

Fiscal Decentralization and the Business Cycle: An Empirical Study of Seven Federations

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Though fiscal policies of central governments sometimes provide modest insurance against regional income shocks, this paper shows that pro-cyclical 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 highly pro-cyclical and contrary to common wisdom, revenue-sharing and discretionary transfers are either acyclical or pro-cyclical. Constituent governments are thus left alone to smooth their own shocks, even though various restraints on borrowing and saving undermine their ability to do so. The resulting pro-cyclicity of provincial fiscal policy is likely to have important implications in a world where considerable fiscal responsibilities are being devolved to subnational governments.

The 2002 U.S. recession was accompanied by a pattern that has become quite familiar: many state and local governments cut social services and shed social workers, teachers, and police officers. While the federal government justified large national deficits with the logic of counter-cyclical Keynesian demand management, state governments partially undermined the potential stimulus with tax increases and expenditure cuts. Only a few years earlier, the states were rapidly expanding their expenditures in conjunction with an unprecedented boom. 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 multi-tiered fiscal systems is a key policy issue in the European Union 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 the opposite direction, especially as central government 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.

This paper sets out to fill a rather large hole in the literature by providing basic facts about comparative subnational fiscal policy. Are pro-cyclical 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? 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. Though a handful of case studies examine the

cyclicality 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 truly 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 multi-tiered systems, and because they exhibit analytically useful institutional variation.

Above all, we confirm that expenditures of constituent units in federations are indeed pro-cyclical 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 pro-cyclical 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 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 pro-cyclicality 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 inter-personal 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 counter-cyclical 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 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 surpluses and credit constraints 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 the presence of fiscal constraints. 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 pro-cyclical—especially in developing federations. A normative assessment of this situation lies beyond the scope of this paper. However, voters in many wealthy countries—especially those in the European Union—have become accustomed to counter-cyclical social expenditures during the post-World War II era. Many of these countries are decentralizing the provision of social expenditures, and some of them are strengthening restrictions on subnational access to credit markets. Under such conditions, fiscal decentralization is likely to undermine the role of government fiscal policy as a shock absorber.

The first 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 next three sections each pursue a different econometric approach to subnational cyclicity across countries, and the final section discusses the results and extracts policy implications.

I. 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. Yet there are more striking cross-country differences 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 European Union countries (Arreaza, Sorensen, and Yosha 1999, Talvi and Vegh 2000, Hallerberg and Strauch 2002). Thus, to differing degrees many (though 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 pro-cyclical as revenues. The lack of smoothing in developing countries has been attributed to credit constraints during bad times (Aizenman, Gavin and Hausmann 1996, Gavin and Perotti 1997a, 1997b; Wibbels 2006) and political obstacles to running surpluses during good times (Tornell and Lane 1999, Talvi and Vegh 2000).

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, pro-cyclical 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 counter-cyclical fiscal policy aids growth because research and development expenditures are the first to be cut in recessions. European 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 multi-tiered 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 (Velasco 2000; Treisman 2000). Nevertheless, no comparative research has examined the role of subnational budget cyclicality as a potential contributor to those coordination problems. Third, despite automatic fiscal stabilizers commonly built into national fiscal policy among EU member states (van den Noord 2000; Brunila, Buti, and in 't Veld 2002), 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 pro-cyclical thanks to sensitive subnational tax base, intergovernmental grants that are sensitive to fluctuations in the national tax base, and impediments to borrowing and saving.

The pro-cyclicality of provincial revenues

At any level of government, revenue will be positively correlated with the business cycle unless income inelastic taxes are available, such as those on property or the sales of food. Even at the national level in the wealthiest of countries, where governments have broad tax bases, the evidence suggests that revenues are always pro-cyclical. Like central governments, regional governments in federations generally rely on tax flows that are highly correlated with income: taxes on personal and corporate income, sales and turnover, and payroll.

In most federations, moreover, there are reasons to suspect that the tax bases of provincial governments are even more sensitive to the business cycle than those of the center. First, provincial governments may be subject to tax competition among regions that constrains the capacity of subnational governments to raise sufficient funds to generate enough savings to combat economic downturns (Norregaard 1997). Moreover, as the normative public economics literature (e.g. Oates 1972) points out, economies of scale in tax collection and redistributive

considerations often require that central governments collect the most important taxes. As a result, provinces frequently have limited revenue streams at their disposal. The taxes they do control, moreover, tend to be highly responsive to the business cycle. While local authorities often have access to relatively income inelastic property taxes, regional officials are left with income, sales, and in some cases, rollover taxes. Thus we expect to find, quite simply, that countries whose provinces are dependent on narrow and income-elastic tax bases will display greater pro-cyclicality.

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 (see below). In both the United States and Canada, provincial governments have depended for decades upon income and sales taxes for own-source revenue (in addition to a provincial VAT 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 pro-cyclical 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 rollover tax, and Brazil’s states depend heavily on a form of value-added tax (the ICMS).

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 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 UK, France, and Italy act to smooth out asymmetric regional shocks. These studies focus on the difference between market (prior to federal tax-transfer) and disposable income, discovering that federal policy provides a modest boost to personal incomes in regions suffering from asymmetric shocks.²

These studies say nothing, however, about the second type of central government stabilization. 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 inter-governmental transfers that is markedly counter-cyclical to prevent provincially-provided expenditures from vacillating with the business cycle. For instance, Rattsø (2004) shows that the Norwegian central government essentially borrows on behalf of local governments during downturns, and provides grants that assure constant local revenue growth in spite of local output fluctuations. In the context of the EU, some have assumed that national transfers do indeed serve to insulate subnational budgets from income shocks. Balassone, Fabrizio, and Franco (2002: 32), for instance, suggest that “while

² The most influential paper is Sachs and Sala-i-Martin’s (1992) study of the United States. Subsequent studies include von Hagen (1992), Melitz and Zumer (1998), Bayoumi and Masson (1995), Obstfeld and Peri (1998), Sorensen and Yosha (1997), van Wincoop (1995), and Brunila, Buti, and in ‘t Veld (2002). Kletzer and von Hagen (2000) provide a literature review.

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, 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 pro-cyclicality of provincial revenues. Sorensen, Wu, and Yosha (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 pro-cyclical (Seitz 2000; von Hagen and Hepp 2001). 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 counter-cyclical fiscal policy and a substantial share of total expenditures are 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 pro-cyclical, 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 use 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 Rattsø's (2004) characterization of Norway. This seems to be a sustainable political equilibrium in the centralized, 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 counter-cyclical 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.³ 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

³ There is yet another reason to expect pro-cyclical grants. Some countries use matching 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. Though 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 provinces are forced to make cuts in these areas.

counteract output shocks. The closest thing to an independent agency with a counter-cyclical mandate is the Commonwealth Grants Commission in Australia.

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- or centrally-imposed rules place limitations on borrowing. 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, Sorensen, and Yosha 1996, Sorensen, Wu, and Yosha 2001, Sorensen and Yosha 1999). The main finding, replicated below, is that expenditures and revenues are both pro-cyclical, but expenditures are significantly less pro-cyclical 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 two 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 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 (Rodden 2006). But unlike the U.S. states, during the period under analysis,

the Canadian provinces had no self-imposed restrictions on borrowing.⁵ 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 considerable access to credit through the *Landesbanks* that they indirectly control, and are free of central restrictions on their authority to issue bonds. The constitutions of the German states impose a “golden rule” that requires them to borrow only for capital expenditures, though 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 2007).

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, though 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,

⁵ A few provinces have adopted such restrictions very recently, but this lies beyond the scope of the paper.

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. Though explicit bailouts like 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), though 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, though enforcement was quite poor throughout the 80s and 90s, 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 90s 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 pro-cyclical 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 developing countries, the

“credit crunch” hypothesis is arguably even more applicable at the subnational level than at the center, and in all three of these federations, even the most well-run state or provincial governments have faced higher interest rates than the central government.

Moreover, if the voracity hypothesis has any merit, it should show up in the Indian states, Argentine provinces, and Brazilian states, where personnel expenditures make up a large share 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.

Empirical expectations

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

II. A Static Approach

We have collected yearly data on revenues, expenditures, deficits, and gross state product 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.⁸ 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.⁹ 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 1990.¹⁰

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 post-estimation 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.¹¹ 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 city-states of Bremen and Hamburg from the German regressions.

⁸ The 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.

⁹ In 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.

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

¹¹ When Alaska and NT are included, the pro-cyclicality of both revenues and expenditures is more pronounced.

A more systematic way of dealing with influential outliers like Wyoming is to follow the weighting technique of Sorensen, Wu, and Yosha (2001), who conduct a first-stage regression of budget items on the cyclical component of 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 2. It produces very similar point estimates, though of course the standard errors are much smaller.

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 component, and gross state product 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, 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. Talvi and Vegh 2000, Persson and Tabellini 2003, Hallerberg and Strauch 2002). 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.¹²

We adopt the more straightforward approach of Sorensen, Wu, and Yosha (2001), defining output fluctuations as yearly deviations from the province's average change in logged GDP per capita over the entire time period.¹³ 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.

[FIGURE 1 HERE]

Regression output is presented in Appendix 1, but the results are best digested by looking at Figure 1, which plots the point estimate and the 95 percent confidence interval for each budget item in each country. For each revenue item and for expenditures, a positive coefficient represents a positive, or pro-cyclical, correlation with the cyclical component of gross state product. However for the surplus, a positive coefficient reveals that governments increase the

¹² For a discussion of the sensitivity of business cycle analysis to detrending techniques, see Canova (1998).

¹³ We have also obtained broadly similar results with other techniques, such as defining the trend with a simple autoregressive model or the band-pass filter.

surplus during good times and/or decrease it (enlarge the deficit) during bad times, which is consistent with counter-cyclical borrowing and saving.

As expected, the first panel of Figure 1 reveals that overall provincial revenues are highly pro-cyclical in all federations. The interpretation of the point estimates is that a one percent increase in GDP per capita, in a Brazilian state for example, is associated with .82 percent increase in state revenue. The coefficient is in the range of .3 to .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, though the size of the effect diminishes in a couple of cases.¹⁴

The next panel reveals that these large coefficients are driven primarily by highly pro-cyclical own-source revenues, which are in each case more income elastic than overall revenues. In fact, the coefficients approach or surpass one 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, though most do reach statistical significance in the weighted models in the appendix. The only country where grants appear to respond in a counter-cyclical fashion to output fluctuations is Australia, which does not attain statistical significance in the Model presented in Figure 1, though it does in the weighted model in the appendix.

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. Though not quite significant in Figure 1, both are significant in the weighted model. This replicates the finding of Sorensen, Wu, and Yosha (2001). A similar downward shift in the point estimates when going from a model emphasizing symmetric shocks to one emphasizing 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 towards states suffering from asymmetric negative shocks. However, this does not help combat the overall pro-cyclicality 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 Grants Commission increases overall allocations during national downturns, but these do not flow disproportionately to affected states during asymmetric downturns.

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

¹⁴ Note that in the weighted models in the appendix, all of the coefficients are positive and significant.

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 pro-cyclicality of expenditures is much smaller than that of revenues, but only in Australia and Canada is the pro-cyclicality 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.¹⁸ 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 when contrasted with their counterparts in other wealthy federations. The coefficients for the German, Canadian, and Australian regional governments approach those obtained in similar studies of EU central government deficits (e.g. .36 in Hallerberg and Strauch 2002).

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 data sets and look for subsets of states or provinces that display counter-cyclical behavior, we obtain very similar results. Though much has been written about the role of soft budget constraints and bailouts in these cases, which one might expect would allow for counter-cyclical 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 Vegh (2000) and Tornell and Lane (1999), overall volatility is much greater in these

¹⁸ The 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.

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.

III. 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 counter-cyclical after all when negative shocks are distinguished from positive.

According to research by Gavin and Perotti (1997), 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 counter-cyclical 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 (1977) 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 recessions. This is closely related to the voracity effect, 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 those where it is below zero (“negative shock”). The positive shock variable is 0 for all years in which income falls below average, and the negative shock variable is 0 for all years when it is above average. We use the same estimation techniques as above. Figure 2 presents the point estimates and 95 percent confidence intervals. Note that for the negative shocks, a positive coefficient of 1 would indicate that a one percent decrease in GDP change (relative to the provincial average) is associated with a one percent *decrease* in the real per capita budget item.

[FIGURE 2 HERE]

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.

The correlation of grants with output fluctuations is relatively symmetric in most cases, although in Brazil and India, if anything, the pro-cyclicality of grants is driven disproportionately by growth during good times. Inspection of Figure 2, along with the graphs for the weighted models in the appendix, 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 Grants Commission 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 pro-cyclical grants in Table 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 of all, 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, though the difference is small and in some alternative specifications, not statistically significant.

For the German *Länder* and Australian states, however, the pattern is quite different. These governments are much more inclined to borrow during downturns than to save during good times. In Australia, when hit with a negative GDP shock of one percent, revenues decline by .5 percent, but expenditures actually *increase* in counter-cyclical fashion by .5 percent. The states do generate surpluses during good times, but this effect is significantly smaller. A one percent increase in GDP relative to the state average is associated with slightly more than a one percent increase in revenues, while yielding an expenditure increase of .6 percent. In Germany, a one

percent negative shock is associated with a corresponding one percent drop in revenue, while expenditures decrease by only .15. During good times, a one percent increase in growth yields a .5 percent increase in revenue and a .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 (1977), 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. Relative to Canada and the United States, regional governments in Australia and Germany are much less dependent on own-source taxation, and the center is more explicitly committed to guaranteeing similar service provision throughout the federation and intervening in subnational budget decisions. 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 take some comfort in the central government's deep pockets and commitment to equity, believing that enhanced assistance in the future is likely if debt burdens grow too large, and perhaps also believing that grants and shared revenues are likely to grow in the future because of strong representation of the state governments in federal institutions (e.g. the German *Bundesrat* and Australian intergovernmental bodies).

The key results of these two sections are easily summarized. There are very few negative coefficients for expenditure and revenue items. Pro-cyclicality is the rule among provinces and states in federations. Own-source and total revenues are always highly pro-cyclical. Grants show fleeting evidence of playing an inter-regional 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 pro-cyclical. 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.

IV. 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, Wu, and Yosha 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 gross state product per capita and four lags. The models also include a panel of dummies for fixed provincial effects, but do not include year dummies.²⁰ 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 percent permanent increase in GSP on the budget components over the five-year period.²¹ 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 HERE]

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 increases (decrease) in provincial income. In no case does either budget category revert to the original value by the end of the period.

This broad similarity aside, the graphs show countries that follow one of two patterns. In the first, which include 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, though 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 U.S., expenditures draw near revenues after four years. In Canada and the U.S., the fiscal response is quite slow and smooth, occurring gradually over the course of the

²⁰ The 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.

²¹ The 1 percent was calculated as a share of average provincial GDP for the most recent year available. For instance, in the U.S., the average state GSP in 1997 (the most recent in our data set) was \$29,123.09. A one percent increase in this case amounts to \$291.23 To generate the graphs we calculate the accumulated

entire five-year period. In Australia, on the other hand, spending reacts sharply in the second year after the increase in GSP, returning quickly to balanced budgets.

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 U.S., 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.

V. Conclusions

Subnational finance in several of the world's most decentralized federations is overwhelmingly pro-cyclical. Given the near universal pro-cyclicality of revenues and expenditures and the lack of intergovernmental grants with insurance effects, it appears that the recession-induced tax increases and expenditure cuts of U.S. state governments are the rule rather than the exception. And while the constituent governments in the OECD federations analyzed here do show signs of responding to negative shocks with increased budget deficits, in no case does this clearly translate into counter-cyclical expenditures. In most federations, it would seem that provincial fiscal policy is often pro-cyclical by design, raising questions about the capacity of

predicted value of the budget component on the basis of the coefficients from the regression of the budget category on GSP and four lags.

general governments to combat the business cycle in decentralized multi-tiered fiscal systems. Particularly where provincial governments are responsible for social policies and poverty alleviation programs, for which demand increases during bad times, this has implications for the poor and unemployed.

Moreover, despite the normative fiscal federalism literature and possible misinterpretations of recent empirical literature, there is very little evidence that federal governments use intergovernmental grants to smooth regional economic shocks. In fact, in many cases, when common shocks are allowed to affect the results, grants are positively associated with the budget cycle.

These findings have implications for ongoing debates in the European Union. Key characteristics of several of the more decentralized member states suggest that the levels of pro-cyclicality 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 pro-cyclical 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. There are no reasons to expect central government grants 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. Even among local governments in Finland, France, and Austria, extensive expenditure decentralization is financed in large part through intergovernmental grants over which the central government has considerable discretion.

In rapidly decentralizing developing countries as well, it is plausible that decentralization will heighten overall pro-cyclicality, 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 on such programs are likely to suffer during recessions.

Potential steps to dampen the pro-cyclicality 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, as in Australia, and creating incentives for subnational governments to save during good times. This paper demonstrated, however, that for the most part, the 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 enjoyed by the Canadian provinces is increasingly rare. 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 understandable responses to a basic moral hazard problem (Rodden 2006).

To the extent that decentralization is funded by intergovernmental grants that move with the business cycle, which in turn encourage central governments to clamp down on subnational borrowing, pro-cyclical 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. For those who are convinced by the normative case for government fiscal stabilization, this paper provides a new perspective on debates about the costs and benefits of fiscal decentralization.

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Figure 1: Elasticity of Budget Items

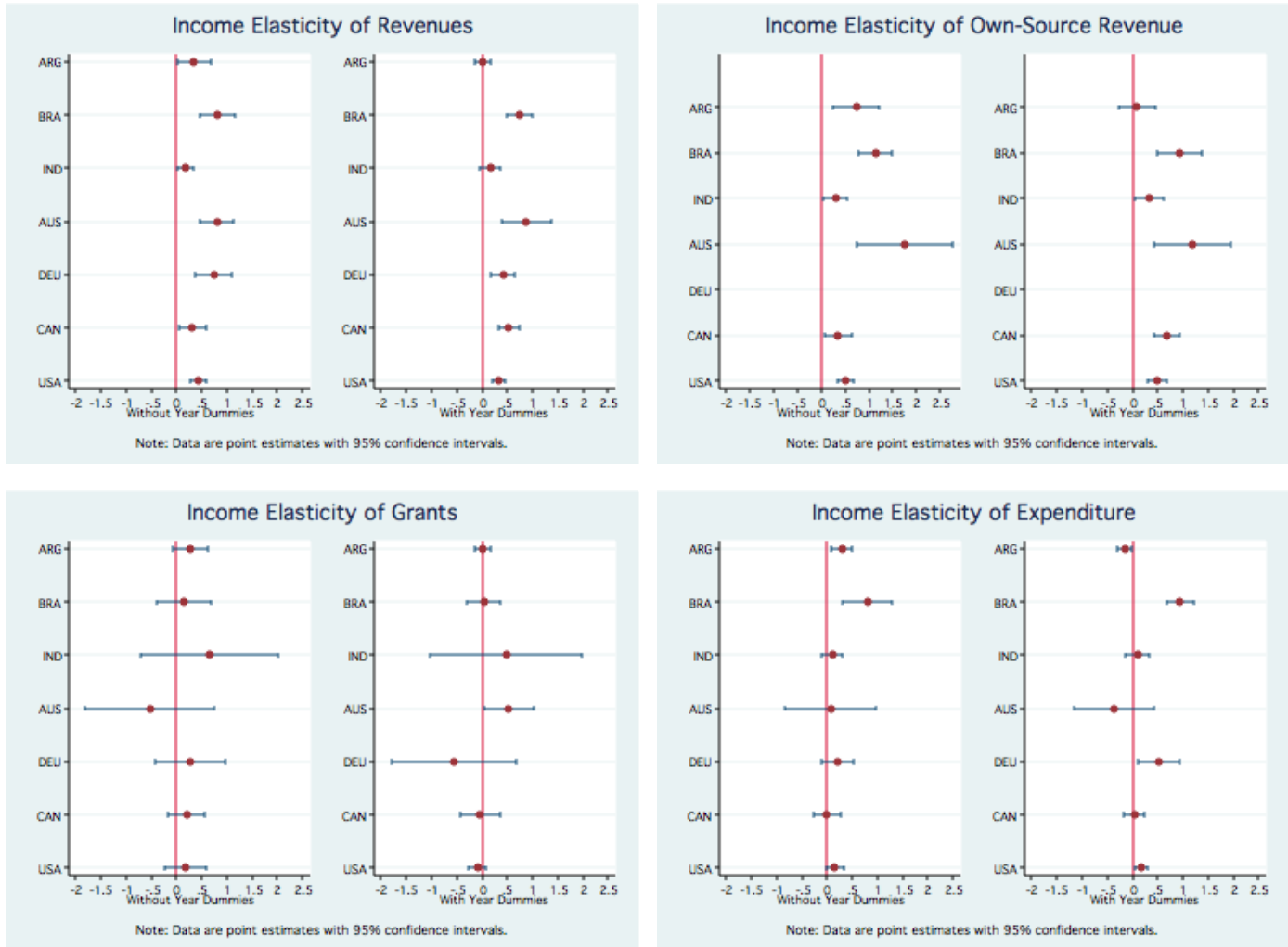


Figure 1, cont.

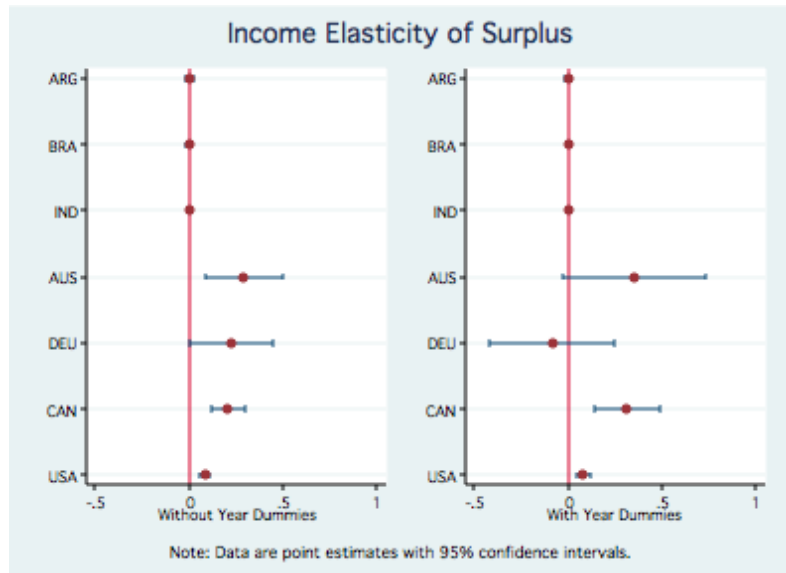


Figure 2: Elasticity of Budget Items, distinguishing between positive and negative shocks

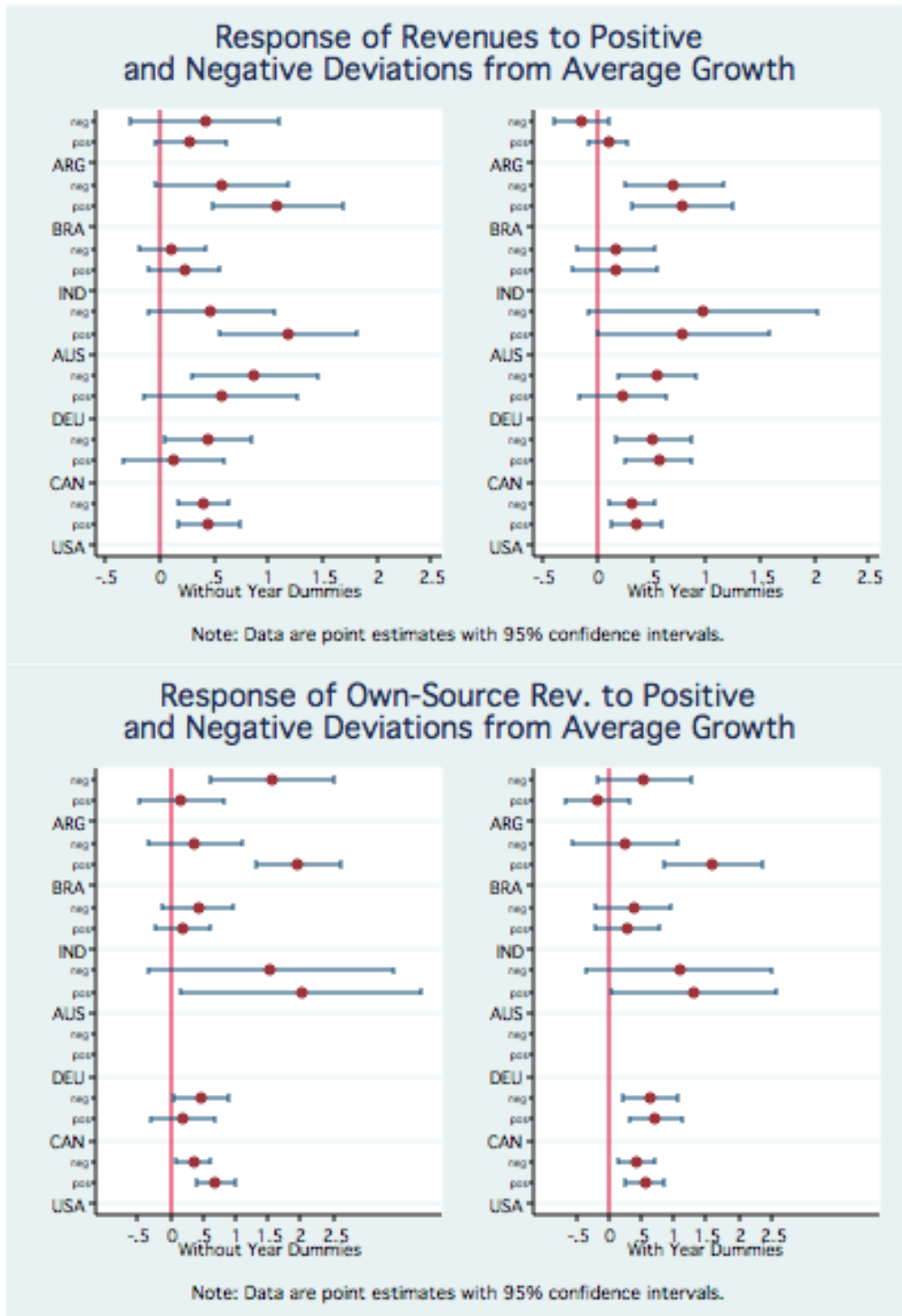


Figure 2, cont.

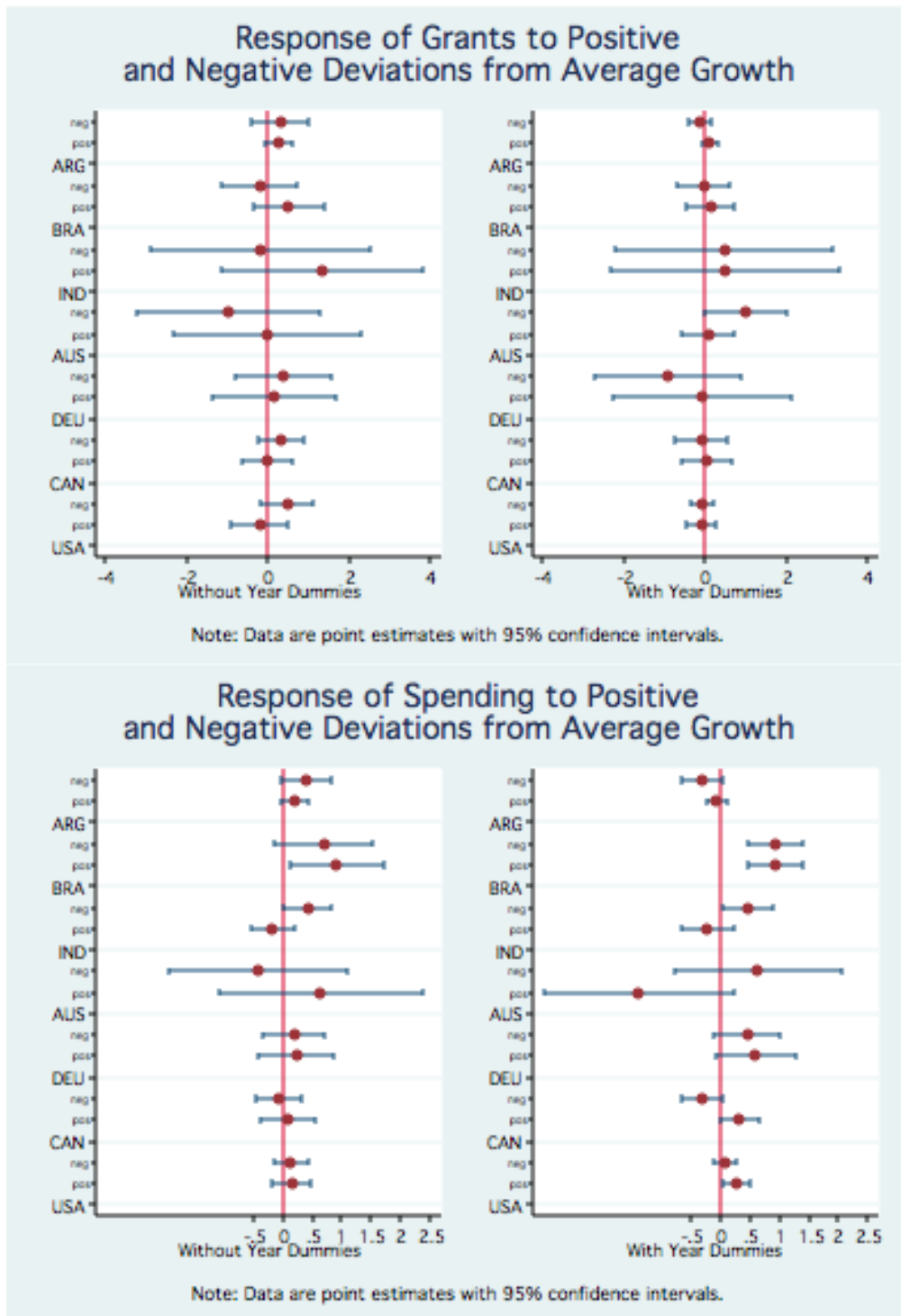


Figure 2, cont.

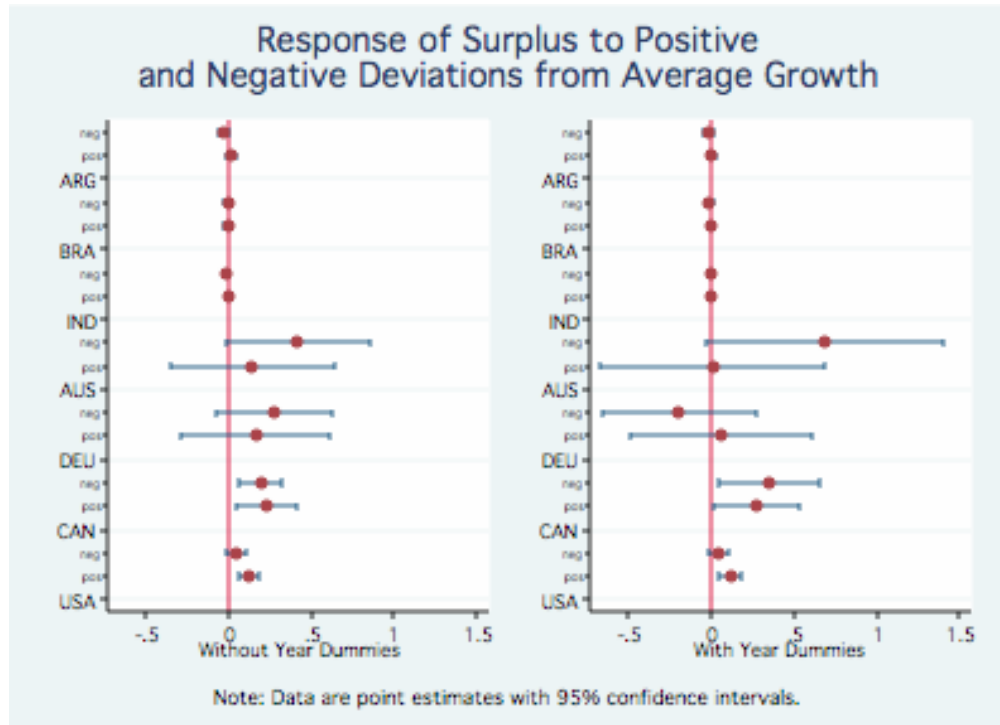


Figure 3: Budget responses to increasing output

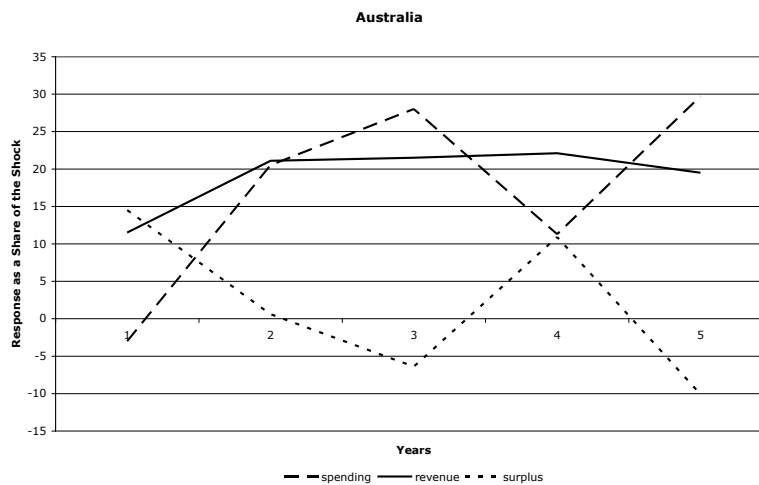
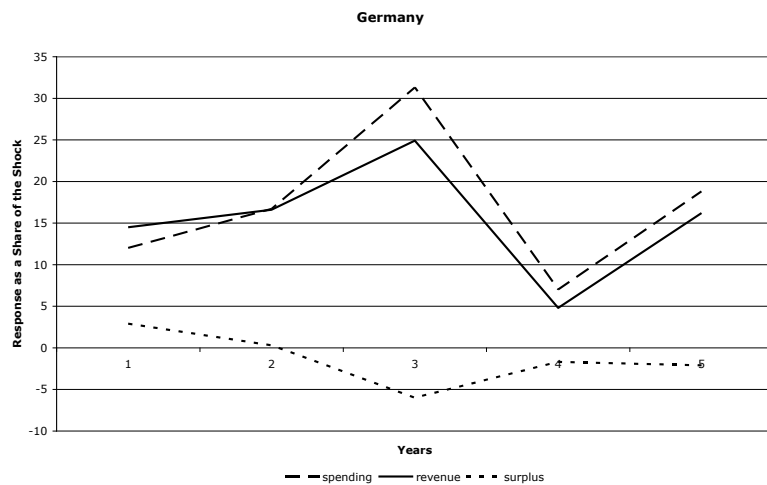
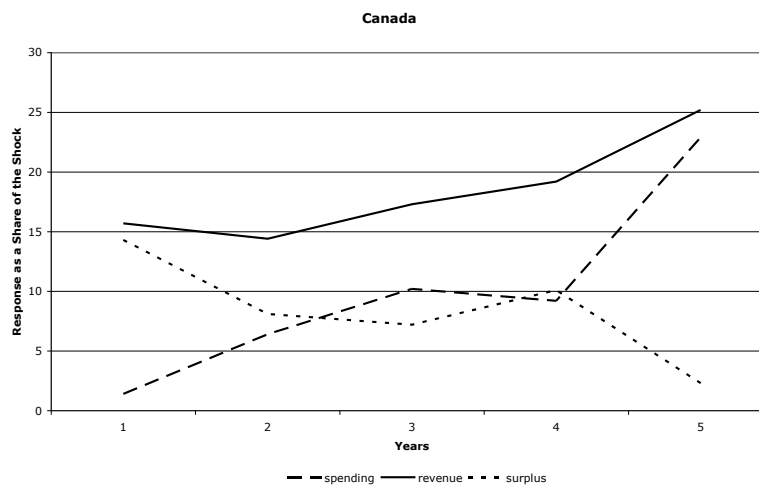
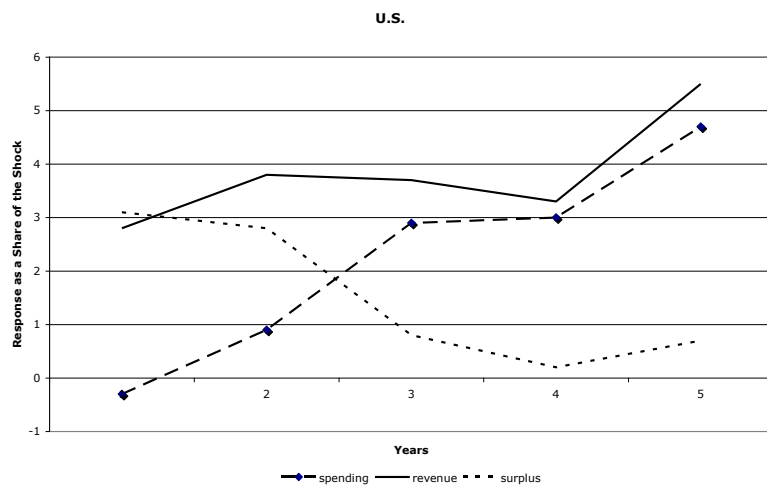
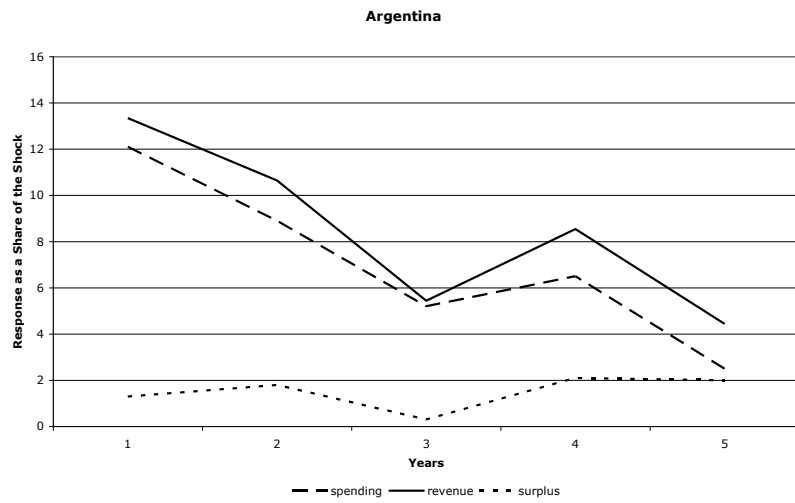
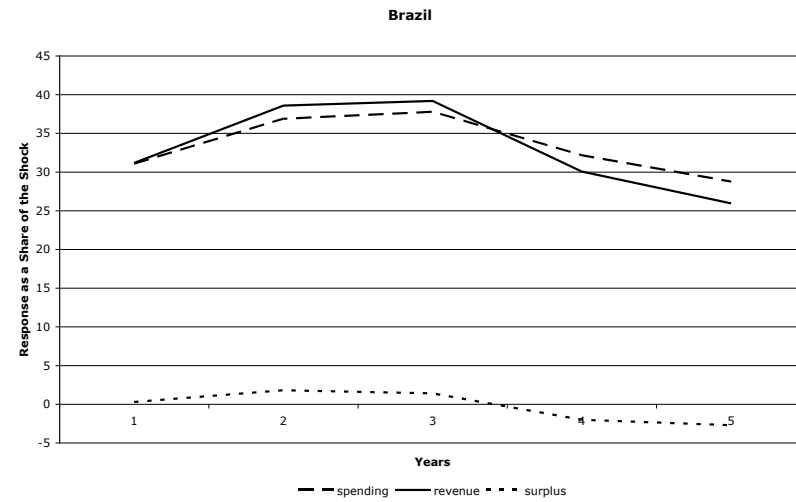
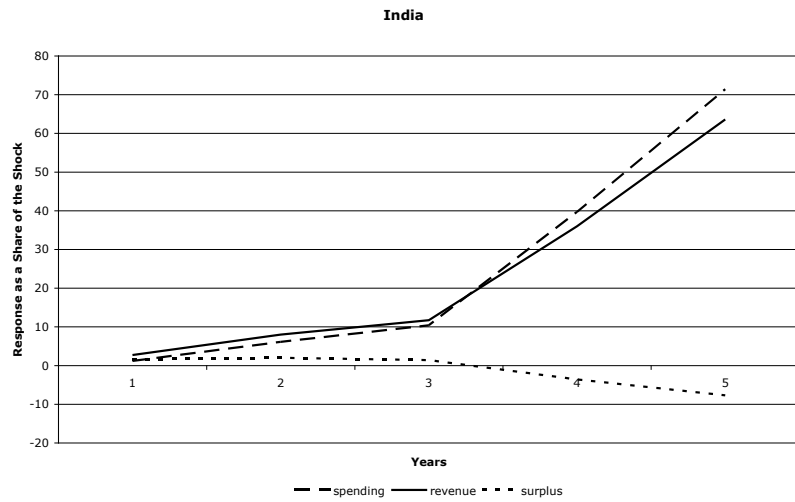


Figure 3a, cont.:



Appendix 1: 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 observ. 23 provinces	Δ GDP	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)	-0.147** (0.072)	0.000 (0.008)
	R square	0.06	0.07	0.04	0.04	0.37	0.54	0.34	0.5	0.41	0.48
	Pos Shock	0.287* (0.163)	0.171 (0.326)	0.269 (0.171)	0.210* (0.117)	0.021 (0.014)	0.099 (0.091)	-0.171 (0.256)	0.102 (0.103)	-0.057 (0.093)	0.009 (0.010)
	Neg shock	0.415 (0.352)	1.565*** (0.492)	0.300 (0.360)	0.407* (0.221)	-0.024 (0.015)	-0.144 (0.130)	0.552 (0.366)	-0.137 (0.155)	-0.312* (0.183)	-0.016 (0.015)
	R square	0.06	0.09	0.04	0.04	0.38	0.54	0.35	0.5	0.42	0.49
Brazil 308 observ. 26 states	Δ GDP	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)
	R square	0.13	0.13	0.02	0.12	0.67	0.34	0.22	0.22	0.42	0.73
	Pos Shock	1.085*** (0.309)	1.962*** (0.334)	0.518 (0.438)	0.912** (0.407)	0.000 (0.011)	0.783*** (0.240)	1.608*** (0.383)	0.133 (0.308)	0.934*** (0.239)	0.003 (0.009)
	Neg shock	0.568* (0.311)	0.379 (0.372)	-0.205 (0.466)	0.692 (0.433)	0.003 (0.012)	0.706*** (0.234)	0.260 (0.411)	-0.043 (0.335)	0.948*** (0.238)	-0.007 (0.009)
	R square	0.14	0.15	0.02	0.12	0.67	0.34	0.23	0.22	0.42	0.73
India 258 observ. 14 states	Δ GDP	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)
	R square	0.02	0.03	0.03	0.01	0.13	0.1	0.13	0.2	0.12	0.66
	Pos Shock	0.232 (0.167)	0.205 (0.217)	1.364 (1.265)	-0.165 (0.183)	0.005 (0.004)	0.164 (0.201)	0.290 (0.244)	0.500 (1.441)	-0.216 (0.227)	0.003 (0.002)
	Neg shock	0.116 (0.158)	0.424 (0.277)	-0.190 (1.385)	0.421** (0.199)	-0.006* (0.003)	0.170 (0.181)	0.381 (0.302)	0.463 (1.359)	0.457** (0.217)	-0.000 (0.002)
	R square	0.02	0.03	0.03	0.02	0.15	0.1	0.13	0.2	0.13	0.66
Australia 77 observ. 7 states	Δ GDP	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)	0.351* (0.192)
	R square	0.27	0.32	0.04	0.03	0.31	0.44	0.7	0.85	0.4	0.39
	Pos Shock	1.184*** (0.320)	2.008** (0.941)	-0.013 (1.190)	0.642 (0.882)	0.148 (0.256)	0.790* (0.404)	1.310** (0.653)	0.066 (0.321)	-1.372* (0.813)	0.013 (0.344)
	Neg shock	0.472 (0.299)	1.544 (0.963)	-0.971 (1.156)	-0.407 (0.776)	0.419* (0.220)	0.973* (0.541)	1.089 (0.724)	0.999* (0.526)	0.629 (0.721)	0.689* (0.366)
	R square	0.29	0.32	0.05	0.04	0.31	0.44	0.7	0.85	0.42	0.4
Germany 206 observ. 10 Länder	Δ GDP	0.735*** (0.192)		0.273 (0.360)	0.211 (0.162)	0.229** (0.112)	0.413*** (0.125)		-0.563 (0.628)	0.520** (0.208)	-0.086 (0.170)
	R square	0.25		0.07	0.04	0.7	0.71		0.26	0.34	0.78
	Pos Shock	0.567 (0.364)		0.146 (0.775)	0.238 (0.325)	0.169 (0.231)	0.237 (0.206)		-0.060 (1.118)	0.603* (0.342)	0.060 (0.282)
	Neg shock	0.871*** (0.297)		0.376 (0.614)	0.188 (0.273)	0.278 (0.176)	0.541*** (0.185)		-0.927 (0.919)	0.461 (0.289)	-0.192 (0.239)
	R square	0.25		0.07	0.04	0.7	0.71		0.26	0.34	0.78
Canada 290 observ. 10 provinces	Δ GDP	0.316** (0.135)	0.358** (0.140)	0.201 (0.183)	-0.001 (0.133)	0.210** (0.046)	0.538*** (0.102)	0.683*** (0.130)	-0.032 (0.203)	0.036 (0.107)	0.313*** (0.088)
	R square	0.09	0.1	0.02	0.01	0.3	0.7	0.63	0.45	0.57	0.46
	Pos Shock	0.129 (0.241)	0.191 (0.255)	0.001 (0.323)	0.097 (0.234)	0.233*** (0.091)	0.560*** (0.155)	0.727*** (0.200)	0.031 (0.321)	0.328** (0.166)	0.279** (0.134)
	Neg shock	0.444** (0.202)	0.473** (0.208)	0.338 (0.280)	-0.068 (0.202)	0.195*** (0.066)	0.512*** (0.177)	0.632*** (0.211)	-0.106 (0.334)	-0.309* (0.176)	0.353** (0.152)
	R square	0.11	0.11	0.02	0.01	0.3	0.7	0.63	0.45	0.59	0.46
USA 980 observ. 49 states	Δ GDP	0.427*** (0.078)	0.503*** (0.086)	0.181 (0.205)	0.153* (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)
	R square	0.13	0.14	0.02	0.03	0.49	0.28	0.24	0.38	0.22	0.53
	Pos Shock	0.453*** (0.147)	0.696*** (0.156)	-0.207 (0.372)	0.161 (0.165)	0.127*** (0.031)	0.352*** (0.120)	0.554*** (0.157)	-0.099 (0.177)	0.279** (0.119)	0.120*** (0.035)
	Neg shock	0.407*** (0.122)	0.351** (0.138)	0.486 (0.334)	0.147 (0.145)	0.051* (0.028)	0.324*** (0.108)	0.441*** (0.147)	-0.091 (0.147)	0.075 (0.102)	0.047 (0.032)
	R square	0.13	0.15	0.02	0.03	0.49	0.28	0.24	0.38	0.23	0.53

note: .01 - ***; .05 - **; .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 2: Regression Results, weighted

		Without year dummies					Including year dummies				
		Revenue	Own-source revenue	Grants	Expenditures	Surplus	Revenue	Own-source revenue	Grants	Expenditures	Surplus
Argentina 289 observ. 23 provinces	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)
	R square	0.08	0.11	0.05	0.05	0.39	0.55	0.38	0.48	0.42	0.48
	Pos 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)
	Neg 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 square	0.08	0.14	0.05	0.05	0.4	0.55	0.39	0.48	0.42	0.48
Brazil 308 observ. 26 states	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)
	R square	0.15	0.14	0.02	0.12	0.6	0.35	0.23	0.27	0.44	0.66
	Pos 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)
	Neg 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 square	0.16	0.14	0.02	0.12	0.6	0.35	0.23	0.27	0.44	0.66
India 258 observ. 14 states	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*** (0.00003)
	R square	0.03	0.03	0.02	0.02	0.13	0.1	0.12	0.22	0.13	0.65
	Pos 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)
	Neg 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 square	0.03	0.04	0.02	0.03	0.15	0.1	0.12	0.22	0.14	0.65
Australia 77 observ. 7 states	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)
	R square	0.3	0.33	0.04	0.05	0.26	0.47	0.69	0.86	0.44	0.39
	Pos 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)
	Neg 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 square	0.31	0.33	0.05	0.07	0.27	0.47	0.69	0.87	0.45	0.39
Germany 206 observ. 10 Länder	Δ GDP	0.739*** (0.028)		0.185** (0.083)	0.239*** (0.021)	0.172*** (0.011)	0.411*** (0.018)		-0.506*** (0.154)	0.489*** (0.027)	0.018 (0.016)
	R square	0.26		0.05	0.05	0.67	0.71		0.26	0.36	0.77
	Pos Shock	0.638*** (0.053)		0.368** (0.183)	0.256*** (0.041)	0.071*** (0.020)	0.289*** (0.030)		0.174 (0.280)	0.489*** (0.042)	0.138*** (0.022)
	Neg shock	0.819*** (0.043)		0.044 (0.142)	0.225*** (0.034)	0.253*** (0.017)	0.501*** (0.027)		-0.960*** (0.220)	0.490*** (0.037)	-0.082*** (0.023)
	R square	0.26		0.05	0.05	0.67	0.71		0.26	0.36	0.77
Canada 290 observ. 10 provinces	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)
	R square	0.07	0.08	0.01	0.01	0.31	0.71	0.64	0.47	0.58	0.49
	Pos 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)
	Neg 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 square	0.09	0.1	0.02	0.01	0.31	0.71	0.64	0.47	0.6	0.49
USA 980 observ. 49 states	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)
	R square	0.17	0.18	0.02	0.04	0.46	0.32	0.28	0.41	0.23	0.5
	Pos 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)
	Neg 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 square	0.17	0.18	0.03	0.04	0.46	0.32	0.28	0.41	0.24	0.5

note: .01 - ***, .05 - **, .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 inverse of the squared residuals from the regressions reported in Appendix 1.