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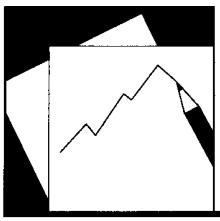

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Subnational Health Spending and Soft Budget Constraints in OECD Countries

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Subnational Health Spending and Soft Budget Constraints in OECD Countries

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Abstract

Government spending on health has grown as a percent of GDP over the last 40 years in industrialized countries. Widespread decentralization of healthcare systems has often accompanied this increase in spending. In this paper, we explore the effect of soft budget constraints on subnational health spending in a sample of OECD countries. We find countries where subnational governments rely primarily on central government financing and enjoy large borrowing autonomy have higher healthcare spending than those with more restrictions on subnational government borrowing.

JEL Classification Numbers:I1; H51; H75

Keywords: Healthcare spending; decentralization; soft budget constraints

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I. INTRODUCTION

Government healthcare spending has steadily increased over the last 40 years in all industrialized countries. Between 1980 and 2007 in OECD countries, the share of general government outlays spent on health increased from 10.9 percent to 16.1 percent, on average. Many explanations for this increase have been offered (e.g., Smith, Newhouse, and Freeland, 2009), but relatively less attention has been paid to whether institutions, in particular fiscal decentralization, have contributed to the increase in health spending.[2]

Healthcare systems have followed a clear decentralization trend in many OECD economies during this period (Tediosi, Gabriele, and Longo, 2009). By bringing fiscal decisions closer to voter preferences, decentralization can improve the allocative efficiency of entitlement expenditures (Azfar and others, 2001; Oates, 1999).[3] Subnational health spending is a large part of overall public health spending in some countries. In the United States, for example, Medicaid, the primary public health insurance program for the poor, is administered at the state level, with financing split between state and federal governments. State and local spending accounts for over half of total public spending in the United States, and in OECD countries, state and local spending on healthcare accounts, on average, for over one-third of public spending.

Decentralization can give rise to coordination problems which manifest themselves in soft budget constraints. Soft budget constraints can take many forms (Kornai, 1979; Kornai, Maskin and Roland, 2003), but in our case arise when subnational governments expect to receive additional resources in case of financial distress.[4] The expectation of federal bailouts weakens the budget constraint of subnational governments and induces them to behave strategically when selecting spending and borrowing levels.[5]

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[2] Gerdtham and Jonsson (2000) review the empirical evidence on the determinants of healthcare spending. They conclude that with respect to non-institutional variables, the association of healthcare expenditure and the age structure of a population and the association of healthcare expenditures and labor market characteristics like unemployment and female labor force participation are usually not statistically significant. Instead, a higher prevalence of risky health behaviors like smoking is found to increase healthcare spending. A very robust finding is a positive association between gross domestic product (GDP) and healthcare expenditure. Most studies find an income elasticity of healthcare spending of unity or close to unity. In terms of institutional variables, Gerdtham and Jonsson (2000) suggest that the absence of gatekeeping, payment schemes requiring patients to make payments before reimbursement, fee-service instead of capitation in physician remuneration, a higher ratio of inpatient to outpatient care, private sector provision of care, and a higher number of physicians per capita tend to increase healthcare expenditures.

[3] Letelier (2005) shows that decentralization of healthcare spending may improve the quality of primary health.

[4] Dewatripont and Maskin (1995) look at soft budget constraints in a model with centralized versus decentralized credit. Maskin (1999) and Kornai and others (2003) provide excellent surveys.

[5] Although the theory of soft budget constraints predicts higher deficits with stronger bailout expectations, the theory is silent as to whether this additional spending meets standards of efficiency. In fact, Besfamille and Lockwood (2008) present a model suggesting that hard budget constraints can lead to suboptimal levels of public investment.

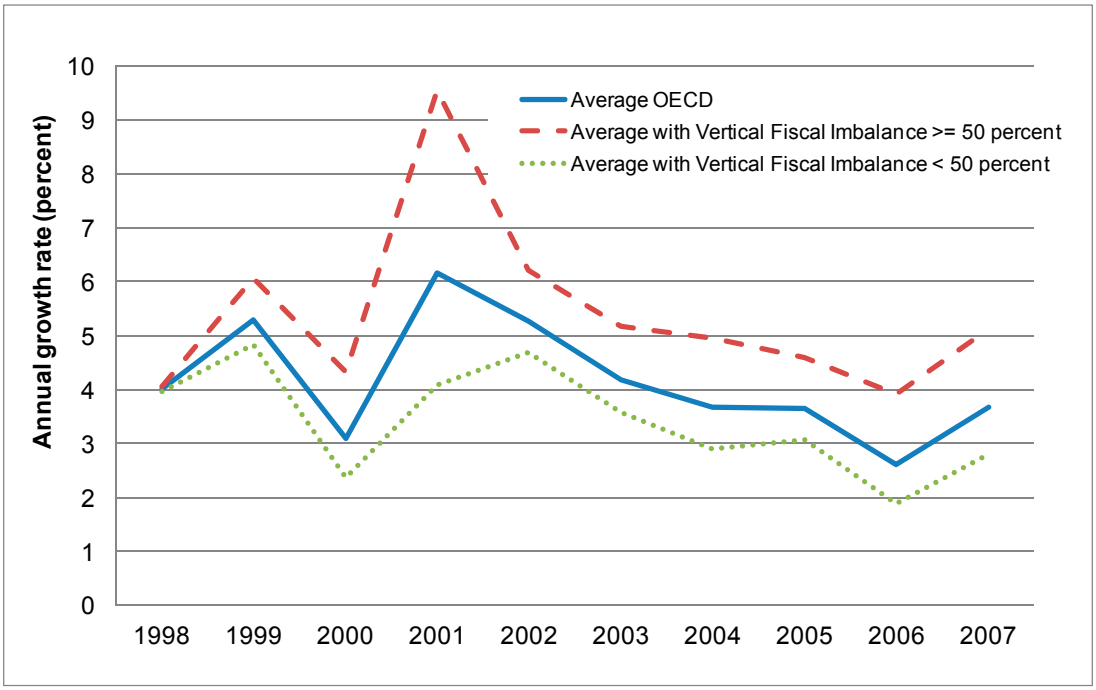
Soft budget constraints may be particularly important with healthcare expenditures, as the central government cannot credibly allow local governments to fail in providing such high visibility services without incurring a significant political cost. This is acutely felt in countries where political and financial responsibilities on health care across different levels of government are not clearly defined. Indeed, when subnational governments rely on transfers from the central government for financing, healthcare spending has grown briskly. For example, while the average annual growth rate of public healthcare spending per capita (in real terms) in OECD countries was 4.3 percent in the period 1998–2007, it was 5.4 percent in countries where healthcare provision is decentralized and subnational dependence on central government transfers is above 50 percent (see Figure 1).[6]

In this paper, we consider the degree of subnational borrowing autonomy, coupled with subnational dependence on central government transfers, as an indication of a soft budget constraint. Our strategy for measuring bailout expectations is most closely related to Rodden (2002).[7] Soft budget constraints are more likely when a high share of subnational spending is financed from the common pool of federal resources. In addition, with large vertical fiscal imbalances, subnational governments have an incentive to borrow beyond socially optimal levels while shifting part of the cost of repayment onto others outside their jurisdictions.

[6] This includes Belgium, Finland, Greece, Ireland, Korea, Luxemburg, Netherlands, New Zealand, Norway, Spain, and the United Kingdom. Per capita public health spending growth was well below the OECD average in Sweden and Canada (at 3.6 percent), where public health spending is highly decentralized but dependence on central government financing is relatively low (below 30 percent).

[7] Other methods involve a "direct" approach, requiring a detailed record of bailout events (Dahlberg and Petterson (2003) on Swedish municipalities). Among "indirect" approaches, Rodden (2000) and Büttner and Wildasin (2006) analyze the change in government spending to unexpected revenue shocks in German and U.S. local governments, respectively. Subnational governments facing a negative revenue shock cut spending if they don't expect federal bailouts. Also Fink and Stratmann (2009) measure bailout expectations of German Länder based on differences in political power arising from over-representation in the upper chamber of parliament.

Figure 1. Annual Growth Rate of Real Public Health Spending per Capita, 1998–2007



Source: Authors' estimates based on OECD Health Data, 2009.

This paper empirically assesses the extent to which soft budget constraints increase subnational health spending. The main result is that the combination of large dependence on central government financing, and a high degree of borrowing autonomy, leads to higher subnational healthcare spending. While previous studies have examined the effect of soft budget constraints on the health sector of individual countries, no study has yet examined this issue at a cross-country level.[8] Bordignon and Turati (2009) look into the strategic interaction between the central and local governments to study bailouts of the health system in Italian regions between 1990 and 1999. They find that regional governments significantly increase healthcare spending in anticipation of higher ex-post central government funding. Also in Italy, Levaggi and Zanola (2003) focus on the consequences of bailout expectations for regional governments when deciding on healthcare spending levels. Another example is Kornai (2009), who documents bailout experiences in the health sector in Hungary.

The rest of the paper is organized as follows. Sections II provides an overview of the theory of soft budget constraints and its determinants. Section III describes the data used in the empirical analysis and the methods for estimation. Section IV presents the results. Section V concludes.

[8] A related study is that of Mosca (2007), which examines whether decentralization is a determinant of healthcare spending during the 1990s in a group of OECD countries.

II. Soft Budget Constraints

A. Theory

When the federal government is unable to commit credibly to a non-bailout policy, strategic behavior by subnational governments may follow, resulting in higher-than-optimal spending and suboptimal borrowing decisions. Inman (2003) analyzes the soft budget constraint problem as a sequential game. In the first stage, the federal government announces the amount of transfers to be allocated among subnational governments. In the second stage, subnational governments make their decisions with respect to spending and borrowing levels, taking into account the expectation of federal bailouts. In the final stage, the federal government decides whether or not to rescue a subnational government in case of financial distress. If the federal government finds it optimal to offer a bailout, then the subnational government may decide to choose unsustainable levels of spending and borrowing, leading eventually to a financial crisis.

A key ingredient of soft budget constraints is the inability of the federal government to bind its own action in the enforcement of fiscal discipline on the subnational government. Even if the federal government acknowledges that the situation of financial distress was caused by fiscal misbehavior at the subnational level, it nonetheless may be willing to provide a bailout. This leads to a time inconsistency problem.

The soft budget constraints literature has identified a number of reasons why the federal government might be willing to provide bailouts to subnational governments. Some of the arguments are: (i) negative spillovers on the rest of the economy in the absence of a bailout (Wildasin, 1997; Crivelli and Staal, 2006); (ii) federal governments care about the welfare of the citizens in the jurisdiction facing financial distress (Persson and Tabellini, 1999; Bordignon, and others, 2001); (iii) political benefits associated with providing a bailout (Rodden, and others, 2003); (iv) subnational governments cannot be made fully accountable for their spending decisions (von Hagen and others, 2000); (v) in case of default of one region, the cost of borrowing for all other regions in a federation could increase, such that all other regions may want to have the defaulting region bailed out (Ter-Minassian, 2007).

Soft budget constraints undermine the fiscal performance of subnational governments. Inman (2003) analyzes the driving forces through which subnational governments select spending and borrowing above efficient levels when facing soft budget constraints. Qian and Roland (1998) detail the implications for the optimal budget allocation between current spending and investment. They find that subnational governments facing soft budget constraints tend to overinvest. In this line of research, Careaga and Weingast (2000) and von Hagen and Dahlberg (2002) find that subnational governments may undertake nonviable projects or projects that are too risky in the expectation of federal bailouts. Goodspeed (2002) shows that subnational governments tend to overborrow in the expectation of federal bailouts.

B. Determinants of Soft Budget Constraints

The existence of large vertical fiscal imbalances (VFI) increases the probability of federal bailouts in light of subnational governments' limited ability to raise revenues in the event of a financial crisis. VFI is the gap between subnational governments' own revenue sources and their expenditure responsibilities that is filled by federal transfers. It is usually measured as the ratio of transfers to total subnational government revenue. Soft budget constraints are more likely when a high share of subnational spending is financed from the common pool of federal resources, since the jurisdiction is not fully responsible for the costs of the projects financed through transfers (Aizenman, 1998; Pisauro, 2001; Sanguinetti and Tommasi, 2004). Moreover, because it is difficult for the federal government to blame the local government for a financial crisis when it has limited ability to raise revenues, the federal government may feel compelled to step in and provide additional transfers (Rodden, 2005).

The coexistence of a high degree of subnational borrowing autonomy with large vertical fiscal imbalances undermines the effectiveness of markets as a disciplining device. At low levels of vertical fiscal imbalance, state and local governments are fully responsible for their spending commitments and, therefore, creditors will punish high indebtedness with higher interest rates as they see subnational governments' obligations as "sovereign." With large vertical fiscal imbalances, however, subnational governments have an incentive to borrow beyond socially optimal levels, while shifting part of the cost of repayment onto others outside the jurisdiction. For that reason, a wide range of strategies have been adopted to limit subnational borrowing autonomy, including numerical ceilings, specific purposes, administrative-type controls, or in some cases even prohibition (Ter-Minassian and Craig, 1997).

Discretion in the allocation of federal transfers is more likely to result in soft budget constraints. With discretion, transfers will tend to be allocated to those jurisdictions in financial distress or those with larger financing gaps (Rodden, and others, 2003). Discretional transfers leave the federal government a large degree of flexibility to direct resources to the jurisdictions with the greatest financial gaps. It thus may be difficult for the federal government to commit to not extend supplementary transfers when it has the discretion to do so, compared to a rules-based approach given by predetermined formulas. Subnational governments may feel they can spend beyond their means and ask for a federal bailout claiming that they did not get their fair share of transfers to begin with. Alternatively, discretional transfers could be allocated according to political considerations (Persson and Tabellini, 1994). Finally, when there are predetermined formulas allocating funds to subnational governments, these governments may engage in a bargaining process with the federal government to get a larger share of the pool (Velasco, 1999; Aizenman, 1992; and Mondino and others, 1996).

C. Bailout Expectations and Externalities

Bailout expectations by subnational governments may be especially high when the provision of local public goods entails spillover benefits to residents living outside of the jurisdiction. Wildasin (1997) concludes that central governments have less incentive to support local governments in financial distress when the costs of the crises are only borne by those residing within the boundaries of the local governments. Interventions become attractive from the viewpoint of the central government, which has the welfare of all citizens in mind, when public goods provided by the local government create spillovers outside its geographic boundary. Thus, the likelihood of central governments offering bailouts depends on the magnitude of the externalities associated with the local public good provision.

In case of financial distress, subnational governments may engage in strategic behavior by cutting the provision of local public goods with high spillover benefits, thereby making federal bailouts more likely. When local governments fall into a serious financial crises, they may strategically cut goods that provide spillover benefits to other jurisdictions. This is because they anticipate that when public goods with spillover benefits are underprovided, the central government is more likely to step in and provide additional funds.

Some areas of healthcare spending are characterized by large spillover benefits and have public good aspects. For example, immunization of local residents not only benefits local residents, but also those living outside of that jurisdiction. Other areas of healthcare spending with large spillovers (or with public good characteristics) include mass health information campaigns, communicable disease control, such as that for influenza, safe drinking water supply, maternal and child health, and sanitation (Akin, Hutchinson, and Strumpf, 2001).

Although other spending entitlements may also be characterized by spillover benefits, the provision of healthcare is more politically visible than other areas. Like health, some infrastructure spending is also characterized by spillovers, but not building or repaving a road is less likely to elicit public complaints than closing a hospital would. The consequences of this higher political visibility are reflected in policy choices in times of economic crisis. For example, examining welfare-state retrenchment in the United Kingdom in the Thatcher era, Pierson (1996) finds high retrenchments in pensions and housing, moderate retrenchments in sickness and disability benefits, and the lowest retrenchments in health care. Similarly, the Reagan government's cutbacks to the welfare state did not include significant cuts to the Medicare system in the United States.Under these circumstances, the central government may be more willing to provide a bailout when healthcare is at risk of underprovision. The fact that access to some basic level of healthcare is a constitutional right in many countries highlights the importance many societies place on health and, to some extent, creates the expectation of central government intervention if local governments fail to fulfill this obligation.

III. DATA

Our dataset includes annual data for twenty-five OECD members between 1990 and 2007. Data on healthcare spending, transfers, and revenues were collected from the OECD National Accounts IV.[9] Health expenditure is available for each applicable level of government (central, state, or local), excluding social security funds. At each level it includes expenses on medical and pharmaceutical products, appliances, and equipment; outpatient services; hospital services; public health services; R&D on health and other expenses such as general administration of health policy, provision of licensing, and dissemination of information. We converted health expenditure from local currency units into real 2007 U.S. dollars. Between 1990 and 2007, real subnational health expenditure per capita grew at an annual rate of 2½ percent in our sample.[10]

Figures 2 and 3 show the share of subnational health spending in 2006 as a percent of total health spending and as a percent of total public health spending. Figure 2 shows the importance of subnational health spending as a fraction of total health spending. Italy leads in this category with almost 80 percent of total health spending being accounted for by subnational governments. Figure 3 shows that Canada and Italy have highest ratios of subnational to total public spending. In contrast, subnational health spending in France, Luxembourg, and Ireland is very small. Data on the degree of healthcare spending autonomy at the subnational level does not exist, but, qualitatively, there is variation across countries in decisions about spending priorities among lower levels of government (Bankauskaite and Saltman, 2007; Vrangbaek, 2007).

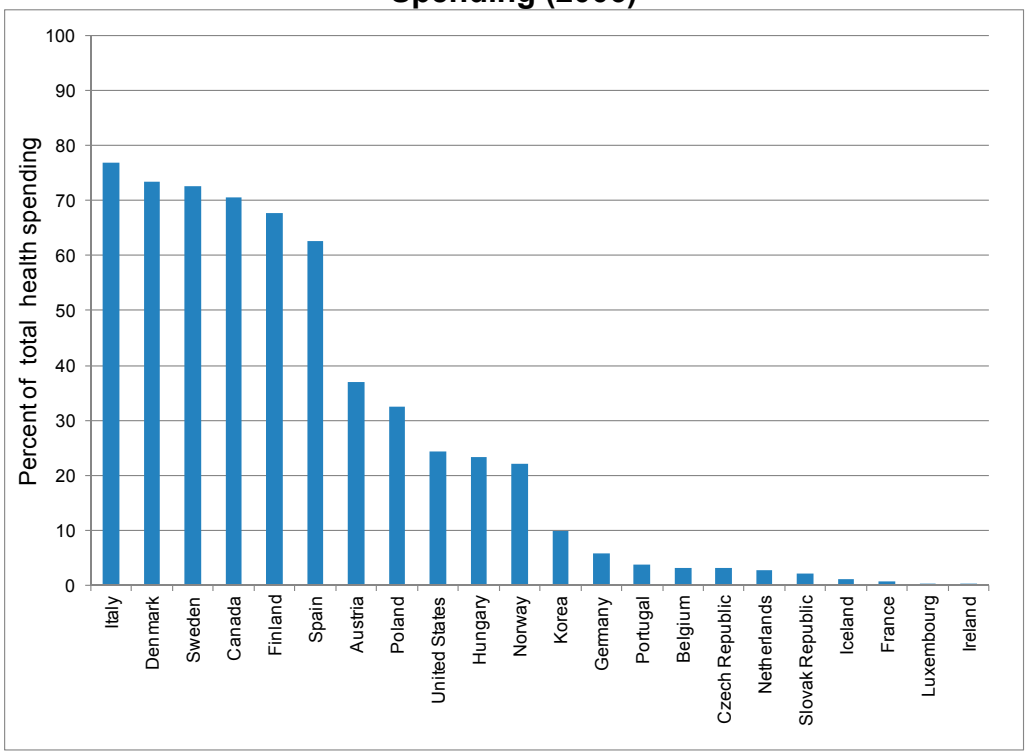
Following common practice, we define the vertical fiscal imbalance (VFI) as transfers from the central government to subnational governments as a share of total subnational revenues. Our measure of central government transfers includes all transfers, that is, earmarked and non-earmarked transfers.[11] Figure 4 presents the change in the VFI for state and local governments for our sample of countries between 1995 and 2007 and Figure 5 presents the average VFI over this period. With respect to VFI levels in 2007, in Finland, Iceland and the Netherlands, all subnational spending was due to funds that come as transfers from the central government; in Sweden and Austria, in contrast, it was less than 30 percent.

[9] Data for the United States was taken from the OECD Revenue Statistics.

[10] This growth rate was slightly below that of general government health spending for the same countries, which was 3.8 percent during this period.

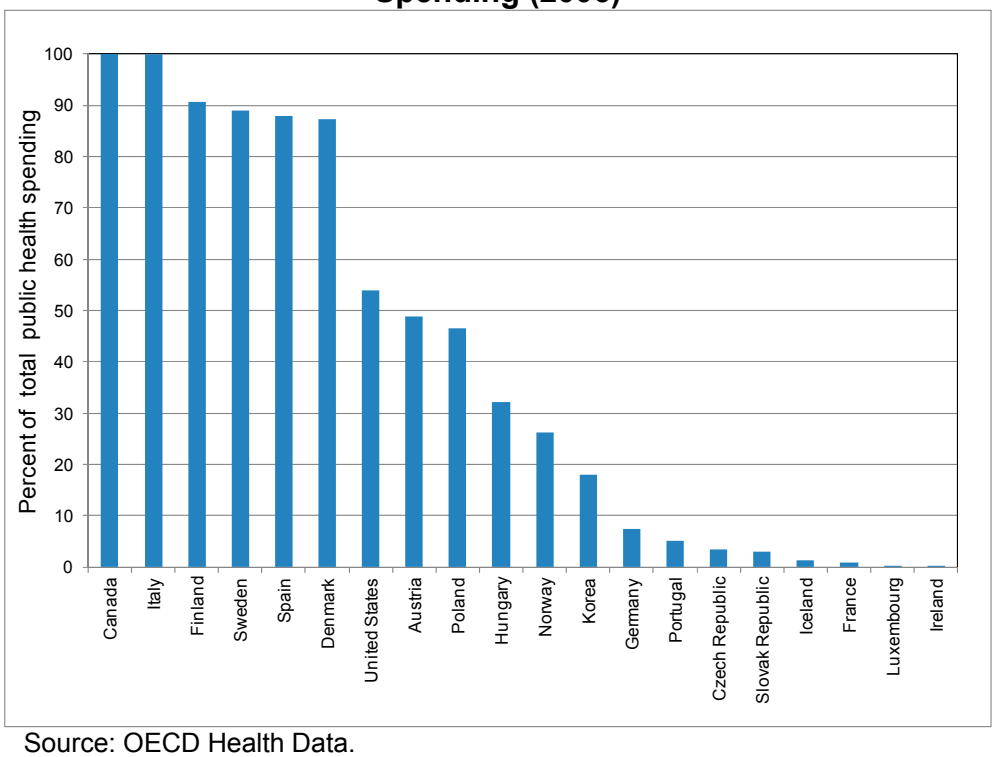
[11] Panel data on earmarked transfers for healthcare spending are not available. However, the results would not be qualitatively affected, since more dependence on earmarked transfers for health would presumably reduce the availability of transfers from general resources.

Figure 2. Local and State Health Spending as a Percentage of Total Health Spending (2006)



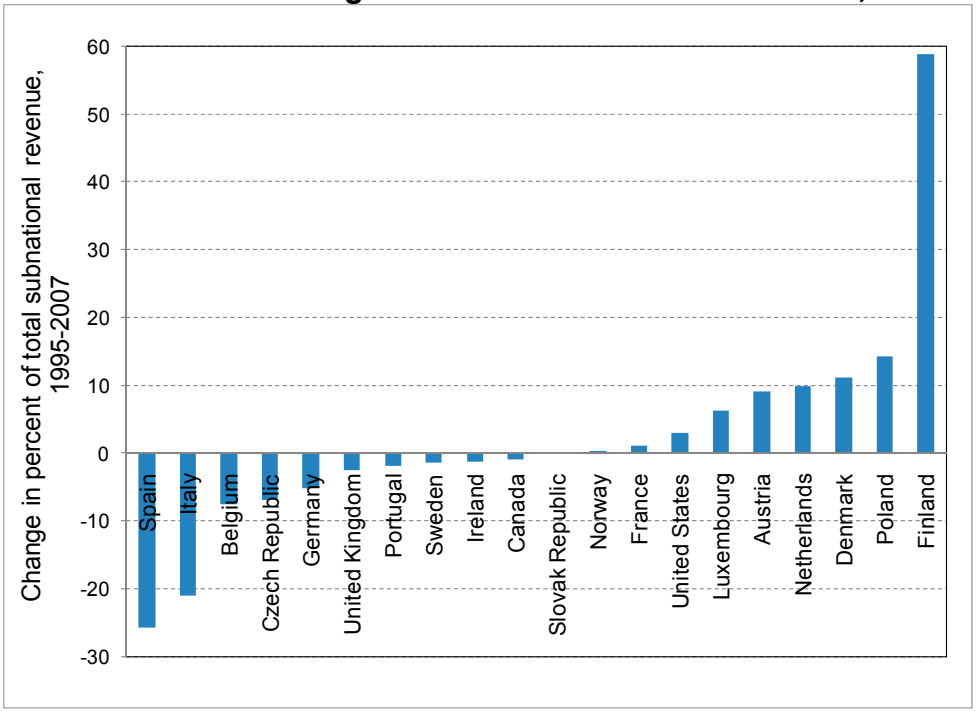
Source: OECD Health Data.

Figure 3 Local and State Health Spending as a Percentage of Public Health Spending (2006)



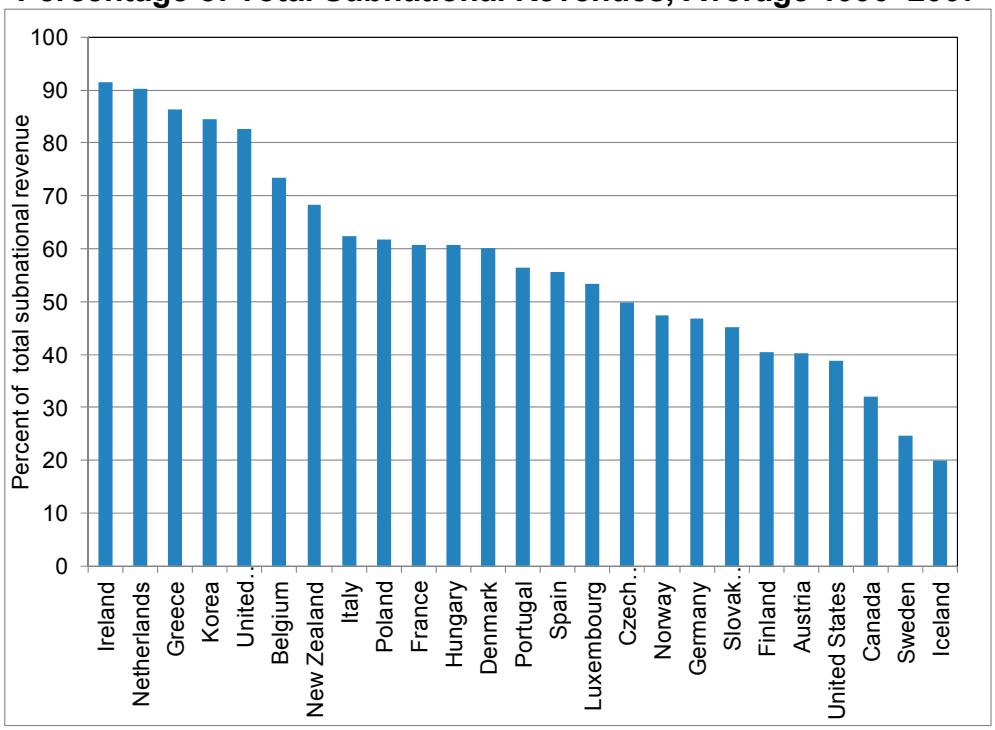
Source: OECD Health Data.

Figure 4. Change in Transfers from Central Government to Subnational Government as a Percentage of Total Subnational Revenues, 1995–2007



Source: OECD National Accounts.

Figure 5. Transfers from Central Government to Subnational Government as a Percentage of Total Subnational Revenues, Average 1990–2007



Source: OECD National Accounts.

Since there is no single accepted measurement of borrowing autonomy, we use two different sources. We constructed one of those measures. Specifically, we generated a borrowing index that measures six components of borrowing regulations:

- *Domestic borrowing prohibition:* subnational governments are not allowed to borrow.
- *International borrowing prohibition:* subnational governments are not allowed to borrow in foreign markets or in foreign currency-denominated debt.
- *Limits on government debt:* An explicit limit on the overall level of indebtedness by individual subnational governments, for example, not to exceed 30 percent of total revenue.
- *Limits on debt service:* New borrowing is permitted up to a level consistent with a maximum allowed debt service ratio. For example, regions in Italy may borrow domestically only if debt service does not exceed 25 percent of regional own revenue.[12]
- *Limits on borrowing for specific purposes*: Borrowing is allowed only for specified purposes, typically investment projects.
- *Requirements of prior approval from higher levels of government:* Implies the review and authorization of individual borrowing operations (including approval of the terms and conditions of the operation).

We constructed this index based on OECD questionnaires sent to senior budget and tax officials in the period 1999–2005 (Sutherland, Price, and Joumard, 2005). For this, we also draw on the information contained in Ter-Minassian and Craig (1997). In the regression results, we refer to this data as "CLS borrowing autonomy data." Our second measure of borrowing autonomy is obtained from the OECD's Fiscal Federalism Network and is based on eight components, which are similar as those listed above.

For each of the six components of our index, we assign a value of 1 if the country does not have the rule and 0 if the country has such a rule in force. We create a variable that is equal to the sum of all six components: a zero corresponds to no borrowing autonomy and a six represents complete autonomy over borrowing decisions. Clearly, if only the first two components are binding, that is if subnational governments are not allowed to borrow either domestically or internationally, the borrowing autonomy index for this country takes also a value of zero. We scale this index and the OECD index to range from 0 to 1. Both measures of borrowing autonomy do not vary over time within countries.

[12] Net of health contributions and the Common Fund.

Lastly, we obtained our other control variables—GDP per capita, the population share over age 65, and tertiary education enrollment rates—from the World Bank's World Development Indicators database. These variables are often considered determinants of health expenditure (Gerdtham and Jonsson, 2000) and may be correlated with transfers, revenue, and borrowing autonomy. Descriptive statistics are presented in Appendix Table 1.

IV. METHODS

We use a combination of the vertical fiscal imbalance and subnational government borrowing autonomy to measure the softness of the budget constraint. If lower levels of government are more dependent on central government transfers than their own revenues to finance expenditures, the possibility for a bailout from the central government appears more likely. A higher vertical fiscal imbalance is not a sufficient condition for bailout expectations, however. We test the hypothesis that subnational governments whose revenues comprise mostly transfers *and* that have a greater degree of borrowing autonomy face a softer budget constraint than those with the same vertical fiscal imbalance, but more restrictions on borrowing.

To test how such institutional factors affect public health spending, we run an OLS regression that takes the following form:

$$y_{it} = \beta_1 VFI_{it} + \beta_2 VFI_{it} \times Borrow_i + \mathbf{X}_{it}\delta + \mu_i + \rho_t + \varepsilon_{it} \quad (1)$$

where y_{it} is the log of real subnational government health expenditure per capita in country i at time t; VFI_{it} is the vertical fiscal imbalance; $Borrow_i$ is the cross-sectional linear index of borrowing autonomy; $\mathbf{X}_{it}\delta$ is a vector of control variables; μ_i denotes a country-specific effect; ρ_t denotes year-specific factors that are common across countries.

We have no priors on the sign of the coefficient on VFI. This is because, in principle, vertical fiscal imbalance should only affect subnational fiscal performance in general, and health spending, in particular, only at high levels of borrowing autonomy. Subnational fiscal indiscipline should be most pronounced in cases where VFI and borrowing autonomy are both high. At low levels of VFI and high levels of borrowing autonomy, voters and creditors view subnational obligations as "sovereign," and face incentives to keep local governments on a tight leash. Creditors punish profligacy with higher interest rates, and voters, knowing that the costs ultimately fall on them, punish politicians at the polls. In addition, when borrowing autonomy is low, subnational governments are not allowed to run deficits, notwithstanding the degree of dependence on the central government's financing.

The coefficient of interest is β_2, which we predict to be positive given the hypothesis that the combination of greater borrowing autonomy and greater reliance on transfers increases spending. We do not include the variable $Borrow_i$ by itself because it is time-invariant and country fixed-effects are included in the regressions.

Our measure of borrowing autonomy gives equal weight to each component. This index is admittedly an imperfect measure of borrowing autonomy and may not capture other important elements of the restrictions sub-national governments face in borrowing. We therefore also construct a dummy variable equal to 1 if the country's borrowing index is at least three-quarters of the highest possible score and zero otherwise. This corresponds to the median value of borrowing autonomy in our dataset. It seems reasonable that countries that have the fewest restrictions should have more borrowing autonomy than those with more restrictions. This dummy variable also allows for non-linearity in the effect of borrowing autonomy on health expenditure. In this case, in equation (1) the $Borrow_i$ variable is the borrowing autonomy dummy variable described above.

One might argue that borrowing autonomy is endogenous to health spending. For example, in response to higher health spending, countries may have restricted borrowing autonomy by lower levels of government. To the extent this occurred, this would bias the coefficient estimates on our soft budget constraint variables downward. Thus, any effect we find could be interpreted as a lower bound of the impact of soft budget constraints in this setting. We also test whether the effects of the institutional factors described above are greater for health expenditure than for other spending areas by running these regressions with the health expenditure share of total sub-national spending as the dependent variable.

It is possible that regulations changed the responsibility of spending between the federal and subnational levels of government during the time period we consider. Unfortunately, the data are not available to test how this might impact the results; however, the results are robust to dropping any one country from the regression.

V. RESULTS

Table 1 presents our results of the regressions of subnational health expenditure levels. Panel A displays the results using the dummy variable for high borrowing autonomy. As mentioned in the previous section, this variable equals 1 if the country's borrowing index is at least three-quarters of the highest possible score and zero otherwise. Panel B lists the results using the linear borrowing autonomy index. Regressions in both panels include our control variables for demographics, education and per capita income, but we list the coefficients only in Panel A, and omit them from panel B since the coefficients on these control variables are very similar across the regressions in both panels.

Table 1. Log Subnational Public Health Expenditure per Capita

A. Borrowing autonomy measure: Dummy variable for highest quarter of index

	OECD Borrowing autonomy data			CLS Borrowing autonomy data		
	(1)	(2)	(3)	(4)	(5)	(6)
VFI	0.081	-0.465**	-0.852***	0.081	-0.253	-0.027
	(0.39)	(-2.46)	(-3.60)	(0.39)	(-1.04)	(-0.11)
VFI x high borrowing autonomy		-0.063	0.761***		4.439**	4.499***
		(-0.41)	(4.11)		(2.35)	(2.88)
% population 65+			23.243***			26.847**
			(4.19)			(2.55)
Log GDP per capita			0.982***			-0.336
			(3.66)			(-0.34)
Tertiary education enrollment rate			0.486			0.755**
			(1.16)			(2.11)
Observations	299	171	153	299	272	248
Within R-squared	0.07	0.64	0.71	0.07	0.12	0.15
Overall R-squared	0.90	0.99	0.99	0.90	0.89	0.89

B. Borrowing autonomy measure: Linear index

	OECD Borrowing autonomy data			CLS Borrowing autonomy data		
	(1)	(2)	(3)	(4)	(5)	(6)
VFI	0.081	-0.511**	-1.570***	0.081	-4.044**	-2.211
	(0.39)	(-2.31)	(-4.99)	(0.39)	(-2.27)	(-1.50)
VFI x borrowing autonomy		0.028	2.007***		6.271**	4.006*
		(0.10)	(4.90)		(2.37)	(1.78)
Controls	No	No	Yes	No	No	Yes
Observations	299	171	153	299	272	248
Within R-squared	0.07	0.64	0.72	0.07	0.10	0.12
Overall R-squared	0.90	0.99	0.99	0.90	0.89	0.89

Source: Authors' calculations.

Note: *t* statistics in parentheses calculated using robust standard errors. Regressions also include country and year effects and a constant. * p<0.1, ** p<0.05, *** p<0.01.

Table 1, Panel A shows that nearly all the coefficient estimates on the interaction of the vertical fiscal imbalance with the high borrowing autonomy indicator variable are positive and statistically significant. This indicates that an increase in the vertical fiscal imbalance increases health spending more in countries with high borrowing autonomy than in countries with low borrowing autonomy. For example, a one percentage point increase in the vertical fiscal imbalance translates into a 4.5 percent greater increase in annual subnational health spending per capita for countries where subnational governments have high borrowing autonomy relative to those with less (Table 1, Panel A, Column 6).[13,14]

When we interact the linear index with VFI (Table 1, Panel B), nearly all coefficients have the predicted positive sign and are statistically significant. These findings support our findings in Table 1, Panel A, namely that a softer budget constraint leads to more health spending. Specifically, the point estimate on the interaction in Table 1, Panel B, Column 6 suggests that a one percentage point increase in the vertical fiscal imbalance increases public health spending by 0.04 percent when the borrowing index increases by one percentage point. In our data, the borrowing index ranges from 0.33 (which represents having four of the six constraints) to 1 (corresponding to having none of the six constraints). So if the borrowing autonomy index increases by 0.66 (equivalent to going from having four constraints to zero), then a one percentage point increase in the VFI leads to 2.6 percent higher health spending per capita. This estimate is about half the magnitude of the 4.5 percent spending increase from Panel A, which suggests that the interaction effect of borrowing autonomy and VFI is non-linear. Spending increases proportionally more for countries that give subnational governments greater borrowing authority.

The economic size of the coefficient estimates of the soft budget constraint variables is large. For example, assume there is an increase in the vertical fiscal imbalance by 5 percentage points, which roughly corresponds to moving from Norway's level to Portugal's level in 2007. Based on the coefficient estimate of the interaction of VFI and borrowing autonomy from Table 1, Column 6, Panel A, a 5 percentage point increase in the VFI corresponds to an increase of 22.5 percent in subnational public health spending in high borrowing autonomy countries relative to low borrowing autonomy countries.[15] If average subnational health spending is 2 percent of GDP, on average, this would represent an increase of over 0.4 percent of GDP.

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[13] The coefficient estimates of VFI and the soft budget constraint variable in Table 1, Panel A, Column 6 are jointly significant at the 1 percent level.

[14] We also experimented with specifications that included levels and interactions of the timing of the Maastricht treaty. The coefficient estimates on our soft budget constraint variable remained stable. However, the results on the effect of Maastricht were inconclusive.

[15] 4.49 multiplied by 5 is roughly 22.5.

A second description of the magnitude of the same coefficient estimate (Table 1, Column 6, Panel A) is in relation to the variance of public health spending over time. Average public subnational health spending is $875 per capita in our sample and the average within-country standard deviation is $354. Therefore, the coefficient estimates of 4.49 on the VFI and borrowing autonomy interaction implies an increase of 0.11 standard deviations in public health spending.[16] The results are qualitatively similar using the OECD borrowing autonomy measure instead, but the magnitudes of the coefficient estimates are slightly smaller.

Table 2 presents the results for sub-national public health spending as a share of total sub-national spending. We find that a 10 percentage point increase in the VFI translates into a 1.9 percentage point increase in the health share of total public spending in countries with a high degree of borrowing autonomy relative to others (Table 2, Panel A, Column 6). This suggests health spending, as opposed to the sum of the remaining spending categories, is especially sensitive to soft budget constraints.

In Panel B of Table 2 the effect of borrowing autonomy using the linear index is less robust, but all of the estimated four coefficients on the VFI×borrowing autonomy interaction have the predicted positive sign. Again, as in the previous table, this result suggests that the effect of the borrowing index is non-linear.

These results hold for local public health spending per capita as well (Appendix Tables 2–3). For example, the coefficient estimates on the interaction of VFI and borrowing autonomy are generally positive and statistically significant.

[16] Average subnational health spending in our sample is $875. Therefore, $39 or 4.49 percent of average subnational health spending amounts to 11 percent of the within-country standard deviation of $354.

Table 2. Subnational Public Health Expenditure as Percent of Total Subnational Expenditure

A. Borrowing autonomy measure: Dummy variable for highest quarter of index

	OECD Borrowing autonomy data			CLS Borrowing autonomy data		
	(1)	(2)	(3)	(4)	(5)	(6)
VFI	0.003	-0.011	-0.092***	0.003	-0.019	-0.011
	(0.23)	(-0.47)	(-2.89)	(0.23)	(-1.22)	(-0.64)
VFI x high borrowing autonomy		0.010	0.081***		0.225**	0.193**
		(0.80)	(3.50)		(2.05)	(2.26)
% population 65+			2.768***			1.662**
			(3.83)			(2.52)
Log GDP per capita			-0.063**			-0.092*
			(-2.28)			(-1.71)
Tertiary education enrollment			0.120***			0.023
			(2.68)			(0.91)
Observations	311	171	153	311	281	257
Within R-squared	0.03	0.04	0.25	0.03	0.07	0.19
Overall R-squared	0.93	0.96	0.96	0.93	0.92	0.93

B. Borrowing autonomy measure: Linear index

	OECD Borrowing autonomy data			CLS Borrowing autonomy data		
	(1)	(2)	(3)	(4)	(5)	(6)
VFI	0.003	-0.021	-0.160***	0.003	-0.225**	-0.048
	(0.23)	(-0.77)	(-3.52)	(0.23)	(-2.18)	(-0.54)
VFI x borrowing autonomy		0.029	0.198***		0.339**	0.088
		(1.07)	(3.61)		(2.27)	(0.72)
Controls	No	No	Yes	No	No	Yes
Observations	311	171	153	311	281	257
Within R-squared	0.03	0.05	0.27	0.03	0.05	0.16
Overall R-squared	0.93	0.96	0.96	0.93	0.92	0.92

Source: Authors' calculations.

Note: *t* statistics in parentheses calculated using robust standard errors. Regressions also include country and year effects and a constant. * p<0.1, ** p<0.05, *** p<0.01.

VI. CONCLUSIONS

Government health spending has steadily grown over the last four decades in OECD countries, accompanied by increased decentralization in healthcare provision. Much of this spending, however, has been financed by the central government. As a result, large vertical fiscal imbalances—dependence on central government transfers—have emerged in many cases. Theory predicts that the combination of this dependence with high borrowing autonomy by state and local governments leads to soft budget constraints, which we define as the expectation of central government bailouts.

Our empirical results suggest that soft budget constraints have partly contributed to the rapid rise of health care spending. High vertical fiscal imbalances, combined with weak borrowing restrictions, increases subnational health spending. Our estimates imply that a one percentage point increase in the vertical fiscal imbalance translates into a 4.5 percent greater increase in annual subnational health spending per capita for countries where subnational governments have high borrowing autonomy relative to those with less.

The empirical results reported above warrant, albeit indirectly, a word of caution on the appropriate pace of reform in countries where healthcare provision is highly decentralized. Reforms oriented at effectively containing government health spending growth should be accompanied by efforts to tightening budget constraints, which concerns both fiscal transfers among levels of governments and subnational borrowing autonomy.

Additional research will be required to assess the welfare effects of these rapid increases in spending associated with decentralization. While we find that health spending is lower when subnational governments face harder budget constraints, our results are not informative regarding conclusions whether the reduced expenditures are welfare enhancing or reducing. Determining what areas of health spending are cut when budget constraints tighten and measuring the productivity of this spending is an important topic for future research.

Appendix Table 1. Descriptive Statistics of Dataset

Variable	Mean	S.D.	Min	Max
Log Public health expenditure per capita (subnational)	5.37	2.08	-0.30	8.28
Log Public health expenditure per capita (local)	4.71	2.10	-0.30	8.28
Health expenditure share of total government expenditure (subnational)	0.14	0.14	0.00	0.48
Health expenditure share of total government expenditure (local)	0.12	0.14	0.00	0.48
VFI (subnational)	0.58	0.25	0.10	1.00
VFI (local)	0.58	0.25	0.10	1.00
Borrowing autonomy (CLS)	0.76	0.15	0.33	1.00
Borrowing autonomy (OECD)	0.56	0.26	0.13	1.00
Log GDP per capita	9.90	0.76	7.34	11.62
Percent of the population age 65 and older	0.14	0.03	0.05	0.20
Tertiary education enrollment rate	0.50	0.20	0.07	0.96

Source: Authors' calculations.

Appendix Table 2. Log Local Public Health Expenditure per Capita

A. Borrowing autonomy measure: Dummy variable for highest quarter of index

	OECD Borrowing autonomy data			CLS Borrowing autonomy data		
	(1)	(2)	(3)	(4)	(5)	(6)
VFI	0.572**	0.198	-0.368	0.572**	0.155	0.113
	(2.08)	(0.84)	(-1.30)	(2.08)	(0.52)	(0.33)
VFI x high borrowing autonomy		0.833	1.773***		4.688**	4.507***
		(1.55)	(2.64)		(2.23)	(2.91)
% population 65+			22.710***			30.697**
			(4.16)			(2.47)
Log GDP per capita			0.898***			-0.360
			(3.37)			(-0.36)
Tertiary education enrollment			1.046**			1.301**
			(2.40)			(2.40)
Observations	281	171	153	281	254	230
Within R-squared	0.05	0.56	0.65	0.05	0.11	0.16
Overall R-squared	0.90	0.99	0.99	0.90	0.90	0.90

B. Borrowing autonomy measure: Linear index

	OECD Borrowing autonomy data			CLS Borrowing autonomy data		
	(1)	(2)	(3)	(4)	(5)	(6)
VFI	0.572**	-0.299	-1.791***	0.572**	-3.265*	-0.749
	(2.08)	(-1.53)	(-5.19)	(2.08)	(-1.92)	(-0.45)
VFI x borrowing autonomy		1.129**	3.631***		5.790**	2.180
		(2.37)	(5.10)		(2.27)	(0.87)
Controls	No	No	Yes	No	No	Yes
Observations	269	164	146	269	242	218
Within R-squared	0.05	0.56	0.68	0.05	0.08	0.12
Overall R-squared	0.90	0.99	0.99	0.90	0.90	0.90

Source: Authors' calculations.

Note: *t* statistics in parentheses calculated using robust standard errors. Regressions also include country and year effects and a constant. * p<0.1, ** p<0.05, *** p<0.01.

Appendix Table 3. Local Public Health Expenditure as Percent of Total Local Expenditure

A. Borrowing autonomy measure: Dummy variable for highest quarter of index

	OECD Borrowing autonomy data			CLS Borrowing autonomy data		
	(1)	(2)	(3)	(4)	(5)	(6)
VFI	0.021	0.070***	-0.005	0.021	-0.006	0.007
	(1.57)	(3.24)	(-0.18)	(1.57)	(-0.36)	(0.33)
VFI x high borrowing autonomy		0.102*	0.194***		0.223*	0.156*
		(1.80)	(2.78)		(1.85)	(1.95)
% population 65+			2.421***			1.945***
			(3.59)			(2.67)
Log GDP per capita			-0.068***			-0.100*
			(-2.73)			(-1.78)
Tertiary education enrollment rate			0.153***			0.085***
			(3.61)			(2.63)
Observations	293	171	153	293	263	239
Within R-squared	0.05	0.10	0.32	0.05	0.09	0.23
Overall R-squared	0.93	0.96	0.97	0.93	0.93	0.93

B. Borrowing autonomy measure: Linear index

	OECD Borrowing autonomy data			CLS Borrowing autonomy data		
	(1)	(2)	(3)	(4)	(5)	(6)
VFI	0.021	0.040***	-0.119***	0.021	-0.160	0.098
	(1.57)	(3.20)	(-2.75)	(1.57)	(-1.62)	(1.13)
VFI x borrowing autonomy		0.052	0.277***		0.263*	-0.106
		(1.45)	(3.38)		(1.85)	(-0.89)
Controls	No	No	Yes	No	No	Yes
Observations	293	171	153	293	263	239
Within R-squared	0.05	0.09	0.33	0.05	0.07	0.22
Overall R-squared	0.93	0.96	0.97	0.93	0.93	0.93

Source: Authors' calculations.

Note: *t* statistics in parentheses calculated using robust standard errors. Regressions also include country and year effects and a constant. * p<0.1, ** p<0.05, *** p<0.0.

References

Aizenman, J., 1992, "Competitive Externalities and the Optimal Seignorage," *Journal of Money, Credit and Banking* 24: pp. 61–71.

Aizenman, J., 1998, "Fiscal Discipline in a Union," in Sturzenegger, F. and M. Tomassi (eds.), *The Political Economy of Reform* (Boston: MIT Press).

Akin, J., P. Hutchinson, and K. Strumpf, 2001, "Decentralization and Government Provision of Public Goods: The Public Health Sector in Uganda," Measure Evaluation, Working Paper 01/35, pp. 1–35.

Azfar, O., S. Kähkönen, and P. Meagher, 2001, "Conditions for Effective Decentralized Governance: a Synthesis of Research Findings," IRIS Center Working Paper, University of Maryland.

Bankauskaite, V., and R. Saltman, 2007, "Central Issues in the Decentralization Debate," in Saltman, R., V. Bankauskaite, and K. Vrangbaek (eds.), *Decentralization in Health Care: Strategies and Outcomes* (Berkshire, U.K., Open University Press), pp. 9–21.

Besfamille, M., and B. Lockwood, 2008, "Bailouts in Federations: Is A Hard Budget Constraint Always Best?," *International Economic Review*, Vol. 49 (May), pp. 577–93.

Bordignon, M., P. Manasse, and G. Tabellini, 2001, "Optimal Regional Redistribution under Asymmetric Information," *American Economic Review*, Vol. 91 (June), pp.709–23.

Bordignon, M., and G. Turati, 2009, "Bailing Out Expectations and Public Health Expenditure," *Journal of Health Economics*, Vol. 28, pp. 305–21.

Buttner, T., and D. Wildasin, 2006, "The Dynamics of Municipal Fiscal Adjustment," *Journal of Public Economics*, Vol. 90, 1115–32.

Careaga, M., and B. Weingast, 2000, "The Fiscal Pact with the Devil: A Positive Approach to Fiscal Federalism, Revenue Sharing, and Good Governance," Working Paper, Stanford University.

Crivelli, E., and K. Staal, 2006, "Size, Spillovers, and Soft Budget Constraints," CESifo Working Paper 1858.

Dahlberg, M., and P. Petterson-Lidbom, 2003, "An Empirical Approach for Evaluating Soft Budget Constraints," Working Paper 28, Uppsala University.

Dewatripont, M., and E. Maskin, 1995, "Credit and Efficiency in Centralized and Decentralized Economies," *Review of Economic Studies*, Vol. 62, pp. 541–55.

Fink, A., and T. Stratmann, 2009, "Institutionalized Bailouts and Fiscal Policy: The Consequences of Soft Budget Constraints," CESifo Working Paper Series No. 2827, Muenchen.

Gerdtham, U-G., and B. Jonsson, 2000, "International Comparisons of Health Expenditure: Theory, Data, and Econometric Analysis," in Culyer, A. and J. Newhouse, *Handbook of Health Economics* (Amsterdam: Elsevier).

Goodspeed, T., 2002, "Bailouts in a Federation," *International Tax and Public Finance*, Vol. 9, pp. 409–21.

Inman, R., 2003, "Transfers and Bailouts: Enforcing Local Fiscal Discipline with Lessons from US Federalism," in Rodden, J., G. Eskelund and J. Litvack (eds.), *Fiscal Descentralization and the Challenge of Hard Budget Constraints* (Cambridge, Massachusetts: MIT Press).

Kornai, J., 1979, "Resource-Constrained Versus Demand-Constrained Systems," *Econometrica*, Vol.47, pp. 801–19.

Kornai, J., E. Maskin, and G. Roland, 2003, "Understanding the Soft Budget Constraint," *Journal of Economic Literature*, Vol. 41(December): pp. 1095–136.

Kornai, J., 2009, "The Soft Budget Constraint Syndrome in the Hospital Sector," *International Journal of Health Care Finance Economics*, Vol. 9, pp. 117–35.

Letelier, L., 2005, "Explaining fiscal decentralization," *Public Finance Review* 33, pp. 155–183.

Levaggi, R., and R. Zanola, 2003, "Flypaper Effect and Sluggishness: Evidence from Regional Health Expenditures in Italy," *International Tax and Public Finance*, Vol. 10, pp. 535–47.

Maskin, E., 1999, "Recent Theoretical Work on the Soft Budget Constraint," *American Economic Review*, Vol. 89 (March), pp. 421–25.

Mondino, G., F. Sturzenegger, and M. Tommasi, 1996, "Recurrent High Inflation and Stabilization: a Dynamic Game," *International Economic* Review, Vol. 37, pp. 981–96.

Mosca, I., 2007, "Decentralization as a determinant of Health Care Expenditure: Empirical Analysis for OECD countries," *Applied Economic Letters*, Vol. 14 (June), pp. 515–55.

Oates, W., 1999, "An Essay on Fiscal Federalism," *Journal of Economic Literature*, Vol. 37 (September), p. 1120-49.

Persson, T., and G. Tabellini, 1994, "Does Centralization Increase the Size of Government?" *European Economic Review*, Vol. 38, pp. 765–73.

Persson, T., and G. Tabellini, 1999, "Political Economics and Public Finance," in Auerbach, A. and M. Feldstein (eds.), *Handbook of Public Economics*, Vol. III., (Amsterdam: North-Holland).

Pierson, P., 1996, "The New Politics of the Welfare State," *World Politics*, Vol. 48 (January), pp. 143.

Pisauro, G., 2001, "Intergovernmental Relations and Fiscal Discipline: Between Commons and Soft Budget Constraints," IMF Working Paper 01/65 (Washington: International Monetary Fund).

Qian, Y., and G. Roland, 1998, "Federalism and the soft Budget Constraint," *American Economic Review*, Vol. 88 (December), pp. 1141–62.

Rodden, J., 2000, "Breaking the Golden Rule: Fiscal Behavior with Rational Bailout Expectations in the German States," mimeo, MIT.

Rodden, J., 2002, "The Dilemma of Fiscal Federalism: Grants and Fiscal Performance around the World," *American Journal of Political Science*, Vol. 46 (July), pp. 670–87.

Rodden, J., G. Eskeland, and J. Litvack, eds., 2003, *Fiscal Descentralization and the Challenge of Hard Budget Constraints*, (Cambridge, Massachusetts: MIT Press).

Rodden, J., 2005, "Achieving Fiscal Discipline in Federations," in Wierts, P. (ed.), *Fiscal Policy Surveillance in Europe* (Cheltenham, U.K., Edward Elgar).

Sanguinetti, P., and M. Tommasi, 2004, "Intergovernmental Transfers and Fiscal Behavior: Insurance versus Aggregate Discipline," *Journal of International Economics*, Vol. 62 (January), pp. 149–70.

Smith, S., J. Newhouse, and M. Freeland, 2009, "Income, Insurance, and Technology: Why Does Health Spending Outpace Economic Growth?" *Health Affairs* 28 (October), pp. 1276–84.

Sutherland, D., R. Price, and I. Joumard, 2005, "Fiscal Rules for Sub-central Governments: Design and Impact," OECD Economics Department Working Papers, No. 465. Paris.

Tediosi, F., S. Gabriele, and F. Longo, 2009, "Governing Decentralization in Health Care under Tough Budget Constraint: What Can We Learn from the Italian Experience?" *Health Policy* 90 (May), pp. 303–12.

Ter-Minassian, T., and J. Craig, 1997, "Control of Subnational Borrowing," in Ter-Minassian, T. (ed*.), Fiscal Federalism in Theory and Practice* (Washington: International Monetary Fund).

Ter-Minassian, T., 2007, "Fiscal Rules for Subnational Governments: Can They Promote Fiscal Discipline?" *OECD Journal on Budgeting* 6 (March).

Velasco, A., 1999, "A Model of Endogenous Fiscal Deficits and Delayed Fiscal Reforms," in Poterba, J. and J. von Hagen (eds.), *Fiscal Institutions and Fiscal Performance* (Chicago: University of Chicago Press).

von Hagen, J., Dahlberg, M., 2002, "Swedish Local Government: Is There A Bailout Problem?" Prepared fort he project on Fiscal Federalism in Sweden, Center for Business and Policy Studies.

von Hagen, J., and others, 2000, "Subnational Government Bailouts in OECD Countries: Four Case Studies," Inter-American Development Bank, Research Network Working Paper R-399.

Vrangbaek, K., 2007, "Towards a Typology for Decentralization in Health Care," in Saltman, R, V. Bankauskaite, and K. Vrangbaek (eds.), 2007, *Decentralization in Health Care* (Maidenhead: MacGraw-Hill), pp.44–62.

Wildasin, D., 1997, "Externalities and Bailouts: Hard and Soft Budget Constraints in Intergovernmental Fiscal Relations," mimeo, Vanderbilt University.