

FISCAL DECENTRALIZATION AND THE BUSINESS CYCLE: AN EMPIRICAL STUDY OF SEVEN FEDERATIONS

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Although fiscal policies of central governments sometimes provide modest insurance against regional income shocks, this paper shows that procyclical fiscal policy among provincial governments can easily overwhelm these stabilizing effects. We examine the cyclicity of budget items among provincial governments in seven federations, showing that own-source taxes are generally highly procyclical, and contrary to common wisdom, revenue sharing and discretionary transfers are either acyclical or procyclical. Constituent governments are thus left alone to smooth their own shocks, and we document the extent to which various restraints on borrowing and saving undermine their ability to do so. The resulting procyclicality of provincial fiscal policy is likely to have important implications in a world where demands for countercyclical fiscal policy are increasing but considerable fiscal responsibilities are being devolved to subnational governments.

1. INTRODUCTION

THE 2008 economic downturn in the United States has been accompanied by a pattern that has become quite familiar: state and local governments are cutting a wide range of expenditures, abandoning infrastructure projects, and shedding social workers, teachers, and police officers as they scramble to balance their budgets. While the federal government justifies large national deficits with the logic of countercyclical Keynesian demand management, state governments undermine the potential stimulus with tax increases and expenditure cuts. As in the 2003 recession, states are demanding ad hoc federal assistance to help them balance operating budgets. Only a few years earlier, the states were rapidly expanding their expenditures in conjunction with rapid economic growth.

Similar stories are often told about Latin American countries, many of which have been decentralizing basic health and social expenditures in recent decades. The cyclicity of expenditures in multitiered fiscal systems is a key policy issue in the European Union (EU) as well, where health and social expenditures are also being decentralized. While national automatic stabilizers might help smooth taxes, consumption, and output over the business cycle, there are strong reasons to expect subnational fiscal policy to pull in

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the opposite direction, especially as central governments clamp down on independent borrowing by subnational governments as part of efforts to abide by the Stability and Growth Pact. Existing comparative empirical research emphasizes the role of national tax-transfer systems in cushioning asymmetric regional shocks, but little is known about the cyclicity of subnational fiscal policy.

As central governments around the world assemble massive fiscal stimulus packages in response to a global downturn, this paper sets out to fill a rather large hole in the literature by providing basic facts about the fiscal policies of subnational governments. Are procyclical state or provincial expenditures the norm in federations? Are there systematic cross-national differences in the fiscal behavior of subnational governments with respect to the business cycle, and if so, how can they be explained? To what degree do intergovernmental grants from higher-level governments serve as a stabilizing mechanism for subnational budgets? Do subnational governments run surpluses and access credit markets in order to smooth expenditures over the business cycle? We analyze the sensitivity of provincial government budgets to regional business cycles in seven federations: Argentina, Australia, Brazil, Canada, Germany, India, and the United States. Although a handful of case studies examine the cyclicity of various components of provincial budgets in individual countries, diverse methodologies and inattention to results from other cases limit what is known about the cyclical characteristics of subnational public finance from a comparative perspective. To our knowledge, this is the first broad comparative study of the relationship between regional business cycles and fiscal outcomes. We have chosen these cases primarily because of the availability of high-quality provincial-level data with sufficiently long time series, but they are useful cases for comparative analysis because they are among the world's most decentralized multitiered systems, and because they exhibit analytically useful institutional variation.

Above all, we confirm that expenditures of constituent units in federations are indeed procyclical in most federations, yet we also demonstrate interesting cross-national variations and offer a conceptual framework that helps explain them. This framework focuses on three features of subnational finance: the income elasticity of provincial revenue sources, the role of the central government in stabilizing regional finances through intergovernmental grants and revenue-sharing schemes, and subnational access to credit markets.

The normative fiscal federalism literature has long recognized that subnational governments often have access to rather narrow revenue streams, which has justified assigning the role of fiscal stabilizer to national governments. Not surprisingly, we find that strongly procyclical revenues – especially from own-source taxes and fees – are the norm among constituent units in federations.

Next we address the tools available to regional governments to smooth expenditures with outside revenue sources from either the central government or the credit markets. Given their deeper pockets, broader tax bases,

ability to print money, greater freedom from institutional constraints, and wide array of policy tools, the traditional “benevolent government” view of fiscal federalism leads to the expectation that central governments will use intergovernmental grants to dampen the inherent procyclicality of subnational finance, especially when decentralized governments are responsible for the provision of welfare services. Such arguments receive indirect support from a vast empirical literature on the United States and several other countries that focuses on asymmetric shocks to regional income, showing that the national tax-transfer systems provide insurance by shifting income toward relatively adversely affected regions. This literature, however, focuses largely on unintended regional consequences of interpersonal tax-transfer policies, and has nothing to say about the budgets of subnational governments and their ability to smooth expenditures over the business cycle. Moreover, as the trend in the devolution of social policies continues, the regional incidence of national tax-transfer systems is likely to be of declining relevance compared with intergovernmental grants and subnational budgets.

In contrast to the welfare economics literature, we suggest that if intergovernmental grants are subject to the discretion of elected central government politicians, they are unlikely to combat downturns affecting the entire country. Given the sensitivity of central government or shared taxes to a declining tax base during downturns, it is unlikely that central governments will face political incentives to raise taxes or shift expenditures away from the central government budget in order to increase grants, especially if part of the electoral benefit of public goods provided at the subnational level must be shared with subnational politicians. Grants are most likely to display countercyclicality if the government can commit to an apolitical allocation process that is explicitly designed to smooth the revenues of constituent units. Indeed, we demonstrate that intergovernmental grants are either acyclical or positively correlated with regional output fluctuations in most federations. Australia, with its independent grants commission, is perhaps the lone exception. This finding provides a new perspective on the common wisdom – often mobilized in debates about the European Monetary Union – that a key function of central government fiscal policy in federations is to smooth regional shocks.

In the absence of stabilizing central transfers, regional governments could mimic central governments in wealthy countries and smooth expenditures by running surpluses during good times and borrowing on credit markets during bad times. We hypothesize that only in federations where regional governments have relatively unfettered capacity to access credit markets during downturns will it be possible to discern the use of the surplus and deficit to smooth expenditures over the business cycle. Indeed, we see that in comparative perspective, the U.S. states with their balanced budget rules engage in less smoothing than other wealthy federations. Moreover, there is no evidence of attempts at expenditure smoothing among regional governments in the three middle-income federations, where political impediments

to building surpluses during booms and credit constraints during downturns are likely rather severe.

More generally, we find that in most federations – even those with elaborate fiscal equalization programs – subnational governments are left alone to deal with business cycle volatility. In order to smooth expenditures, constituent governments must rely on their own borrowing and/or saving rather than support from the central government. As a result, subnational expenditures are often sharply procyclical – especially in developing federations. While a normative assessment of this situation lies beyond the scope of this paper, it should be noted that voters in many wealthy countries – especially those in the EU – have become accustomed to countercyclical social expenditures during the post-World War II era. Many of these countries are decentralizing the provision of social expenditures, and many are strengthening restrictions on subnational access to credit markets. Under such conditions, fiscal decentralization can complicate the role of government fiscal policy as a shock absorber.

The next section of the paper discusses expectations about the cyclicity of subnational finance drawn from normative public economics and political economy perspectives, reviews the empirical literature, and maps the institutional structures of seven federations onto this framework. The following three sections each pursue a different econometric approach to subnational cyclicity across countries, and the final section discusses the results and extracts policy implications.

2. FEDERALISM, SUBNATIONAL BUDGETS, AND THE BUSINESS CYCLE

A large literature examines the role of fiscal policies of central governments in muting the business cycle. Most revenue sources available to central governments are highly income elastic, and revenues in most countries are highly correlated with output. The most striking cross-country differences are on the expenditure side. Central government expenditures are uncorrelated with output fluctuations in most G7 countries, and are negatively correlated with the business cycle in a handful of EU countries (Arreaza et al., 1999; Hallerberg and Strauch, 2002; Talvi and Végh, 2000). Thus, to differing degrees many (although not all) OECD countries use some combination of saving during good times and borrowing during downturns to smooth expenditures.

A very different pattern is evident in the rest of the world, where expenditures are often just as procyclical as revenues. The lack of smoothing in developing countries has been attributed to credit constraints during bad times (Aizenman et al., 1996; Gavin and Perotti, 1997a, 1997b; Wibbels, 2006) and political obstacles to running surpluses during good times (Talvi and Végh, 2000; Tornell and Lane, 1999).

While this paper takes an agnostic view, macroeconomic stabilization through fiscal policy has many adherents ranging from classic Keynesians to new growth theorists. For example, procyclical fiscal policy is said to

exacerbate downturns and enhance economic stability, which hurts a country's growth potential (Ramey and Ramey, 1995). Aghion and Marinescu (2006) argue that countercyclical fiscal policy aids growth because research and development expenditures are the first to be cut in recessions. Social Democrats argue that large swings in fiscal policy are especially difficult for a society's most vulnerable citizens if social spending is reduced at times when it is most needed.

While there are many comparative studies of the cyclicity of central government budgets, there has been surprisingly little research on subnational budgets in multitiered systems, even though they sometimes account for more than half of all expenditures. This is unfortunate for several reasons. First, the general trend around the world has been toward greater fiscal decentralization (Rodden, 2004). Especially in the world's largest federations, a very large portion of spending, and to a lesser extent taxation, takes place at the subnational level. Second, while fiscal decentralization may be attractive if it improves service delivery and accountability, a growing literature points out that under certain conditions it may have high costs in terms of fiscal coordination across levels of government (Treisman, 2000; Velasco, 2000). Nevertheless, no comparative research has examined the role of subnational budget cyclicity as a potential contributor to those coordination problems. Third, despite automatic fiscal stabilizers commonly built into national fiscal policy among EU member states (Brunila et al., 2003; Van den Noord, 2000), subnational budgets in the world's federations have few such mechanisms. Indeed, there are good reasons to believe that subnational fiscal policy will be inherently procyclical thanks to a sensitive subnational tax base, intergovernmental grants that are sensitive to fluctuations in the national tax base, and impediments to borrowing and saving.

2.1 The Procyclicality of Provincial Revenues

While some relatively income-inelastic taxes are available, like those on property or the sale of food or alcohol, government revenue at any level is generally positively correlated with the business cycle. In some federations, the tax bases of provincial governments might be even more sensitive than those of the center. First, provincial governments may be subject to interregional tax competition that constrains their capacity to generate savings during good times or raise taxes during recessions (Norregaard, 1997). Moreover, economies of scale in tax collection, concerns with horizontal equity, and a history of centralization during wartime often leave central governments with control rights over the most lucrative taxes. As a result, provinces frequently have limited revenue streams at their disposal, and while local authorities often have access to relatively income-inelastic property taxes, regional officials are left with highly sensitive sales, personal

and corporate income, value-added, and payroll taxes. In some countries – particularly those using revenue-sharing systems relying on periodic inter-governmental negotiations – provinces have little scope to alter the rate or base in response to business conditions, and in all federations, tax increases during downturns are politically painful. Thus we expect to find, quite simply, that countries whose provinces are most constrained by the basic fiscal contract to rely on an inflexible, income-elastic tax base will display greater procyclicality.

There is considerable variance in the elasticity of purely subnational tax bases across our cases. In Germany, the *Länder* have extremely limited “own” taxes – essentially the income-inelastic motor vehicle tax – since most taxes are shared across levels. In both the United States and Canada, provincial governments have depended for decades on income and sales taxes for own-source revenue (in addition to a provincial value-added tax in Canada) – all quite sensitive to the business cycle. While the Indian states also receive a share of their own-source revenues from personal income and sales taxes, they also have access to potentially less procyclical revenue sources like excise duties on alcohol and an urban property tax. The own-source revenues of Australia’s states come primarily from a payroll tax, and a small share from property taxes and a series of small, indirect taxes. Argentina’s provinces historically have relied on a highly sensitive turnover tax, which is levied on the gross income that a company receives on business activities in all the relevant provinces, where double taxation is avoided through multilateral interprovincial deals. Brazil’s states depend heavily on a form of value-added tax (the ICMS), for which tax rates and exemptions have been used by the state to compete for investment.

2.2 Does the Center Help the Provinces Smooth Their Expenditures?

In the traditional fiscal federalism literature, the task of stabilization is assigned to the central government, which has a broader tax base, the power to print money, and the ability to borrow at lower interest rates (Musgrave, 1959). A more recent literature suggests that an important task of a benevolent central government in a large country that experiences stochastic, asymmetric regional shocks is to use fiscal policy to pool risk across regions. The central government in a federation might pursue stabilization either through interpersonal or through intergovernmental transfers. In the case of the former, a centralized, automatic interpersonal social insurance program would disproportionately favor the affected region because of the geographic concentration of poor or unemployed individuals. A large empirical literature has demonstrated that central government tax-transfer policies in the United States, Canada, the United Kingdom, France, and Italy act to smooth out asymmetric regional shocks. These studies focus on the difference between market (before federal taxes transfers) and disposable income,

discovering that federal policy provides a modest boost to personal incomes in regions suffering from asymmetric shocks.¹

These studies shed little light on the second type of central government stabilization since, if they include intergovernmental grants at all, they are lumped in with taxes and direct federal expenditures in order to capture net fiscal flows. In fact, it is possible that the modest relative income boost associated with *national* interpersonal tax-transfer policy during an asymmetric regional downturn is completely undone by the need for *provincial* governments to raise taxes or cut expenditures because of flagging revenues. If the typical characterization of subnational governments as fiscally inflexible and credit-constrained compared with the center is correct, the assignment of “stabilization” to the central government in the fiscal federalism literature seems to imply not just interpersonal transfers, but a revenue-sharing scheme or system of intergovernmental transfers that is markedly countercyclical to prevent provincially provided expenditures from vacillating dramatically with the business cycle (see Spahn, 1997). In the context of the EU, some have assumed that national transfers do indeed serve to insulate subnational budgets from income shocks. Balassone et al. (2002, p. 32), for instance, suggest that “while at present in most countries (Germany being an exception) sub-national governments’ budgets are largely insulated from the effects of cyclical developments, in the future this feature may vanish if more tax bases are assigned to lower government tiers.”

Indeed, revenue equalization schemes in federations like Germany, Austria, Canada, and Spain explicitly redistribute revenue from relatively wealthy to relatively poor regions in order to reduce disparities in service provision and/or revenue-raising capacity. But horizontal redistribution should not be confused with insurance against asymmetric regional shocks (von Hagen, 1992). Indeed, there is some evidence that national transfers in federations may exacerbate the procyclicality of provincial revenues. Sorensen et al. (2001), for instance, show that grants from the U.S. federal government to the states are positively correlated with the business cycle. Likewise, revenues flowing to the German states through its tax-sharing scheme are decisively procyclical (von Hagen and Hepp, 2001; Seitz, 2000). Grants and revenue-sharing schemes might smooth out asymmetric shocks in a *relative* sense – i.e. extra resources shift from Bavaria to Bremen after a shock to the shipbuilding industry – but this does not mean that Bremen’s government can keep up with demands for increased state expenditures in the face of rising unemployment and declining growth.

Curiously, the literature has paid very little attention to symmetric shocks. If a country aims to achieve countercyclical fiscal policy and a substantial

¹The most influential paper is Sala-i-Martin and Sachs’s (1992) study of the United States. Subsequent studies include Bayoumi and Masson (1995), Brunila et al. (2003), von Hagen (1992), Melitz and Zumer (1998), Obstfeld and Peri (1998), Sorensen and Yosha (1997) and van Wincoop (1995). von Hagen (2007) provides a literature review.

share of total expenditure is provided by local governments and funded through grants, those grants must counteract symmetric shocks as well. If the own-source revenues of provincial governments are procyclical, and they are major public sector employers and the primary providers of education, unemployment, health, and welfare benefits, presumably the assignment of stabilization responsibilities to the central government requires that the center uses its deeper pockets to borrow on behalf of regions and bolster their revenues through increased transfers in the face of a country-wide recession, as in Rattso's (2004) characterization of Norway. This seems to be a sustainable political equilibrium in the unitary countries of Europe, where the central government retains most of the authority over taxation and is the clear locus of political accountability for fiscal policy. If there are political costs associated with local expenditure cuts during downturns, they will be experienced directly by the central government.

Yet there is reason to believe that countercyclical flows from the center to the constituent units are not compatible with the central government's incentives in a decentralized federation. Since tax increases and expenditure cuts are politically painful, central governments face incentives to shift the costs of adjustment onto subnational officials if the political costs can be shifted as well in a decentralized federation where subnational officials are held accountable in large part for their own fiscal policies. To the extent that central governments borrow to smooth expenditures, election-motivated governments will be more inclined to borrow in order to maintain the path of their own expenditures, for which they can directly claim electoral credit, than those of subnational governments. If resources are severely constrained and further borrowing is costly, the center might even be tempted to shift some of its responsibilities to the constituent governments without providing additional funding – perhaps even cutting existing funding. Such so-called “unfunded mandates” are the common complaint of constituent governments in virtually every federation around the world, and the complaints seem to grow loudest during recessions.

Thus we expect to see that with respect to fluctuations affecting the entire country, in the absence of a strong institutional commitment to counter cyclicity, intergovernmental grants will be positively correlated with output in decentralized federations.² While our cases display considerable heterogeneity in the discretion afforded the central government in altering the size and distribution of the grant pool each year, as far as we can tell none has an explicit mandate to counteract output shocks. The closest thing

²There is yet another reason to expect procyclical grants. In an effort to encourage spending by subnational governments in areas characterized by positive externalities, central governments sometimes offer to match provincial spending up to some limit. Although provinces are likely to make cuts during recessions in areas that are not subject to matching, it is possible that some matching funds will be lost if very poor and credit-constrained provinces are forced to make cuts in these areas.

to an independent agency with a countercyclical mandate is the Commonwealth Grants Commission in Australia, but even in Australia the size of the grant pool is ultimately at the discretion of the federal government.

2.3 *Can Provinces Smooth Expenditures through Borrowing?*

If own-source and transferred revenues are positively correlated with output fluctuations as we suspect, provincial governments will only be able to smooth expenditures by saving and borrowing. Yet in many federations, self-imposed or centrally imposed rules place limitations on borrowing. Moreover, poor or small subnational governments might be unable to access credit markets during downturns, and political incentives can undermine saving during booms.

All but one U.S. state has some sort of self-imposed balanced budget rule. The empirical literature on the U.S. states is by far the most developed of any federation, and it is a useful starting point for our analysis (e.g. Asdrubali et al., 1996; Sorensen and Yosha, 1999; Sorensen et al., 2001). The main finding, replicated below, is that expenditures and revenues are both procyclical, but expenditures are significantly less procyclical than revenues, indicating that the state fiscal balance is used to smooth shocks by saving during good times and borrowing during bad times. Further, Sorensen and Yosha (2001) divide the states into groups according to the stringency of their self-imposed balanced budget requirements and the relative “conservativeness” of their voters, finding that less stringent and more liberal states conduct considerably more smoothing. Poterba (1994) finds that the more stringent states react to fiscal crises more quickly than states with less stringent rules.

The empirical analysis below will allow us to place the familiar U.S. results in comparative perspective. Perhaps the most obvious contrast is with the Canadian provinces, which have had essentially unlimited access to domestic and international credit markets. Like the U.S. states, the central government has no tools with which to regulate provincial borrowing. The provinces have a long history of borrowing on domestic and international credit markets, and bond yields and credit ratings reveal that market actors view the provinces essentially as sovereign debtors (Rødden, 2006). But unlike the U.S. states, during the period under analysis, the Canadian provinces had no self-imposed restrictions on borrowing.³ Nor do they display any of the constitutional limitations on revenue growth that might interfere with savings during good times as in the U.S. states.

Subnational entities in the other wealthy federations fall somewhere between the Canadian provinces and the most constrained U.S. states. The German states are the largest subnational debtors in Europe, and have had considerable access to credit through the Landesbanks that they indirectly control, and have been free of central restrictions on their authority to issue

³A few provinces have adopted such restrictions very recently, but this lies beyond the scope of the paper.

bonds. The constitutions of the German states impose a “golden rule” that requires them to borrow only for capital expenditures, although the line between capital and current is extremely porous, enforcement mechanisms are weak, and some states have simply ignored their constitutions. The constitutional court has interpreted the constitution as requiring federal bailouts of states facing extreme budgetary crises, which may have encouraged at least some state budgeters to believe that it would be possible to smooth expenditures during downturns and eventually externalize the costs to residents of other states. Given the perceived likelihood of federal bailouts, even highly indebted states have had no problem issuing debt at favorable interest rates (Heppke-Falk and Wolff, 2008).

Since the 1930s the Australian central government has undertaken borrowing on behalf of the states, and the distribution of loans among the states has been determined by the Australian Loan Council. Above all, this has allowed the states to pay lower interest rates in exchange for some loss of autonomy over borrowing. Since the early 1990s – covering most of the period under analysis below – the Commonwealth government has backed away from directly securing the loans, and now, through the Loan Council, negotiates yearly limits on the amount each state is allowed to borrow, although the states have always found various ways of circumventing these to some extent (Grewal, 2000). As with the Grants Commission, it appears that the Loan Council has always had the capacity to channel loans to states suffering from asymmetric negative shocks, and at least since the 1930s it has provided a forum for state governments attempting to use state fiscal policy to combat downturns (Grewal, 2000). Given the strong representation of state officials in its decision-making process, it allows increased state-level borrowing across the board during national downturns. Although explicit bailouts resembling those in Germany have not occurred in the recent past, credit markets do appear to put some positive probability on the likelihood of federal support in the event of state-level defaults (Rodden, 2006), and states are able to borrow at favorable rates.

The three developing federations are also interesting cases for comparative analysis. In each case, borrowing among regional governments has been a source of major concern for fiscal sustainability, but the literature does not offer clear hypotheses about their behavior over the business cycle. The Indian central government is heavily involved in regulating the borrowing of the states. It must approve new debt issues and imposes limits on states that are debtors to the center (in practice, all states), although, again, the states have some means of circumventing these limits. In Argentina, the privatization of provincially owned banks and a number of intergovernmental agreements in the 1990s served to somewhat constrict a system that previously left provinces wide leeway in borrowing domestically and even abroad. In Brazil, the federal government has made various attempts to restrict the borrowing of states, although enforcement was quite poor

throughout the 1980s and 1990s, during which time the states borrowed extensively from abroad and from state-owned banks. In each of these countries, a relatively large literature describes episodes in the 1980s and 1990s when central governments bailed out indebted states or provinces, generating incentives for further expenditure growth and larger deficits.

While access to credit and central bailouts may seem to provide subnational governments with opportunities to smooth expenditures, in these federations there are strong countervailing reasons to expect expenditures to be as procyclical as revenues. In Germany and perhaps Australia, the federal government's role as implicit guarantor of subnational debt might enhance the ability of regional governments to borrow during downturns. But in most federations, especially those in the developing world, the "credit crunch" hypothesis is arguably even more applicable at the subnational level than at the center. In the three middle-income federations examined here, even the most well-run state or provincial governments have faced higher interest rates than the central government, and access to credit markets dries up during recessions.

Moreover, the "voracity effect" identified by Tornell and Lane (1999) describes a situation in which powerful interest groups and weak institutions undermine saving during booms. In the Indian and Brazilian states and Argentine provinces, personnel expenditures make up large shares of the budget and public employees top the list of organized interest groups pushing for salary increases and other new expenditures during good times when the regional tax base and intergovernmental resources are increasing, or, at moments, when bailouts or increases in discretionary grants create short-term bumps in revenue. More generally, interest group politics might undermine incentives for elected officials to contribute to "rainy day funds" in other federations as well.

2.4 Empirical Expectations

To recap, we expect to find that own-source provincial revenues are procyclical in all federations, especially in countries that rely most heavily on income-elastic taxes. Similarly, although formulaic revenue-sharing programs may provide some horizontal insurance against asymmetric income shocks, the underlying procyclicality of the shared tax base will make for procyclical flows of grants and shared revenue as well. To the extent that regional governments face incentives to smooth expenditures over the business cycle by accessing credit markets, the Canadian provinces seem to have the most conducive institutional environment, followed by Germany and Australia.

3. A STATIC APPROACH

We have collected yearly data on revenues, expenditures, deficits, and gross state product (GSP) for each state or provincial government in seven federations around the world. Moreover, we have broken the revenue data

down into grants and own-source provincial revenues (primarily taxes, but this category also includes user fees, income from state-owned enterprises, etc.) and grants.⁴ The expenditure data include both capital and current expenditures. We have obtained consumer price indices and yearly population estimates to obtain real per capita income and fiscal data.⁵ We have collected the longest possible consistent time series for each country. The best coverage is for Canada, which begins in 1968. The worst is for Australia, which because of a change in accounting regimes only covers 12 years beginning in 1990.⁶

Thus for each country we have panels of yearly inflation-adjusted per capita fiscal and income observations for each province. Complete Indian data are only available for the so-called “major states,” and we only include the “old” western states of Germany. We have conducted extensive tests for the influence of outliers, guided both by postestimation residual plots, knowledge of the cases, and reviews of each country’s empirical literature. The most important considerations appear to be dependence on natural resources and the special status of capital cities. We exclude Alaska and the District of Columbia from the U.S. regressions, the Northern Territory from the Australian regressions, Berlin from the German regressions, the Federal District from the Brazilian regressions, and the city of Buenos Aires from the Argentina regressions. Only in the cases of Alaska and the Northern Territory (Australia) does the exclusion affect the results substantially.⁷ The results below are not affected by the exclusion of other western U.S. states that depend heavily on natural resources, nor are they affected by the exclusion of Alberta from the Canadian regressions, or the rather unique Hanseatic city-states of Bremen and Hamburg from the German regressions.

A more systematic way of dealing with influential outliers like Wyoming is to follow the weighting technique of Sorensen et al. (2001), who conduct a first-stage regression of budget items on the cyclical component of gross domestic product (GDP) and then use the mean residual for each state to down-weight outlier states in the second-stage regression. We present results based on this approach in Appendix B. It produces very similar point estimates, although of course the standard errors are much smaller.

⁴The German yearly data do not allow us to distinguish between tax revenues obtained through shared taxes and the miniscule taxes actually controlled by the individual Länder. The variable called “grants” in the analysis below refers to a combination of the grants distributed by the Bund in the third stage of the equalization process and various other shared-cost and federally funded programs.

⁵In Australia, Germany, Canada, and India, it was possible to use province-specific deflators, while for the other cases we were forced to use national-level price data.

⁶Coverage is as follows: the United States 49 states 1977–1997, Canada 10 provinces 1968–1997, Germany 10 Länder 1974–1995, Australia six states and the Australian Capital Territory 1990–2001, India 14 states 1980–1998, Brazil 26 states 1986–2000, and Argentina 23 provinces 1980–2001.

⁷When Alaska and the Northern Territory are included, the procyclicality of both revenues and expenditures is more pronounced.

Our basic approach is to examine the correlation between regional output fluctuations and budget items in separate panel regressions for each country. We should emphasize that these are mere correlations. We do not have access to regional-level data that would allow us to instrument for output growth, and while such an approach might be taken using data for world growth and interest rates and national terms of trade, for our purposes this would not be very illuminating. In most countries, the expenditure, revenue, and GSP series demonstrate pronounced upward trends, and unit root tests indicated non-stationarity in the vast majority of provinces. Thus for the expenditure and revenue models, all variables are first differences of logged data. Only the per capita surplus/deficit data are clearly stationary, and so these enter the regressions as levels (also logged).

A common technique in the cross-national literature is to isolate short-term output fluctuations by taking real per capita GDP as a deviation from trend using the Hodrick–Prescott smoothing filter (e.g. Hallerberg and Strauch, 2002; Persson and Tabellini, 2003; Talvi and Végh, 2000). We have obtained rather similar overall correlations between output fluctuations and budget items using this technique, but cannot find a compelling reason to use both lags and leads to define the output trend, especially in the next section, where we attempt to differentiate between fiscal behavior during upturns and downturns in the regional economy. Because of the use of leads, the Hodrick–Prescott filter generates a trend where many of the years of highest growth are actually treated as small *negative* output deviations.⁸

We adopt the more straightforward approach of Sorensen et al. (2001), defining output fluctuations as yearly deviations from the province's average change in logged GDP per capita over the entire time period.⁹ We include provincial fixed effects in order to focus exclusively on within-province variation and present the results of OLS models with panel-corrected standard errors.

For each regression, we report results both with and without a panel of year dummies, each with a different interpretation. Models that include year dummies control for common shocks experienced by all states in a particular year – for example a symmetric downturn in the national economy or a change in federal macroeconomic policy that has symmetric effects on all states. As a result, such models hone in on the effects of asymmetric provincial income shocks. Following the discussion above, this is of particular importance in the analysis of grants. However, many of the arguments explored above require that the year dummies be left out so that symmetric national shocks are allowed to affect the results. In order to draw policy implications, it is also more useful to understand the impact of absolute rather than merely relative economic shocks.

⁸For a discussion of the sensitivity of business cycle analysis to detrending techniques, see Canova (1998).

⁹We have also obtained broadly similar results with other techniques, such as defining the trend with a simple autoregressive model or the band-pass filter.

Regression output is presented in Appendix A, but the results are best digested by looking at Figure 1, which plots the point estimate and the 95% confidence interval for each budget item in each country. For each revenue item and for expenditures, a positive coefficient represents a positive, or procyclical, correlation with the cyclical component of GSP. However, for the surplus, a positive coefficient reveals that governments increase the surplus during good times and/or decrease it (enlarge the deficit) during bad times, which is consistent with countercyclical borrowing and saving.

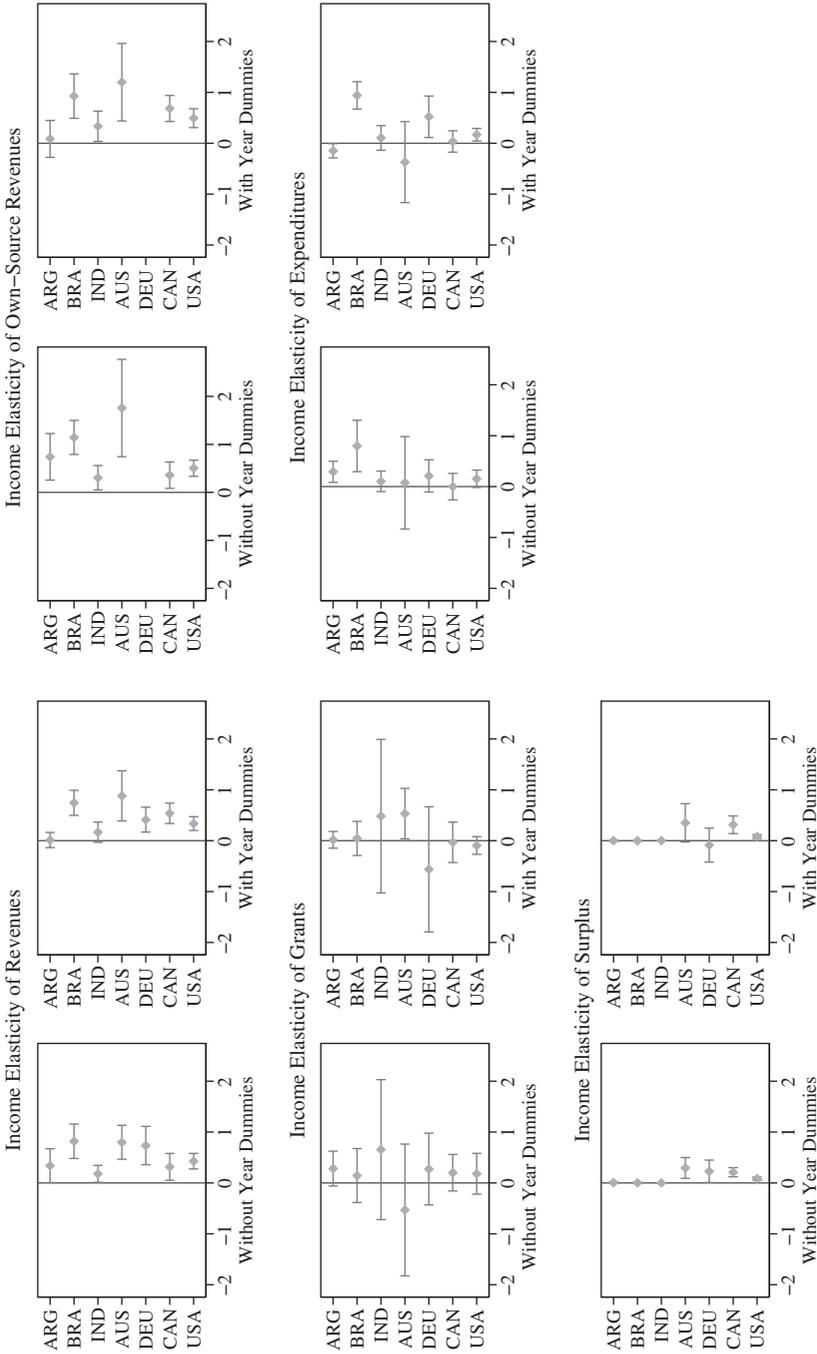
As expected, the first panel of Figure 1 reveals that overall provincial revenues are highly procyclical in all federations. The interpretation of the point estimates is that a 1% increase in GDP per capita, in a Brazilian state for example, is associated with 0.82% increase in state revenue. The coefficient is in the range of 0.3–0.4 for the United States, Canada, and Argentina, and roughly twice as high in Australia, Germany, and Brazil. Interestingly, the Indian tax base does appear to be less income elastic than those of the other federated units. The models with year dummies reveal that, in most countries, provincial revenues are also positively correlated with purely asymmetric income fluctuations, although the size of the effect diminishes in a couple of cases.¹⁰

The next panel reveals that these large coefficients are driven primarily by highly procyclical own-source revenues, which are in each case more income elastic than overall revenues. In fact, the coefficients approach or surpass 1 in Argentina, Brazil, and Australia. (In Germany we are unable to disaggregate own-source and shared tax revenues.)

Perhaps the most intriguing coefficients are for grants. These results should put to rest any perception that intergovernmental grants are broadly countercyclical. Above all, save for Australia, there is not a single negative coefficient for any model that allows national income fluctuations to affect the results. All of the point estimates are positive but rather imprecise, although most do reach statistical significance in the weighted models in Appendix B. The only country where grants appear to respond in a countercyclical fashion to output fluctuations is Australia, which does not attain statistical significance in the model presented in Figure 1, although it does in the weighted model in Appendix B.

An interesting pattern can be seen when contrasting the models with and without year dummies. Note that in the United States, the positive point estimate in the model without year dummies becomes negative in the model that controls for time effects. Although not quite significant in Figure 1, both are significant in the weighted model. This replicates the finding of Sorensen et al. (2001). A similar downward shift in the point estimates when going from a model emphasizing symmetric shocks to one emphasizing

¹⁰Note that in the weighted models in Appendix B, all of the coefficients are positive and significant.



Point estimates with 95% confidence intervals.

Figure 1. Elasticity of budget items.

asymmetric shocks can be seen in Germany, and to a lesser extent in Canada, India, Brazil, and Argentina. A reasonable interpretation is that progressive intergovernmental transfer programs provide, if anything, a modest relative shift of resources toward states suffering from asymmetric negative shocks. However, this does not help combat the overall procyclicality of state revenues. When common shocks are allowed to affect the results, grants are positively correlated with the business cycle. However, it should be noted that in every country except India the correlation between grants and regional output fluctuations is not as high as that for own-source revenues.

Only in Australia do we see a different pattern. It appears that, if anything, the pool of grants increases during national downturns, but these do not flow disproportionately to affected states during asymmetric downturns.

Next we examine whether these largely procyclical revenues translate into procyclical expenditures. The answer is approximately yes in all countries but Canada and Australia. Figure 1 displays positive but imprecise point estimates for most countries, although all but Canada and Australia are significant in the weighted models in Appendix B. Procyclicality on the expenditure side is especially pronounced in Argentina. In both Argentina and Brazil, the procyclicality of the provinces and states is even larger than that reported by Talvi and Végh (2000) for the central government. For both Germany (Gali and Perotti, 2003) and the United States (Talvi and Végh, 2000), the procyclical correlation for the states contrasts with modestly countercyclical federal expenditures. In Canada and Australia, the zero correlation is consistent with what Talvi and Végh (2000) report for the federal government.

Finally, the positive, significant coefficients in the surplus panel suggest that the U.S. states, Canadian provinces, Australian states, and German Länder all use the surplus and deficit to smooth output fluctuations by borrowing during bad times and possibly saving during good times. In each of these cases, the procyclicality of expenditures is much smaller than that of revenues, but only in Australia and Canada is the procyclicality of revenue completely neutralized.

These results place the American states in comparative perspective and reveal that they engage in far less expenditure smoothing than their neighbors to the north, and, perhaps more surprisingly, also less than their German and Australian counterparts.¹¹ Whether constrained by their balanced budget rules or conservative voters, the U.S. states are relatively resistant to the use of borrowing or “rainy day funds” to smooth income fluctuations. The coefficients for the German, Canadian, and Australian regional governments approach those obtained in similar studies of EU central government deficits (e.g. 0.36 in Hallerberg and Strauch, 2002).

¹¹The German coefficient is somewhat sensitive to model specification, which seems to reflect the fact that, as argued by Rodden (2007), the incentives to abide by the “golden rule” vary across states according to their place in the equalization system.

Finally, there is no evidence whatsoever that Indian, Brazilian, or Argentine regional governments use the surplus to smooth expenditures over the business cycle. Even when we parse these datasets and look for subsets of states or provinces that display countercyclical behavior, we obtain very similar results. Although much has been written about the role of soft budget constraints and bailouts in these cases, which one might expect would allow for countercyclical expenditures, the findings are likely driven by the facts presented above: there is undoubtedly a severe credit crunch during downturns, and consistent with the arguments of Talvi and Végh (2000) and Tornell and Lane (1999), overall volatility is much greater in these federations (according to our data, almost twice as high as in the developed federations), in a context where interest groups compete for expenditures during periods of revenue growth.

4. DIFFERENTIATING BETWEEN POSITIVE AND NEGATIVE SHOCKS

It is worthwhile to examine whether some of the results above are driven disproportionately by positive or negative fluctuations, or whether perhaps some interesting relationships have been masked by suppressing possible asymmetric responses. For instance, taxes might fall more precipitously during a downturn than they rise during an expansion of equal magnitude if tax rates are cut during expansions or collection efforts are curtailed. Or perhaps grants will appear to be countercyclical after all when negative shocks are distinguished from positive.

According to research by Gavin and Perotti (1997a, 1997b), fiscal behavior in industrialized countries is asymmetric over the business cycle such that government consumption is moderately procyclical during expansions, but government consumption and transfers are strongly countercyclical during recessions. Hercowitz and Strawczynski (2004) demonstrate that this produces a ratchet effect among OECD central governments whereby government consumption as a share of GDP increases during expansions and is not fully offset during recessions. Buchanan and Wagner (1978) suggest that such asymmetric fiscal policy emerges when budgeters attempt to implement long-term Keynesian fiscal policies, but are also influenced by short-term political considerations such that it is politically attractive to increase spending during recessions, while it is difficult to convince interest groups that those expansions should be clawed back during booms. This is closely related to the voracity effect of Tornell and Lane (1999), which also predicts asymmetry if interest group politics places limits on government's ability to run surpluses during good times. Asymmetry might also result if provincial governments face political pressure to reduce taxation during good times but also face incentives to counteract recessions.

Our approach is to create separate variables for those years when deviation from average output change is greater than zero ("positive shock") and

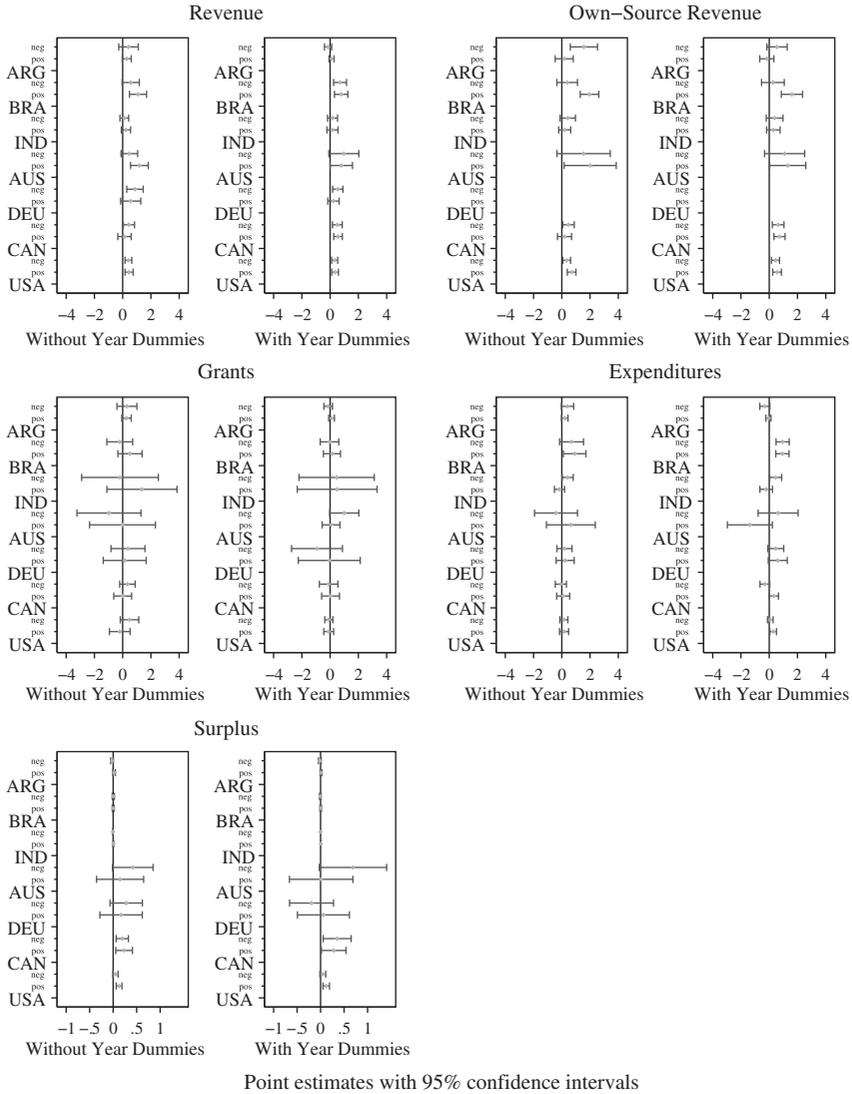


Figure 2. Response of budget items to positive and negative deviations from average growth.

those where it is below zero (“negative shock”). The positive shock variable is zero for all years in which income falls below average, and the negative shock variable is zero for all years when it is above average. We use the same estimation techniques as above. Figure 2 presents the point estimates and 95% confidence intervals. Note that for the negative shocks a positive coefficient of 1 would indicate that a 1% decrease in GDP change (relative to

the provincial average) is associated with a 1% decrease in the real per capita budget item.

Before discussing the results, we should point out that apparent asymmetries in fiscal policy are quite sensitive to the way one defines “good” and “bad” times. As mentioned above, the “good times” and “bad times” identified by Hodrick–Prescott or band-pass filters are not very highly correlated with those identified by the prediction of an autoregressive model or the simple provincial average first differences used here. Some of the small but statistically significant asymmetries in Figure 2 are not robust to alternative specifications.

From this perspective, the asymmetries on the revenue side are not all that impressive. There are a few cases worthy of discussion in the models without year dummies. The own-source revenues of Brazil and Argentina display very different patterns. In Argentina, provincial taxes are much more responsive to output during downturns than during good times, perhaps reflecting a decline in tax collection during periods of high growth. Curiously, the opposite pattern holds in Brazil: revenues (primarily from the ICMS tax) are extremely sensitive to positive deviations from average GDP growth, but much less sensitive to negative deviations. On a much smaller scale, Canada and Germany demonstrate something similar to the Argentine pattern, while Australia resembles Brazil in that its revenues are more sensitive to output fluctuations during good times. Some of these results are worthy of further analysis elsewhere.

The correlation of grants with output fluctuations is relatively symmetric in most cases, although in Brazil and India, if anything, the procyclicality of grants is driven disproportionately by growth during good times. Inspection of Figure 2, along with the weighted models in Appendix B, reveals that there is very little support for the notion that central governments use grants to smooth revenue shocks. Only in Australia do we see that the federal government appears to be acting to combat national recessions: the negative coefficient for grants in Figure 1 is driven primarily by grant increases that correspond to nation-wide recessions. (But note that this same coefficient is positive in the model with year dummies.) In Canada and the United States, if anything, it appears that the modestly procyclical grants in Figure 1 were driven primarily by cuts during downturns. Turning to the models with year dummies that are more likely to capture an asymmetric insurance effect, we see that there is some evidence that grants increase in response to Land-level downturns in Germany. Otherwise, negative point estimates are not to be found.

Perhaps the most interesting results are for the surplus. First, the point estimates for the three developing federations are zero for both positive and negative shocks. For the United States and Canada, the reaction of the surplus/deficit to output fluctuations is very close to symmetric during good times and bad times. If anything, the surpluses of the U.S. states are more responsive to output shocks during good times than bad times, although the difference is small and, in some alternative specifications, not statistically significant.

For the German Länder and Australian states, however, the pattern is different. These governments are more inclined to borrow during downturns than to save during good times. In Australia, when hit with a negative GDP shock of 1%, revenues decline by 0.5%, but expenditures actually *increase* in countercyclical fashion by 0.5%. The states do generate surpluses during good times, but this effect is significantly smaller. A 1% increase in GDP relative to the state average is associated with slightly more than a 1% increase in revenues, while yielding an expenditure increase of 0.6%. In Germany, a 1% negative shock is associated with a corresponding 1% drop in revenue, while expenditures decrease by only 0.15%. During good times, a 1% increase in growth yields a 0.5% increase in revenue and a 0.2% increase in expenditures. These results are robust to a variety of alternative specifications.

This asymmetry is consistent with the short-term political expediency described by Buchanan and Wagner (1978), or the voracious interest groups of Tornell and Lane (1999). Regional governments find it attractive to borrow during bad times, but they do not generate countervailing savings during good times. The contrast with the United States and Canada is intriguing. One possible interpretation of the results is that while politicians, voters, and creditors in Canada and the United States understand that the provinces and states are boats that must float on their own bottoms, elected officials and their voters and creditors in Australia and Germany perceive some implicit federal guarantee, believing that enhanced assistance in the future is likely if debt burdens grow too large.

The key results of these two sections are easily summarized. There are very few negative coefficients for expenditure and revenue items. Procyclicality is the rule among provinces and states in federations. Own-source and total revenues are always highly procyclical. Grants show fleeting evidence of playing an interregional insurance role in a handful of federations, shifting additional resources to states that suffer from asymmetric negative shocks. But when common income shocks are considered, grants are either acyclical or procyclical. In the developed federations, regional governments do increase the deficit during bad times and bolster the surplus during good times, making expenditures less sensitive to the business cycle than revenues. Among the wealthy federations, this activity is least pronounced in the U.S. states, presumably because of self-imposed fiscal restrictions. In Germany and Australia, this smoothing takes place primarily during downturns. In spite of such attempts at smoothing, however, expenditures are positively correlated with the business cycle in every federation except for Australia and Canada.

5. A DYNAMIC APPROACH

An alternative approach to the static one taken thus far is to examine the dynamic reaction of budgets to innovations in provincial economies by using lagged levels of GSP per capita. This step has a number of advantages. First,

we expect that economic shocks have budgetary implications over a number of years. A sharp contraction in income this year, for instance, is likely to reduce revenues for a number of years to come. Second, it is possible that the cyclical properties noted above are very short term and therefore less problematic than if the effects were very persistent through time, which would raise concerns about the possibility that subnational taxing and spending exacerbates the business cycles. Additionally, we expect interesting differences across federations in how budgetary components respond to economic changes through time. There is evidence, for instance, that revenues in the U.S. states are quickly affected by economic shocks, while expenditures move more slowly (Sorensen et al., 2001). The net result is a tendency toward consistent (if small) surpluses (deficits) over several years in the presence of a positive economic innovation (deterioration). Consistent with the “voracity effect,” however, we expect provincial governments in Argentina and Brazil to be politically incapable of running surpluses. In contexts of volatile tax bases and political clientelism, the pressure to increase spending at once in response to positive economic shocks is likely irresistible. When combined with a history of profoundly soft budget constraints and scarce credit during recessions, the result should be that income shocks will produce similar effects for both revenues and expenditures in such cases, thus eliminating the potential for smoothing.

To investigate the dynamic response of provincial budgets to provincial income, we regress per capita real-state surpluses, revenues, and expenditures on real GSP per capita and four lags. The models also include a panel of dummies for fixed provincial effects, but do not include year dummies.¹² Since both revenues and expenditures are non-stationary, we do not present parameter estimates. Consistent with Sorensen et al. (2001), we graph the predicted effect of a 1% permanent increase in GSP on the budget components over the five-year period.¹³ The graphs present the effect on budget components of an identical *percent* increase in income across provinces in the eight countries. As a result, the shapes of the graphs are directly comparable across cases, allowing us to examine how budgetary components move in each national setting.

Figure 3 shows some similarities across all nations. Most notably and consistent with the findings above, both revenue and expenditure tend to increase (decrease) over the course of the five-year period after a permanent increase (decrease) in provincial income. In no case does either budget category revert to the original value by the end of the period.

¹²The inclusion of year dummies yields broadly similar results. The most notable difference is the tendency for revenues and expenditures to revert to the mean more quickly when controlling for national shocks.

¹³The 1% was calculated as a share of average provincial GDP for the most recent year available. For instance, in the United States, the average state GSP in 1997 (the most recent in our dataset) was US\$29,123.09. A 1% increase in this case amounts to US\$291.23. To generate the graphs we calculate the accumulated predicted value of the budget component on the basis of the coefficients from the regression of the budget category on GSP and four lags.

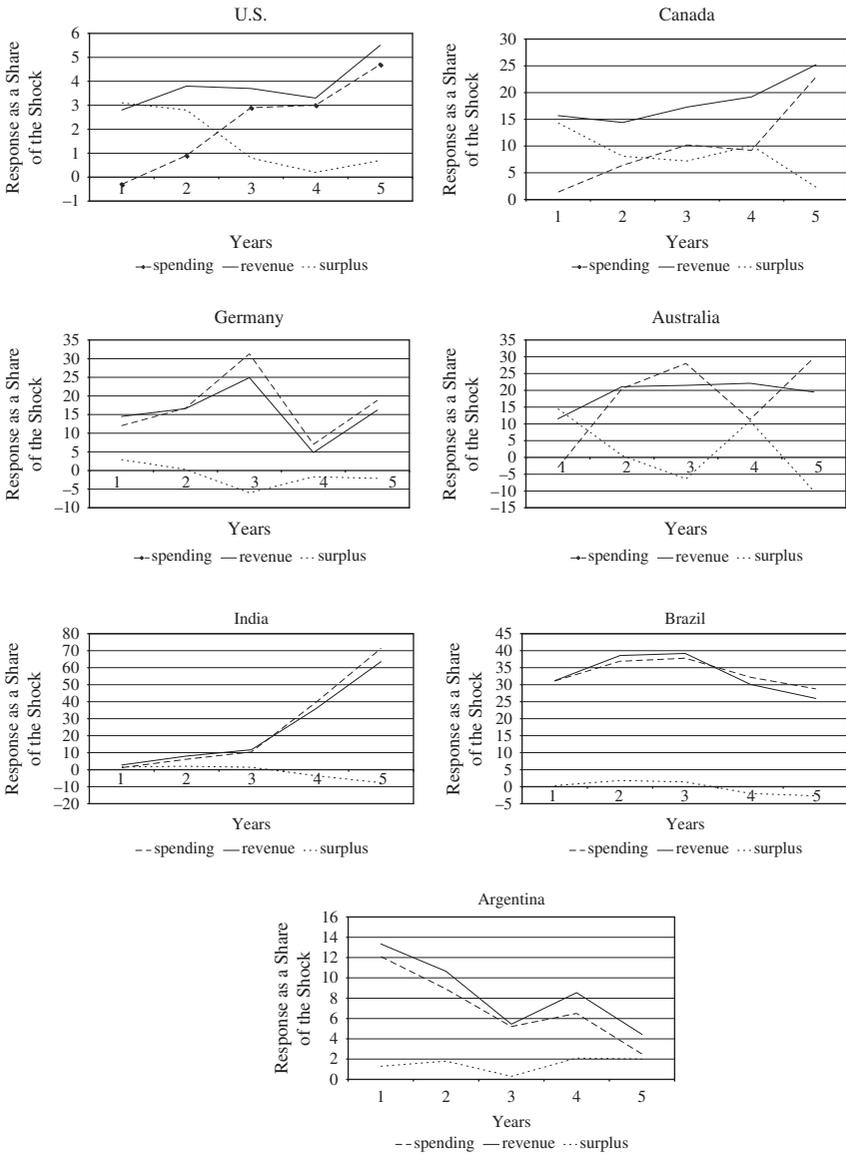


Figure 3. Budget responses to increasing output.

This broad similarity aside, the graphs show countries that follow one of two patterns. In the first, which includes the United States, Canada, and Australia, provincial revenues climb (fall) sharply in the initial year in which GSP increases (falls), with expenditures reacting more slowly through time, although at varying speeds across these countries. The result is that the

surplus or deficit plays a smoothing role in these cases, reverting to zero after between two (Australia) and five (Canada) years. In the United States, expenditures draw near revenues after four years. In Canada and the United States, the fiscal response is quite slow and smooth, occurring gradually over the course of the entire five-year period. In Australia, on the other hand, spending reacts sharply in the second year after the increase in GSP.

The second pattern includes the German, Brazilian, Argentine, and Indian cases. Unlike the dynamic described above, here revenues and expenditures move together very closely. Note that the difference is not on the revenue side. Like the United States, Canadian, and Australian states, regional governments in these cases display a sharp revenue response in the initial year of the income innovation. Indeed, the Brazilian states and Argentine provinces are noteworthy for the very strong response of revenues in the first year. These cases are quite different, however, on the expenditure side, where spending responds immediately rather than more smoothly, and the deficit responds somewhat in the initial years in Germany and Argentina, and not at all in Brazil and India.

These results are broadly consistent with those presented above, with the exception of Germany, where the dynamic approach suggests less smoothing through borrowing and saving than the static approach.

6. CONCLUSIONS

Subnational finance in several of the world's most decentralized federations is overwhelmingly procyclical. Given the near-universal procyclicality of revenues and expenditures and the lack of countercyclical grants, it appears that the recession-induced tax increases and expenditure cuts of U.S. state governments are the rule rather than the exception. Constituent governments in the other OECD federations analyzed in this paper make greater use of borrowing to smooth expenditures during recessions, but in no case does this clearly translate into countercyclical expenditures.

During deep recessions, the fiscal retrenchment of state and provincial governments can complicate efforts by the central government to generate fiscal stimulus, and where provincial governments are responsible for social policies and poverty alleviation programs, the implications for the poor and unemployed can be severe. As demonstrated by current events in the United States as this paper goes to press, such moments can lead to demands for ad hoc federal transfers in order to help subnational governments meet their obligations. Anticipation and jockeying for such bailouts can lead to a host of bad incentives.

The results presented in this paper also have implications for ongoing debates in the EU. Key characteristics of several of the more decentralized member states suggest that the levels of procyclicality observed in our cases are likely to be evident elsewhere. Reforms aimed at increasing the autonomy of regional governments over broad-based taxes, as in Belgium and Spain, will likely create procyclical revenue streams. Yet in most European

countries, serious tax decentralization is not on the agenda, and an enhanced expenditure role for subnational governments is driven by intergovernmental grants or shared revenues. In many countries, there are reasons for skepticism about the central government's incentives and wherewithal to help subnational governments smooth expenditures over their business cycles. In Italy, for instance, weak regional revenue bases combine with an extensive system of rather volatile discretionary grants.

In rapidly decentralizing developing countries as well, it is plausible that decentralization will heighten overall procyclicality, especially of health, education, and social expenditures. Since it is often extremely difficult to fire workers, whose salaries make up the lion's share of subnational budgets, expenditures other than payroll are likely to suffer during recessions.

Potential steps to dampen the procyclicality of subnational finance in decentralizing countries include finding less volatile tax sources, taking steps to insulate grants from the volatility of the national tax base, and creating incentives for subnational governments to save during good times. This paper demonstrated, however, that for the most part, even the wealthiest and most stable decentralized federations of the world have not established such mechanisms. A final option – enhancing independent subnational borrowing autonomy – has allowed for some expenditure smoothing in federations like Canada, but it is being taken off the table in many decentralizing countries. As European countries attempt to bring overall deficits in line with EMU criteria and developing countries attempt to avoid or recover from bouts of subnational over-borrowing, countries are scrambling to adopt golden rules, deficit limits, national stability pacts, and other constraints that limit the borrowing authority of subnational governments. The kind of unfettered access to domestic and international credit markets traditionally enjoyed by the Canadian provinces is increasingly rare.

In any case, for many subnational jurisdictions, access to credit during recessions would be impossible without a central government guarantee. In the majority of newly decentralizing countries where subnational governments are highly dependent on transfers, efforts by central governments to tighten regulations on local borrowing are responses to a basic moral hazard problem associated with the possibility that creditors will perceive that such a guarantee is implied by the transfer system (Rodden, 2006).

If fiscal decentralization around the world is funded by intergovernmental grants that move with the business cycle, which in turn encourage central governments to clamp down on subnational borrowing, procyclical expenditures in newly decentralized sectors like health and education will be unavoidable, and the fiscal activities of subnational governments will often act at cross-purposes with any central efforts at stabilization. To the extent that this is not politically acceptable, the most recent global downturn might encourage policy-makers to seek out new mechanisms for smoothing shared revenues and grants over the business cycle.

APPENDIX A: REGRESSION RESULTS, UNWEIGHTED

	Without year dummies					Including year dummies				
	Revenue	Own-source revenue	Grants	Expenditures	Surplus	Revenue	Own-source revenue	Grants	Expenditures	Surplus
Argentina										
289 observations	0.339** (0.170)	0.741*** (0.248)	0.282 (0.174)	0.291*** (0.106)	0.006 (0.010)	0.013 (0.076)	0.085 (0.185)	0.017 (0.084)	-0.1147** (0.072)	0.000 (0.008)
23 provinces	R ²	0.06	0.04	0.04	0.37	0.54	0.34	0.5	0.41	0.48
	Positive shock	0.287* (0.163)	0.171 (0.326)	0.269 (0.171)	0.210* (0.117)	0.099 (0.091)	-0.171 (0.256)	0.102 (0.103)	-0.057 (0.093)	0.009 (0.010)
	Negative shock	0.415 (0.352)	1.565*** (0.492)	0.300 (0.360)	0.407* (0.221)	-0.144 (0.130)	0.552 (0.366)	-0.137 (0.155)	-0.312* (0.183)	-0.016 (0.015)
	R ²	0.06	0.09	0.04	0.38	0.54	0.35	0.5	0.42	0.49
Brazil										
308 observations	0.819*** (0.173)	1.145*** (0.181)	0.145 (0.271)	0.798*** (0.258)	0.002 (0.007)	0.744*** (0.125)	0.926*** (0.223)	0.044 (0.171)	0.941*** (0.137)	-0.002 (0.006)
26 states	R ²	0.13	0.13	0.12	0.67	0.34	0.22	0.22	0.42	0.73
	Positive shock	1.085*** (0.309)	1.962*** (0.334)	0.518 (0.438)	0.912** (0.407)	0.783*** (0.240)	1.608*** (0.383)	0.133 (0.308)	0.934*** (0.239)	0.003 (0.009)
	Negative shock	0.568* (0.311)	0.379 (0.372)	-0.205 (0.466)	0.692 (0.433)	0.706*** (0.234)	0.260 (0.411)	-0.043 (0.335)	0.948*** (0.238)	-0.007 (0.009)
	R ²	0.14	0.15	0.12	0.67	0.34	0.23	0.22	0.42	0.73
India										
258 observations	0.179** (0.085)	0.305** (0.130)	0.655 (0.701)	0.103 (0.103)	0.000 (0.002)	0.167 (0.102)	0.334** (0.152)	0.483 (0.769)	0.105 (0.123)	0.002 (0.001)
14 states	R ²	0.02	0.03	0.01	0.13	0.1	0.13	0.2	0.12	0.66
	Positive shock	0.232 (0.167)	0.205 (0.217)	1.364 (1.265)	-0.165 (0.183)	0.164 (0.201)	0.290 (0.244)	0.500 (1.441)	-0.216 (0.227)	0.003 (0.002)
	Negative shock	0.116 (0.158)	0.424 (0.277)	-0.190 (1.385)	0.421** (0.199)	0.381 (0.181)	0.170 (0.302)	0.463 (1.359)	0.457** (0.217)	-0.000 (0.002)
	R ²	0.02	0.03	0.02	0.15	0.1	0.13	0.2	0.13	0.66
Australia										
77 observations	0.799*** (0.170)	1.757*** (0.517)	-0.531 (0.661)	0.074 (0.463)	0.295*** (0.104)	0.882*** (0.251)	1.199*** (0.389)	0.533** (0.253)	-0.371 (0.406)	1.351* (0.192)
7 states	R ²	0.27	0.32	0.03	0.31	0.44	0.7	0.85	0.4	0.39
	Positive shock	1.184*** (0.320)	2.008** (0.941)	-0.013 (1.190)	0.642 (0.882)	0.790* (0.404)	1.310** (0.655)	0.066 (0.321)	-1.372* (0.813)	0.013 (0.344)
	Negative shock	0.472 (0.299)	1.544 (0.963)	-0.971 (1.156)	-0.407 (0.776)	0.973* (0.541)	1.089 (0.724)	0.999* (0.526)	0.629 (0.721)	0.689* (0.366)

APPENDIX A: *Continued*

		Without year dummies				Including year dummies					
		Revenue	Own-source revenue	Grants	Expenditures	Surplus	Revenue	Own-source revenue	Grants	Expenditures	Surplus
R²		0.29	0.32	0.05	0.04	0.31	0.44	0.7	0.85	0.42	0.4
Germany											
206 observations	Δ GDP	0.735*** (0.192)	0.273 (0.360)	0.211 (0.162)	0.413*** (0.125)	0.229** (0.112)	0.538*** (0.130)	0.493*** (0.095)	-0.563 (0.628)	0.520** (0.208)	-0.086 (0.170)
10 Länder	R ²	0.25	0.07	0.04	0.71	0.7	0.63	0.24	0.26	0.34	0.78
	Positive shock	0.567 (0.364)	0.146 (0.775)	0.238 (0.325)	0.237 (0.206)	0.169 (0.231)	0.560*** (0.155)	0.554*** (0.120)	-0.060 (1.118)	0.603* (0.342)	0.060 (0.282)
	Negative shock	0.871*** (0.297)	0.376 (0.614)	0.188 (0.273)	0.541*** (0.185)	0.278 (0.176)	0.512*** (0.177)	0.441*** (0.147)	-0.927 (0.919)	0.461 (0.289)	-0.192 (0.239)
R²		0.25	0.07	0.04	0.71	0.7	0.63	0.24	0.26	0.34	0.78
Canada											
290 observations	Δ GDP	0.316*** (0.135)	0.358** (0.140)	0.201 (0.183)	0.538*** (0.102)	0.210*** (0.046)	0.683*** (0.130)	0.493*** (0.095)	-0.032 (0.203)	0.036 (0.107)	0.313*** (0.088)
10 provinces	R ²	0.09	0.1	0.02	0.01	0.3	0.7	0.63	0.45	0.57	0.46
	Positive shock	0.129 (0.241)	0.191 (0.255)	0.001 (0.323)	0.233*** (0.091)	0.097 (0.234)	0.727*** (0.200)	0.560*** (0.155)	0.031 (0.321)	0.328** (0.166)	0.279** (0.134)
	Negative shock	0.444** (0.202)	0.473** (0.208)	0.338 (0.280)	0.195*** (0.066)	-0.068 (0.202)	0.632*** (0.211)	0.512*** (0.177)	-0.106 (0.334)	-0.309* (0.176)	0.353** (0.152)
R²		0.11	0.11	0.02	0.01	0.3	0.7	0.63	0.45	0.59	0.46
USA											
980 observations	Δ GDP	0.427*** (0.078)	0.503*** (0.086)	0.181 (0.205)	0.84*** (0.087)	0.084*** (0.016)	0.337*** (0.069)	0.493*** (0.095)	-0.094 (0.089)	0.168*** (0.063)	0.080*** (0.020)
49 states	R ²	0.13	0.14	0.02	0.03	0.49	0.28	0.24	0.38	0.22	0.53
	Positive shock	0.453*** (0.147)	0.696*** (0.156)	-0.207 (0.372)	0.352*** (0.127***)	0.161 (0.165)	0.554*** (0.120)	0.554*** (0.120)	-0.099 (0.177)	0.279** (0.119)	0.120*** (0.035)
	Negative shock	0.407*** (0.122)	0.351** (0.138)	0.486 (0.334)	0.324*** (0.108)	0.051* (0.028)	0.441*** (0.147)	0.441*** (0.147)	-0.091 (0.147)	0.075 (0.102)	0.047 (0.032)
R²		0.13	0.15	0.02	0.03	0.49	0.28	0.24	0.38	0.23	0.53

Note: ***0.01; **0.05; *0.1.

The dependent variable in each model is the first difference of the logged real per capita budget item specified in each column.

The independent variable in the first model for each country is the deviation from the province's average first difference of logged real GDP per capita.

The second model for each country differentiates between positive and negative deviations from the provincial average first difference.

All models include province fixed effects.

Panel-corrected standard errors are in parentheses.

APPENDIX B: REGRESSION RESULTS, WEIGHTED

		Without year dummies				Including year dummies					
		Revenue	Own-source revenue	Grants	Expenditures	Surplus	Revenue	Own-source revenue	Grants	Expenditures	Surplus
Argentina	Δ GDP	0.416*** (0.057)	0.929*** (0.097)	0.328*** (0.061)	0.333*** (0.036)	0.002*** (0.0002)	0.043* (0.026)	0.210*** (0.075)	0.032 (0.030)	-0.117*** (0.026)	-0.006*** (0.0003)
289 observations	R ²	0.08	0.11	0.05	0.05	0.39	0.55	0.38	0.48	0.42	0.48
23 provinces	Positive shock	0.305*** (0.053)	0.305*** (0.122)	0.276*** (0.060)	0.223*** (0.039)	0.006*** (0.0002)	0.071** (0.030)	-0.071 (0.099)	0.060* (0.036)	-0.028 (0.032)	-0.004*** (0.0005)
	Negative shock	0.575*** (0.119)	1.828*** (0.193)	0.398*** (0.123)	0.488*** (0.074)	-0.016*** (0.001)	-0.010 (0.046)	0.754*** (0.155)	-0.018 (0.053)	-0.284*** (0.066)	-0.013*** (0.001)
	R ²	0.08	0.14	0.05	0.05	0.4	0.55	0.39	0.48	0.42	0.48
Brazil	Δ GDP	0.835*** (0.063)	1.081*** (0.076)	0.168 (0.118)	0.784*** (0.100)	0.0004 (0.0003)	0.752*** (0.047)	0.895*** (0.087)	0.102 (0.072)	0.929*** (0.051)	-0.002*** (0.0002)
308 observations	R ²	0.15	0.14	0.02	0.12	0.6	0.35	0.23	0.27	0.44	0.66
26 states	Positive shock	1.049*** (0.110)	1.422*** (0.130)	0.533*** (0.191)	0.825*** (0.153)	-0.003*** (0.000)	0.774*** (0.085)	1.121*** (0.142)	0.203 (0.126)	0.901*** (0.088)	-0.0005 (0.0003)
	Negative shock	0.635*** (0.111)	0.756*** (0.150)	-0.169 (0.196)	0.743*** (0.168)	0.004*** (0.0005)	0.730*** (0.084)	0.661*** (0.164)	0.006 (0.133)	0.957*** (0.089)	-0.003*** (0.0004)
	R ²	0.16	0.14	0.02	0.12	0.6	0.35	0.23	0.27	0.44	0.66
India	Δ GDP	0.182*** (0.017)	0.279*** (0.029)	0.527* (0.276)	0.118*** (0.023)	-0.0002*** (0.0001)	0.198*** (0.020)	0.314*** (0.033)	0.454 (0.292)	0.129*** (0.027)	0.001*** (0.0003)
258 observations	R ²	0.03	0.03	0.02	0.02	0.13	0.1	0.12	0.22	0.13	0.65
14 states	Positive shock	0.209*** (0.035)	0.181*** (0.048)	0.791 (0.503)	-0.131*** (0.041)	0.004*** (0.0001)	0.175*** (0.038)	0.235*** (0.050)	0.093 (0.542)	-0.152*** (0.048)	0.003*** (0.0001)
	Negative shock	0.151*** (0.032)	0.393*** (0.061)	0.219 (0.524)	0.414*** (0.045)	-0.005*** (0.0001)	0.225*** (0.036)	0.402*** (0.065)	0.843* (0.506)	0.441*** (0.048)	-0.0003*** (0.0001)
	R ²	0.03	0.04	0.02	0.03	0.15	0.1	0.12	0.22	0.14	0.65
Australia	Δ GDP	0.767*** (0.025)	1.773*** (0.112)	-0.541*** (0.145)	0.116 (0.086)	0.226*** (0.012)	0.792*** (0.036)	1.235*** (0.088)	0.416*** (0.052)	-0.314*** (0.073)	0.198*** (0.018)
77 observations	R ²	0.3	0.33	0.04	0.05	0.26	0.47	0.69	0.86	0.44	0.39
7 states	Positive shock	1.132*** (0.045)	1.854*** (0.202)	-0.058 (0.258)	0.930*** (0.160)	0.059** (0.030)	0.857*** (0.057)	1.256*** (0.145)	0.102 (0.067)	-0.884*** (0.138)	-0.002 (0.036)
	Negative shock	0.452*** (0.043)	1.702*** (0.215)	-0.951*** (0.254)	-0.557*** (0.137)	0.372*** (0.026)	0.719*** (0.080)	1.214*** (0.166)	0.754*** (0.112)	0.254* (0.141)	0.406*** (0.038)
	R ²	0.31	0.33	0.05	0.07	0.27	0.47	0.69	0.87	0.45	0.39

APPENDIX B: *Continued*

		Without year dummies				Including year dummies					
		Revenue	Own-source revenue	Grants	Expenditures	Surplus	Revenue	Own-source revenue	Grants	Expenditures	Surplus
Germany	Δ GDP	0.739*** (0.028)	0.305*** (0.031)	0.185** (0.083)	0.239*** (0.021)	0.172*** (0.011)	0.411*** (0.018)	0.544*** (0.029)	-0.506*** (0.154)	0.489*** (0.027)	0.018 (0.016)
206 observations	R ²	0.26	0.08	0.05	0.05	0.67	0.71	0.64	0.26	0.36	0.77
10 Länder	Positive shock	0.638*** (0.053)	0.057 (0.058)	0.368** (0.183)	0.256*** (0.041)	0.071*** (0.020)	0.289*** (0.030)	0.578*** (0.046)	0.174 (0.280)	0.489*** (0.042)	0.138*** (0.022)
	Negative shock	0.819*** (0.043)	0.464*** (0.045)	0.044 (0.142)	0.225*** (0.034)	0.253*** (0.017)	0.501*** (0.027)	0.504*** (0.047)	-0.960*** (0.220)	0.490*** (0.037)	-0.082 (0.023)
	R ²	0.26	0.1	0.05	0.05	0.67	0.71	0.64	0.26	0.36	0.77
Canada	Δ GDP	0.263*** (0.029)	0.305*** (0.031)	0.158*** (0.053)	-0.011 (0.031)	0.159*** (0.005)	0.423*** (0.022)	0.544*** (0.029)	-0.044 (0.056)	0.034 (0.025)	0.179*** (0.011)
290 observations	R ²	0.07	0.08	0.01	0.01	0.31	0.71	0.64	0.47	0.58	0.49
10 provinces	Positive shock	0.007 (0.053)	0.057 (0.058)	-0.121 (0.093)	0.056 (0.057)	0.145*** (0.011)	0.457*** (0.033)	0.578*** (0.046)	0.031 (0.090)	0.349*** (0.039)	0.156*** (0.017)
	Negative shock	0.428*** (0.043)	0.464*** (0.045)	0.348*** (0.081)	-0.055 (0.048)	0.168*** (0.008)	0.382*** (0.037)	0.504*** (0.047)	-0.131 (0.093)	-0.328*** (0.041)	0.207*** (0.018)
	R ²	0.09	0.1	0.02	0.01	0.31	0.71	0.64	0.47	0.6	0.49
USA	Δ GDP	0.486*** (0.013)	0.551*** (0.014)	0.214*** (0.049)	0.171*** (0.015)	0.092*** (0.001)	0.372*** (0.011)	0.511*** (0.016)	-0.076*** (0.020)	0.179*** (0.011)	0.093*** (0.001)
980 observations	R ²	0.17	0.18	0.02	0.04	0.46	0.32	0.28	0.41	0.23	0.5
49 states	Positive shock	0.518*** (0.024)	0.734*** (0.026)	-0.147* (0.088)	0.175*** (0.029)	0.119*** (0.002)	0.395*** (0.019)	0.546*** (0.026)	-0.084*** (0.040)	0.310*** (0.021)	0.124*** (0.002)
	Negative shock	0.461*** (0.020)	0.409*** (0.023)	0.497*** (0.079)	0.168*** (0.025)	0.071*** (0.002)	0.353*** (0.017)	0.482*** (0.024)	-0.069*** (0.033)	0.071*** (0.017)	0.068*** (0.002)
	R ²	0.17	0.18	0.03	0.04	0.46	0.32	0.28	0.41	0.24	0.5

Note: ***0.01; **0.05; *0.1.

The dependent variable in each model is the first difference of the logged real per capita budget item specified in each column.

The independent variable in the first model for each country is the deviation from the province's average first difference of logged real GDP per capita.

The second model for each country differentiates between positive and negative deviations from the provincial average first difference.

All models include province fixed effects.

Panel-corrected standard errors are in parentheses.

This appendix reports results of weighted least squares regressions, where each province is weighted by the provincial average of the squared residuals from the regressions reported in Appendix A.

APPENDIX C: DATA SOURCES

Argentina: Fiscal data and gross provincial product are from the Ministry of Economy, Subsecretary of Regional Programming, adjusted for inflation using the CPI developed by Sanguinetti and Tommasi (1997). Provincial population data are from the National Institute of Statistics and Census.

Australia: Fiscal data are from Australian Bureau of Statistics, Government Finance Statistics State government series, adjusted for inflation using the CPI of the largest city in the state (produced by ABS). GSP and population data are from ABS state accounts. All data were obtained directly from the ABS.

Brazil: Fiscal data were obtained directly from the Ministry of Finance: Ministério da Fazenda, Secretaria do Tesouro Nacional, Coordenação-Geral das Relações e Análise Financeira de Estados e Municípios. Inflation adjustment was conducted using the INPC deflator prepared by IBGE, Diretoria de Pesquisas, Departamento de Índices de Preços. Population and GSP are from IBGE, Diretoria de Pesquisas, Departamento de Contas Nacionais, Contas Regionais do Brasil, microdados.

Canada: All data are from Statistics Canada, CANSIM series, deflated using provincial-level CPI.

Germany: Fiscal data are from the *Statistisches Bundesamt*, accessed from <http://www.statistik-bund.de> (no longer in service, replaced by <http://www.destatis.de>). Land-level GDP, population, and Land-specific deflators were provided directly by the Baden-Württemberg Ministry of Finance.

India: Population and inflation-adjusted fiscal data were kindly provided by Shahrokh Fardoust at the World Bank. Inflation-adjusted gross state domestic product data were obtained from the Reserve Bank of India.

The United States: Fiscal and population data were obtained directly from the Census Department. Fiscal data were adjusted for inflation with the national CPI produced by the U.S. Department of Commerce, Bureau of Economic Analysis (BEA). CPI and GSP were obtained from the BEA web page: <http://www.bea.gov>.

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