. Federal public debt $\left(D^F\right)^*$ is determined using these optimal values in any of the budget constraints:

$$(A40)$$