

Pro-cyclical Fiscal Policy in Brazil

Evidence from the States

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Abstract

The empirical literature on budget cyclicity has generally focused more on assessing the degree of pro-cyclicality in federal (central government) revenues and expenditures and less on budget cyclicity at the sub-national level in multi-tiered systems. This paper attempts to contribute to the literature on budget cyclicity by examining how sub-national fiscal revenues and expenditures are linked to the business cycle in Brazil, particularly after the introduction of the Fiscal Responsibility Law. It explains the degree of pro-cyclicality across Brazilian states, and assesses whether intergovernmental transfers help to stabilize states' finances. These issues are addressed using both a time-series and a cross-section dimension at the Brazilian state

level for the period 1991–2006. The empirical evidence suggests the existence of a pro-cyclical fiscal policy in Brazil at the state level. However, the introduction of the Fiscal Responsibility Law helped to reduce Brazilian states' spending-side pro-cyclicality. For the Brazilian states, the main source of the observed pro-cyclicality is found in the behavior of tax revenues directly collected by the state governments. Intergovernmental transfers (federal transfers to the states) are not associated with changes in gross state product, but they are pro-cyclically aligned with national gross domestic product, which could amplify the pro-cyclical behavior of sub-national expenditures.

This paper—a product of the Economic Policy Department, Poverty and Economic Management Unit of the Latin American and Caribbean Region—is part of a larger effort in the department to analyze fiscal policy. Policy Research Working Papers are also posted on the Web at <http://econ.worldbank.org>. The authors may be contacted at marena@worldbank.org and jrevilla@worldbank.org.

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Pro-cyclical Fiscal Policy in Brazil: Evidence from the States

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1. Introduction

A large body of empirical literature has provided evidence that pro-cyclical fiscal policies are highly prevalent in developing countries, demonstrating that fiscal policy tends to expand in periods of economic growth (“good times”) and contract during recessions or slowdowns (“bad times”).¹ The empirical literature on budget cyclicality has generally focused more on assessing the degree of pro-cyclicality in federal (central government) revenues and expenditures and less on budget cyclicality at the sub-national level in multi-tiered systems.² Sub-national governments often rely on narrow and sensitive revenue streams, have limited access to credit markets, and may be subject to the manipulation of intergovernmental transfers, all of which combine to make sub-national fiscal policy inherently and systematically pro-cyclical. If spending by sub-national governments is pro-cyclical, the need to offset this spending pattern imposes an additional burden on fiscal policy at the federal level. Moreover, pro-cyclical actions by the federal government could affect the cyclical behavior of sub-national jurisdictions through intergovernmental transfers, amplifying rather than mitigating the pro-cyclicality of sub-national fiscal policy.³ According to a recent World Bank study (World Bank, 2008b), the international evidence shows that budget rigidities the tendency to adopt a pro-cyclical stance, especially during “good times”, have been a main source of the deficit bias of fiscal policy in both industrial and developing countries.

In the recent experience of emerging markets crises, Argentina and Brazil constitute two cases in which sub-national governments worsened the overall fiscal situation. In the Argentine case, the fiscal behavior of the provinces was an important element in the overall fiscal deterioration leading to the 2001 crisis. In the Brazilian case, the default of the state of Minas Gerais in 1999 prompted the devaluation of the Brazilian Real in 1999. Although the empirical literature on the Argentine case is extensive, the Brazilian case has been relatively less studied. This paper examines how sub-national fiscal revenues and expenditures are linked to the business cycle in Brazil by addressing the following questions: Are the Brazilian states’ expenditures pro-cyclical, even after the introduction of the Fiscal Responsibility Law? If so, what explains the degree of pro-cyclicality across Brazilian states? And do intergovernmental transfers stabilize or destabilize state finances?

These questions are addressed using both a time-series and a cross-section dimension at the Brazilian state level for the period 1991-2006, which will allow us to assess the degree of state budget pro-cyclicality while taking into account state characteristics, as

¹See Gavin and Perotti (1997), Braun (2001), Lane (2003), Kaminsky, Reinhart, and Vegh (2004), Gupta, Clements, Akitoby, and Inchauste (2004), and Ilzetki and Vegh (2008).

² Some exceptions are Wibbels and Rodden (2006), Sturzenegger and Werneck (2006) and Rocha and Giuberti (2006).

³ Conversely, the procyclical behavior of subnational governments could also exacerbate the procyclicality of fiscal policy at the federal level through “voracity effects” and the use of bailouts and discretionary transfers (Sturzenegger and Werneck, 2006); i.e., competing demands for intergovernmental transfers by multiple states could have a reciprocal impact on the federal government, exacerbating its procyclicality while constraining its ability to save resources for countercyclical discretionary spending during economic downturns. However, this issue is not analyzed in the study.

well as to test for the sources of pro-cyclicality, and to evaluate the impact of intergovernmental transfers on both state and federal cyclicality. The evidence provided suggests the existence of pro-cyclical fiscal policy in Brazil at the state level, which is more pronounced during economic downturns. For the Brazilian states the main source of observed pro-cyclicality is found in the pro-cyclical behavior of tax revenues directly collected by state governments (ICMS). Intergovernmental transfers (federal transfers) are not associated with changes in gross state product, but they are associated (pro-cyclically) with the national GDP, which could amplify the pro-cyclical behavior of sub-national expenditures.

The structure of the rest of the paper is as follows. Section 2 presents a review of the literature on sub-national budget cyclicality. Section 3 describes the characteristics of fiscal federalism in Brazil. Section 4 provides evidence on the pro-cyclicality of sub-national fiscal policy in Brazil. Section 5 provides evidence on the sources of pro-cyclicality by exploring the information available on the different levels of pro-cyclicality observed across the Brazilian states. Finally, conclusions are offered in Section 6.

2. Review of the Literature

As mentioned above, there is a significant amount of empirical literature on budget cyclicality at the central government level compared to the relatively scarce literature analyzing budget cyclicality at the sub-national level in multi-tiered systems. Important contributions to the sub-national level-analyses, including the Brazilian experience, are presented below.

Sturzenegger and Werneck (2006) provide an assessment of the relationship between pro-cyclicality and fiscal federalism in the Argentine and Brazilian cases. The authors tackle the questions of how the degree of pro-cyclicality of federal fiscal policy has been affected by the behavior of sub-national governments, and what the sources of state pro-cyclicality are. For the Argentine case, the authors use both time-series and cross-sectional dimensions at the state level for the period 1992-2002. The authors argue that the pro-cyclicality in Argentine provinces' expenditures are mostly related to the nature of the tax base of sub-national jurisdictions. For the Brazilian case, however, the authors use a monthly time-series of aggregated fiscal variables for states and municipalities as a whole for the period 1997-2002. Based on the correlation of the cyclical components of fiscal variables (revenues, expenditures, and transfers) and output, the authors conclude that the spending of sub-national governments has shown a marked degree of pro-cyclicality, which is closely related to the behavior of the tax revenues directly collected by sub-national governments. In the study of the Brazilian case, there is no analysis of the sources of pro-cyclicality.

Wibbels and Rodden (2006) analyze the sensitivity of provincial government finances to regional business cycles in eight federal republics (The United States, Canada, Germany, Australia, Spain, India, Brazil, and Argentina). Using annual data (from 1986 to 2000 for Brazil) on revenues, expenditures, deficits, and gross state product for each state or provincial government, the authors perform panel estimations for each fiscal item. Their results show that Brazilian states' expenditures are highly pro-cyclical both in good times

and bad, that own-source taxes are highly pro-cyclical, and that revenue-sharing and discretionary transfers from the central government are either a-cyclical or pro-cyclical (pro-cyclical in both the Brazilian and Argentine cases).

Rocha and Giuberti (2005) study the behavior of the Brazilian states' fiscal policy seeking to answer two questions: (i) Is state fiscal policy pro-cyclical or anti-cyclical? And: (ii) Is state fiscal behavior asymmetric during contractions and expansions? The authors tackle these questions using a fiscal reaction function framework for the period 1997-2003 (annual data). Within this framework the authors assess the sensitivity of the states' primary surplus to the states' stock of consolidated debt while controlling for the cyclical component of output. According to their results, the states' fiscal policies have been pro-cyclical with some evidence of being asymmetric as well (i.e. more pro-cyclical during expansions), but the authors also found that this result was no longer accurate after the introduction of the Fiscal Responsibility Law in 2000. However, one key element not mentioned by the authors is the positive and significant coefficient associated with the states' stock of consolidated debt, which would suggest that states increase their primary surplus to match increases in state debt in order to meet the intertemporal budget constraint.

In addition, this paper benefits from related literature regarding the fiscal consolidation of the Brazilian states. Blanco (2001) uses measures of fiscal impulse to identify and characterize the states' fiscal stance during the period 1985-1997. According to the author's results, it was not possible to identify empirical regularities (stop-and-go policies) for most of the Brazilian states. However, after 1994 more cases of fiscal expansion were observed. In addition, the author assesses the effects of political and institutional characteristics (e.g. the degree of competitiveness of the political system, the degree of fragmentation in political representation, the degree of political participation among the populace, and the degree of political similarity between the state and federal administrations) on the fiscal behavior of the Brazilian states in terms of their primary expenditures. After controlling for economic characteristics, political economy variables like the participation rate, the degree of fragmentation, and the similarity between state and federal administrations would have a statistically significant effect on states' primary expenditures. Rocha and Rocha (2003) attempt to establish which state characteristics determine the probability that fiscal adjustments, once made, will remain in place. After controlling for economic variables (e.g. the ratio of tax revenue to current revenue, the ratio of personnel expenditures to current revenues, and the number of previous fiscal adjustments), the authors find that the polarization of preferences towards political parties (participation of leftist parties in the Legislative Assembly) and the permanence in power (proxy for reelection) are the key political factors that explain the continuation of fiscal adjustment episodes.

This paper builds upon these previous analyses to extend and complement the empirical evidence of budget cyclicity for the Brazilian states. The questions it poses are addressed using both a time-series and a cross-section dimension at the Brazilian state level for the period 1991-2006, which will make it possible to assess the degree of state budget pro-cyclicity while taking into account state characteristics (e.g. size and

geographical position), different national legislative contexts (i.e. both before and after the introduction of the Fiscal Responsibility Law), and the vacillations of the country's business cycle. The time-series and cross-section dimensions also allow us to test for the sources of proc-yclicity by examining the different levels of observed cyclicity across Brazilian states while controlling for political economy characteristics such as the degree of political similarity between the state and federal administrations. This panel framework also allows us to evaluate whether or not the federal government affects the degree of state budget cyclicity through transfers, and to analyze the effect of those transfers on federal fiscal cyclicity.

3. Brazilian Federalism: States, Municipalities, and Their Cyclical Fiscal Stance

Brazil has three government levels: the central government (federal), the states (there are 26 states plus the Federal District of Brasilia), and more than 5,500 municipalities. Municipalities are explicitly considered in the Constitution to represent a tier of the federation, giving them a higher status than is usual in federal republics. In Brazil, each state is represented in the upper house (the Senate) by three senators, while in the lower house (the Chamber of Deputies) the Constitution establishes a constrain of no more than 70 deputies and no less than 8 for each state; both measures serve to increase the relative representation of the less populated states.

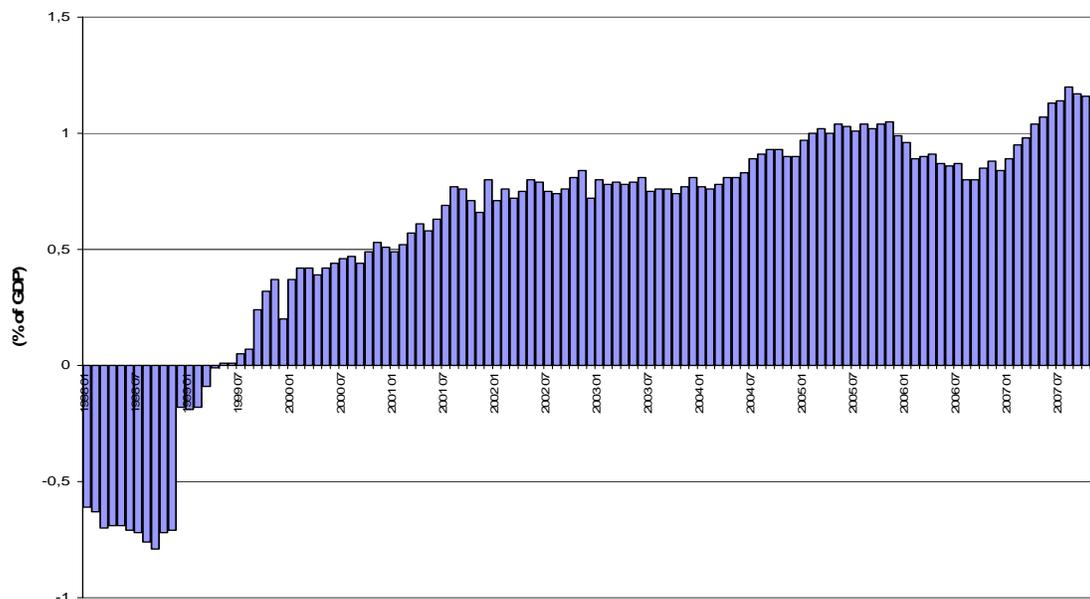
The origins of the current political representation system and overall federal structure in Brazil can be traced to the desired for increased decentralization following the adoption of the 1988 Constitution. In addition to greater representation for the less populated (and poorer) states, the Constitution greatly increased public sector responsibilities for the provision of social services and expanded public sector employee benefits. This was funded by additional transfers from the federal government to states and municipalities guaranteed by enhanced revenue-sharing arrangements.

As in other federal systems sub-national governments can help or worsen the overall fiscal stance of the national government (Sturzenegger and Werneck, 2006). The effects of the fiscal behavior of the states and the indebtedness of state and large municipal governments in Brazil were a major source of macroeconomic instability in the country until the 1990s. Expansionary state fiscal policies and a lack of effective indebtedness controls resulted in sub-national debt crises in 1989, 1993, and 1997 that had significant effects on the fiscal profile of the country. In 1997, the federal government assumed the debts of 25 of the 27 states that were unable to service their debt—an amount equivalent to about 13 percent of GDP. About 90 percent of the state debt was restructured so as to be paid off in 30 years at a favorable interest rate, and the rest was forgiven. The debt restructuring was successful in improving the fiscal balances of states and municipalities. Within 18 months the states' negative primary balances turned positive, averaging one percent of GDP in recent years, and thereby contributing to the improved macroeconomic conditions in Brazil (Figure 1).

Economic growth and fiscal and external balances in Brazil have been historically affected by large variations that have sometimes resulted in fiscal, balance of payments, and debt crises. Brazil's response to the deteriorating fiscal situation in the 1990s was a sharp fiscal adjustment policy, which relied on increasing the primary surplus to stabilize the public debt, coupled with a program of liability management designed to reduce risk. The fiscal adjustment process, however, has been characterized by drastic increases in tax revenues and cuts in infrastructure spending as a way to finance increases in current spending.

Brazil's fiscal position has improved following significant reforms since the launching of the Real Plan in 1994. Brazil's long history of high inflation fueled by weak fiscal policies has been reversed. The implied reduction in Brazil's external vulnerability to foreign capital swings and the fiscal adjustment process have paved the way for lower domestic interest rates and accelerated economic growth. Improvements in the country's fiscal position have been supported by a new fiscal responsibility law enacted in 2000. Pursuit of sound macroeconomic policies, including the generation of primary public sector surpluses that averaged about 4 percent of GDP annually between 2002 and 2007, allowed federal government debt to achieve an investment grade rating in April 2008.

Figure 1: Primary balances of Subnational Governments, 1998-2007
(as percent of GDP)



Source: Central Bank of Brazil

According to a recent World Bank report (World Bank, 2008a), in 2006 intergovernmental transfers in Brazil amounted to R\$185 billion, equivalent to 8.2 percent of GDP and 24 percent of the tax revenues. Federal transfers to states and municipalities were at 5.3 percent of GDP (2.5 percent of GDP to states and 2.8 percent

to municipalities) or more than 20 percent of federal tax revenue. State transfers to municipalities accounted for an additional 2.5 percent of GDP, or 30 percent of state tax revenue. Intergovernmental transfers therefore represent an important source of financing for sub-national governments, especially municipal governments. Comparisons with other federal countries show that the Brazilian states have considerable capacity to raise their own tax revenues and are less dependent on transfers than state governments in other countries. However, municipalities in Brazil are more dependent on transfers than their counterparts in other federal countries (Table 1).⁴

Table 1: Revenue Composition of Subnational Governments

		Taxes	Transfers	Other	Total
Brazil (2004)	States	68%	20%	12%	100%
	Municipalities	24%	66%	10%	100%
Mexico (2000)	States	41%	51%	8%	100%
	Municipalities	58%	27%	14%	100%
Canada (2002)	States	60%	16%	24%	100%
	Municipalities	43%	39%	19%	100%
United States (2001)	States	51%	26%	23%	100%
	Municipalities	38%	40%	22%	100%
Australia (2001)	States	31%	50%	19%	100%
	Municipalities	38%	17%	45%	100%
Germany (2002)	States	71%	17%	12%	100%
	Municipalities	37%	35%	28%	100%
Colombia (2000)	States	17%	50%	33%	100%
	Municipalities	28%	31%	41%	100%
Spain (2000)	States	33%	61%	6%	100%
	Municipalities	51%	36%	13%	100%
South Africa (2002)	States	1%	96%	3%	100%
	Municipalities	23%	18%	59%	100%
Average (without Brazil)	Municipalities	38%	46%	16%	100%
	States	40%	30%	30%	100%

Source: World Bank (2008a)

Since their inception the vast majority of intergovernmental transfers have been financed through revenue-sharing rules laid down in the Constitution. The automatic and formula-based nature of these rules guarantees transparency and autonomy, keeping political interference at bay. The use of revenue-sharing rules has increased in recent decades. A

⁴ There are significant regional disparities in Brazil: while the more developed states can be considered largely self-sufficient, the great majority of the more than 5,500 municipal governments are highly dependent on transfers.

high degree of political and administrative centralization was imposed by the military regime (1964-1985), and the subsequent democratic government promoted decentralization by increasing federal transfers to states and municipalities, mostly via the 1988 Constitution.

According to The World Bank (2008a) the substantial increase in federal transfers to states and municipalities, as well as in state transfers to municipalities, could be justified on several grounds. First, as the economic cost of raising municipal taxes tends to be higher than that of federal taxes, it makes sense for more tax revenue to be collected by federal and state governments and transferred to the municipalities. Second, well-designed conditional federal transfers can encourage states and municipalities to invest in budget items that produce positive externalities, such as education and health care. Third, transfers can be used to redistribute income from richer areas to poorer ones, thereby contributing to the reduction of regional disparities. While Brazil's system of intergovernmental transfers has enjoyed partial success in each of these three areas, its evolution suggests that problematic are issues have also arisen.

Conditional transfers are used in Brazil to ensure that different states and municipalities are able to achieve similar levels of expenditure on selected public goods and services such as health and education. The financing of public health, for instance, is based on conditional matching grants through a large and complex system of multi-government transfers. States and municipalities are obligated to earmark a fixed percentage of their revenues for health spending, and the same is true for education. These revenues are then complemented by federal transfers. As a result, public health spending has achieved a high degree of equality among different regions of the country (Table 2).

Table 2: Public Health Expenditures by Region, 1986 and 2005

Region	% of total health expenditures		% of national population		Per capita index	
	1986	2005	1986	2005	1986	2005
North	2.3	7.2	5.5	8.0	0.41	0.90
Northeast	18.1	28.1	28.8	27.7	0.63	1.01
Southeast	59.3	43.1	43.8	42.6	1.35	1.01
South	15.1	14.4	15.1	14.6	1.00	0.98
Center West	50	7.2	6.8	7.1	0.74	1.02
Brazil	100	100	100	100	1.00	1.00

Source: World Bank (2008a).

4. Empirical Evidence at the Sub-national Level

In order to study the cyclical behavior of sub-national revenues and expenditures, annual data on revenues, expenditures, primary balances, and gross state product have been collected for the 26 states and the Federal District of Brasilia for the period from 1990 to 2006. Revenue and expenditure data have also been broken down into different categories—total revenue, tax revenue, intergovernmental revenue transfers, sales tax revenue (*ICMS*), total expenditures, primary expenditures (total expenditures excluding

interest payments), expenditures on personnel, other current expenditures, and interest payments—in order to assess potentially different degrees of cyclicity for revenue and expenditure categories.

Individual regressions are conducted for each fiscal item of gross state product using OLS, fixed effects (FE), and feasible generalized least squares (FGLS).⁵ Given that in almost all states expenditure and revenue components and the gross state product data demonstrate pronounced upward trends and non-stationary behavior, all variables are expressed in growth rates. The specifications are as follows:

$$(1) \Delta \text{Revenues}_{it} = \alpha_i + \beta (\Delta \text{GDPST})_{it} + \sum \gamma_t (\text{Yeardum})_t + \varepsilon_{it},$$

$$(2) \Delta \text{Expenditures}_{it} = \alpha_i + \beta (\Delta \text{GDPST})_{it} + \sum \gamma_t (\text{Yeardum})_t + \varepsilon_{it}; i=1, \dots, 27; \\ t=1991, \dots, 2006$$

where Δ refers to the rate of change. Revenues (all in logs) are: Total Revenues, Tax Revenues, Sales Tax (ICMS), and Intergovernmental Transfers. Expenditures (again all in logs) are: Total Expenditures, Primary Expenditures, Personnel Expenditures, Maintenance and Capital Expenditures, and Interest Payments. ΔGDPST is the rate of change in the gross domestic state product.

The coefficients should be interpreted as how much fiscal revenues or expenditures change in response to a 1 percent change in gross state product, or the changes in fiscal revenues or expenditures due to by a 1 percent increase in gross state product. In the case of the estimation con FE and FGLS the coefficients should be interpreted as “within” each state or jurisdiction. All regressions include time (year) dummies to control for common effects experienced by all states in a particular year (i.e. national economic downturns or changes in the federal macroeconomic policy with symmetric effects on all states) so the coefficient on the gross state product hone in on the effects of asymmetric provincial income shocks. The products of this methodology include the correlation (degree of association) between output and fiscal variables but not causality effects.

Table 3 reports the results using the three different estimation methods. As expected, revenue variables (total revenues, tax revenues and VAT) show a pro-cyclical relationship to the gross state product The main source of pro-cyclicity is related to the main tax revenue directly collected by the states (the sales tax or ICMS). Regarding expenditures, total and primary expenditures show a pro-cyclical behavior with respect to gross state product. Among expenditure categories expenditures on personnel have a higher degree of pro-cyclicity than maintenance and capital expenditures.

Changes in intergovernmental transfers are not associated with changes in gross state product, which would suggest the potentially a-cyclical behavior of federal government transfers with respect to the states. However, intergovernmental transfers are pro-cyclical

⁵ This estimation method allow us to present fixed effects regressions with panel-corrected standard errors, correcting for first order autocorrelation of residuals, and assuming the disturbance terms to be heteroskedastic and contemporaneously correlated across panels.

with respect to national GDP (see Annex 1) which suggest that federal transfers could be amplifying the pro-cyclical behavior of state expenditures.⁶ Consequently, the Brazilian federal government does not appear to play a (macroeconomic) stabilization role with regard to the states, particularly in the context of symmetric shocks to the regions. By design, most intergovernmental transfers in Brazil are automatic, without a stabilizing component.⁷

Table 3: Cyclical Sensitivity of Fiscal Policy: Subnational Level

Variables	OLS	Fixed Effects (FE)	Feasible Generalized Least Squares (FGLS)
<u>Revenues:</u>			
Total Revenue	0.190 ** [0.082]	0.197 ** [0.093]	0.273 *** [0.036]
Intergovernmental Transfers	-0.003 [0.123]	0.034 [0.146]	0.091 [0.066]
Tax Revenue	0.303 *** [0.071]	0.274 *** [0.075]	0.309 *** [0.030]
V.A.T. (ICMS)	0.266 *** [0.074]	0.237 *** [0.081]	0.312 *** [0.040]
<u>Expenditures:</u>			
Total Expenditure	0.377 *** [0.116]	0.397 *** [0.128]	0.305 *** [0.031]
Primary Expenditure	0.358 *** [0.118]	0.376 *** [0.129]	0.302 *** [0.073]
Maintenance and capital	0.468 *** [0.142]	0.503 *** [0.153]	0.340 *** [0.089]
Personnel Expenditure	0.823 *** [0.227]	0.859 *** [0.250]	0.703 *** [0.057]
Interest Payments	0.538 * [0.314]	0.551 [0.352]	0.516 *** [0.127]

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. Standard Errors in brackets. Robust standard errors in the OLS and FE estimation. Correction for heteroskedasticity and autocorrelation (AR(1)) in the FGLS estimation.

⁶ As mentioned by Wibbels and Rodden (2006, p.9), there is evidence that national transfers in federal systems may exacerbate the procyclicality of provincial revenues. Sorensen, Wu, and Yosha (2001) show that grants from the U.S. federal government to the states are positively correlated with the business cycle. In addition, Seitz (2000), and von Hagen and Hepp (2002) show that revenues flowing to the German states through its tax-sharing scheme are procyclical.

⁷ At the federal-state level the main transfer program is the State Participation Fund (FPE), and the states' share of the taxes that feed the Fund is based on fixed percentages of particular taxes.

Table 4 reports the results for large and small states.⁸ The seven large states together account for approximately 75 percent of national GDP, and are located mainly in the South and Southeast regions of Brazil (São Paulo, Rio de Janeiro, Minas Gerais, Rio Grande do Sul, Paraná, Bahia, and Santa Catarina). According to the results, smaller states are more pro-cyclical than larger states for all revenue (except intergovernmental transfers) and expenditure categories. As in the results for all states, personnel expenditures show a higher degree of pro-cyclicality among expenditure categories. Large states show pro-cyclical behavior for both total revenues and total expenditures (driven mainly by personnel expenditures).

Table 4: Cyclical Sensitivity of Fiscal Policy: Subnational Level – Big and Small States

Variables	All States		Big States		Small States	
<u>Revenues:</u>						
Total Revenue	0.273	***	0.409	***	0.215	***
	[0.036]		[0.142]		[0.049]	
Intergovernment Transfers	0.091		0.306		0.083	
	[0.066]		[0.223]		[0.067]	
Tax Revenue	0.309	***	0.110		0.280	***
	[0.030]		[0.096]		[0.044]	
V.A.T. (ICMS)	0.312	***	0.070		0.256	***
	[0.040]		[0.112]		[0.049]	
<u>Expenditures:</u>						
Total Expenditure	0.305	***	0.255	*	0.352	***
	[0.031]		[0.165]		[0.074]	
Primary Expenditure	0.703	***	0.104		0.319	***
	[0.057]		[0.162]		[0.074]	
Maintenance and capital	0.340	***	0.306		0.396	***
	[0.088]		[0.313]		[0.112]	
Personnel Expenditure	0.703	***	0.448	**	0.538	***
	[0.056]		[0.224]		[0.104]	
Interest Payments	0.516	***	1.067	*	0.479	**
	[0.126]		[0.648]		[0.230]	

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.
 Large states include Sao Paulo, Rio de Janeiro, Minas Gerais, Rio Grande do Sul, Paraná, Bahia, and Santa Catarina.
 Estimation done with FGLS.

⁸ From here on, all the results are related to the FGLS estimation.

Table 5 presents the results by geographic region.⁹ States in the North and Northeast regions, which are among the smaller states, show pro-cyclical behavior for tax revenues (including the ICMS), total and primary expenditures, maintenance and capital expenditures (non-personnel expenditure and capital spending). States in the South and Southeast, which are the bigger states in terms of economic activity, demonstrate pro-cyclical behavior for expenditures and a much higher pro-cyclicality in total revenues. States in the Center-West region, which include the Federal District, show pro-cyclical behavior only for tax revenues (including the ICMS) and personnel expenditures.

⁹ There are 5 regions in Brazil: the North, Northeast, Southeast, South, and Center-West. The states in the North region are Acre, Amapa, Amazonas, Para, Rondonia, Roraima, and Tocantins. The states in the Northeast region are Alagoas, Bahia, Ceara, Maranhao, Paraiba, Pernambuco, Piaui, Rio Grande do Norte, Sergipe. The states in the Southeast region are Espiritu Santo, Minas Gerais, Rio de Janeiro, and Sao Paulo. The states in the South region are Parana, Santa Catarina, and Rio Grande do Sul. The states in the Center-West region are Distrito Federal, Goias, Mato Grosso, and Mato Grosso do Sul.

Table 5: Cyclical Sensitivity of Fiscal Policy: Subnational Level – By Regions

Variables	All States	North	Northeast	South	Southeast	Center-West
<u>Revenues:</u>						
Total Revenue	0.273 *** [0.036]	0.243 *** [0.056]	0.004 [0.086]	0.408 ** [0.199]	0.605 *** [0.150]	0.189 * [0.108]
Intergovernment Transfers	0.091 [0.066]	0.176 ** [0.072]	-0.138 [0.106]	0.285 [0.257]	-0.068 [0.320]	0.038 [0.203]
Tax Revenue	0.309 *** [0.030]	0.336 *** [0.074]	0.195 *** [0.067]	0.392 ** [0.199]	0.129 [0.103]	0.250 *** [0.058]
V.A.T. (ICMS)	0.312 *** [0.040]	0.340 *** [0.074]	0.172 ** [0.081]	0.171 [0.199]	0.199 [0.133]	0.185 *** [0.071]
<u>Expenditures:</u>						
Total Expenditure	0.305 *** [0.031]	0.467 *** [0.104]	0.281 ** [0.117]	0.445 ** [0.223]	0.378 ** [0.163]	0.124 [0.133]
Primary Expenditure	0.703 *** [0.057]	0.464 *** [0.107]	0.223 * [0.121]	0.189 [0.209]	0.330 ** [0.171]	0.098 [0.128]
Maintenance and capital	0.340 *** [0.089]	0.560 *** [0.154]	0.337 ** [0.175]	0.832 ** [0.432]	0.155 [0.297]	0.248 [0.190]
Personnel Expenditure	0.703 *** [0.057]	0.834 *** [0.172]	0.367 ** [0.153]	0.488 * [0.284]	0.580 ** [0.268]	0.450 *** [0.164]
Interest Payments	0.516 *** [0.127]	0.267 [0.354]	0.635 * [0.384]	1.559 * [0.916]	1.169 * [0.700]	0.521 * [0.309]

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.
Estimation done with FGLS.

Table 6 reports the results by dividing the sample into two periods: 1991-1999 and 2000-2006.¹⁰ In 2000 the government of Brazil began to implement fiscal adjustments as part of a broad effort to stabilize macroeconomic policy that included the Fiscal Responsibility Law (FRL), which imposed important constraints on sub-national governments.¹¹ The states show less pro-cyclical behavior for the period from 2000 to 2006 in both primary and personnel expenditures. And even though the interaction term in the tax revenue and ICMS has a negative sign, there are no statistically significant differences between the coefficients of both periods with respect to revenue variables. These results do not necessarily imply that the effects on the coefficients for the period 2000-2006 are due exclusively to the FRL, though they suggest that further exploration of that hypothesis is warranted.

Table 6: Cyclical Sensitivity of Fiscal Policy: Subnational Level by Periods

Variables	Coefficient for 1991-2006	Coefficient for 1991-1999	Interaction term (with dummy)	Coefficient 2000 -2006
<u>Revenues:</u>				
Total Revenue	0.273 *** [0.036]	0.198 *** [0.079]	0.066 [0.101]	
Intergovernment Transfers	0.091 [0.066]	0.009 [0.102]	0.160 [0.131]	
Tax Revenue	0.309 *** [0.030]	0.338 *** [0.062]	-0.119 [0.088]	
V.A.T. (ICMS)	0.312 *** [0.040]	0.312 *** [0.068]	-0.138 [0.097]	
<u>Expenditures:</u>				
Total Expenditure	0.305 *** [0.031]	0.583 *** [0.102]	-0.425 *** [0.146]	0.158 [0.104]
Primary Expenditure	0.703 *** [0.057]	0.458 *** [0.105]	-0.266 * [0.148]	0.192 * [0.105]
Maintenance and Capital	0.340 *** [0.088]	0.707 *** [0.161]	-0.598 *** [0.225]	0.109 [0.156]
Personnel Expenditure	0.703 *** [0.056]	0.879 *** [0.148]	-0.655 *** [0.204]	0.224 * [0.141]
Interest Payments	0.516 *** [0.126]	0.957 *** [0.329]	-0.801 * [0.462]	0.156 [0.324]

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The dummy variable takes the value of 1 for the period 2000-2006. Estimation done with FGLS

¹⁰ A dummy variable is used to capture the potential shift period. The dummy takes the value of 1 for the period 2000-2006.

¹¹ See Sturzenegger and Werneck (2006) for more details on the FRL.

Finally, potential asymmetric effects over the business cycle are tested to determine whether pro-cyclical behavior differs between business cycle upturns and downturns. Upturns are defined as periods where the actual level of the output variable (GDP, GSP) exceeds the value of its trend.¹² Downturns are defined in the opposite way. The results presented in Table 7 suggest that the fiscal expenditures of the states are more pro-cyclical during downturns than in upturns over the period of analysis. Personnel expenditures are also pro-cyclical during upturns, but to a lesser degree than they are in downturns. Total revenues, tax revenues, and ICMS all exhibit the same degree of pro-cyclicality in both upturns and downturns.

Table 7: Cyclical Sensitivity of Fiscal Policy: Subnational Level – During Upturns and Downturns

Variables	All States	Upturns	Downturns
<i>Revenues:</i>			
Total Revenue	0.273 *** [0.036]	0.212 *** [0.068]	0.228 *** [0.078]
Intergovernment Transfers	0.091 [0.066]	0.123 [0.087]	0.055 [0.099]
Tax Revenue	0.309 *** [0.030]	0.262 *** [0.063]	0.280 *** [0.062]
V.A.T. (ICMS)	0.312 *** [0.040]	0.196 *** [0.067]	0.294 *** [0.068]
<i>Expenditures:</i>			
Total Expenditure	0.305 *** [0.031]	0.213 ** [0.102]	0.490 *** [0.102]
Primary Expenditure	0.703 *** [0.057]	0.175 * [0.103]	0.446 *** [0.104]
Maintenance and Capital	0.340 *** [0.088]	0.164 [0.152]	0.656 *** [0.162]
Personnel Expenditure	0.703 *** [0.056]	0.345 ** [0.144]	0.730 *** [0.147]
Interest Payments	0.516 *** [0.126]	0.412 [0.322]	0.584 * [0.326]

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

The dummy variable equals 1 during upturns, which are defined as the positive difference between the actual value of the variable and its trend. Estimation done with FGLS

¹² The cyclical component was calculated using the Baxter and King (Band-Pass) filter.

5. Testing the Sources of Pro-cyclicality

The literature offers two major explanations for fiscal expenditure pro-cyclicality: (i) the financial channel explanation, and (ii) the political economy explanation.

With respect to the financial channel explanation, Gavin et al. (1996) present the hypothesis that pro-cyclicality arises from inadequate capital markets, or limited access to those markets, particularly during downturns, which constricts government spending just when it is needed most. Also, Caballero and Krishnamurthy (2004) argue that advanced and emerging economies differ in their financial depth—defined as private credit over GDP and liquid liabilities over GDP—and show that lack of financial depth constrains fiscal policy in a way that can overturn standard Keynesian fiscal policy prescriptions.

Regarding the effect of political economy factors, Talvi and Vegh (2000) argue that fiscal policies are pro-cyclical because the emergence of fiscal surpluses provokes intense lobbying for higher public spending during upturns, or in other words, that spending pressures are an increasing function of the incipient fiscal surplus. In this context, high output volatility (and the associated revenue volatility) would create a political environment conducive to pro-cyclical fiscal behavior. Such strong pressures to increase public spending during upturns have been explained by Lane and Tornell (1996) and Tornell and Lane (1999) through the “voracity effect” hypothesis. The authors develop a framework in which multiple power blocks compete for a share in fiscal revenues, and the intensity increases particularly during upturns when the size of the pie is bigger. Under this common pool problem, groups have strong incentives to appropriate a part of the incipient fiscal surpluses before other groups do so. In this framework, the increase in spending can actually outpace the increase in income as policymakers attempt to satisfy multiple competing interests simultaneously, creating a highly pro-cyclical outcome.

The empirical literature has mainly tested these hypotheses using cross-country analysis (see Stein et al, 1999; Talvi and Vegh, 2000; Lane, 2002; Caballero and Krishnamurthy, 2004). However, these hypotheses have been less studied at the sub-national level.¹³ The focus of this subsection will be on understanding the determinants of pro-cyclicality for Brazilian states. According to Sturzenegger and Werneck (2006), the financial channel hypothesis and the voracity effect hypothesis could also be applied to sub-national governments.

In the case of the financial channel hypothesis, states could tend to be more pro-cyclical than the federal government assuming that states’ access to capital market becomes more difficult under a credit constraint scenario, particularly during downturns. With respect to the voracity effect hypothesis, the authors argue that “this effect is probably at work in the case of sub-national governments, which are usually suspected of being subject to a higher degree of cronyism and corruption than the national government.” (p. 4).

¹³ To our knowledge only Sturzenegger and Werneck (2006) test these hypotheses for the Argentine case.

In this context, the financial channel hypothesis that suggests that pro-cyclicality arises because states are cut off from financial markets during downturns will be tested by relating the degree of state pro-cyclicality to the level (ratio) of state indebtedness. The voracity effect will be tested by relating the pro-cyclicality of Brazilian sub-national government spending to the pro-cyclicality of state revenues (and also to the volatility of state revenues and output). In addition, expenditure pro-cyclicality could arise or be exacerbated if intergovernmental transfers are also subject to voracity effects; i.e., if states are preying the common (national) pool of resources. This will be tested by relating the degree of state pro-cyclicality to the ratio of intergovernmental transfers.

To analyze this issue, this paper first assesses the pro-cyclicality of expenditure (current and total expenditure) and revenue (current and tax revenue) variables by state. The degree of pro-cyclicality is measured relative to each state's GSP following equations (3) and (4) and estimated using feasible generalized least squares (FGLS).

$$(3) \Delta \text{Revenues}_{it} = \alpha + \sum \beta_i (\Delta \text{GDPST})_{it} + \sum \gamma_t (\text{Yeardum})_t + \varepsilon_{it} ;$$

$$(4) \Delta \text{Expenditures}_{it} = \alpha + \sum \beta_i (\Delta \text{GDPST})_{it} + \sum \gamma_t (\text{Yeardum})_t + \varepsilon_{it}$$

$$i=1, \dots, 27 ; t= 1991, \dots, 2006$$

Table 8 presents the estimated β coefficients for the revenue and expenditure equations by state. According to the results, the expenditures and revenues of small states are mainly pro-cyclical, which is consistent with the result in Table 4, where small states demonstrate greater pro-cyclical behavior for all revenue (except intergovernmental transfers) and expenditure categories compared to large states. Even within the group of small states there is substantial variation in behavior. For example, in the case of current expenditures the elasticity ranges from a low of 0.37 for the Federal District to a high of 1.1 for Amapá. In the case of current revenues, the elasticity ranges from a low of 0.26 for Tocantis to a high of 1.13 for Rondonia.

Table 8: Procyclicality by State in Brazil 1991-2006

State	Current Expenditures		Total Expenditures		Tax Revenue		Current Revenue	
Acre	0.558	**	0.422		0.919	***	0.398	***
Alagoas	0.268		0.020		0.555	***	0.355	
Amazonas	0.473		0.897	*	0.671	*	0.382	
Amapá	1.074	**	0.968		0.593	**	0.870	**
Bahia	0.023		0.831		0.135		0.022	
Ceará	0.056		-0.548		0.272	**	-0.001	
Distrito Federal	-0.361	*	0.058		0.173	***	-0.499	**
Espírito Santo	0.617	***	0.695	**	0.807	***	0.858	***
Goiás	0.303		0.440		0.337	***	0.485	***
Maranhão	0.347		0.337		0.365	**	0.108	
Minas Gerais	0.289		0.208		0.154		0.859	***
Mato Grosso do Sul	1.179	***	0.686	*	0.432		0.250	
Mato Grosso	0.204		0.246		0.579	***	0.451	***
Pará	0.167		0.307		0.297	**	0.058	
Paraíba	-0.053		0.696		-0.008		-0.127	

Pernambuco	0.135		0.168		0.277		0.090
Piauí	0.746	***	0.244		0.121		0.204
Paraná	0.291		0.747		0.209		0.326
Rio de Janeiro	0.054		-0.448		-0.136		0.447
Rio Grande do Norte	0.139		0.371		0.170		0.066
Rondônia	0.936	**	0.887	**	0.952	***	1.129
Roraima	0.519		1.059	***	0.123		0.170
Rio Grande do Sul	0.421		0.123		0.566	***	0.601
Santa Catarina	0.857	**	1.027		0.021		0.670
Sergipe	0.365	*	0.312		0.119		-0.138
São Paulo	0.052		0.083		-0.022		0.050
Tocantins	0.559	***	0.694	**	0.233	**	0.259

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Estimation done with FGLS.

Table 9 presents the results of relating the coefficient of pro-cyclicality for expenditures, (current and total expenditures), to the variables that could explain this behavior according to the financial channel and voracity effect hypotheses, following:

$$(5) \hat{\beta}_i = \alpha + \lambda z_i + \varepsilon_i; i=1, \dots, 27$$

Where β_i is the set of estimated parameters from equation (2) and Z_i is a set of control variables. Controlling by state size and by indebtedness (financial channel hypothesis), different specifications are presented to account for all the potential variables included under the voracity effect hypothesis (state revenue pro-cyclicality, state output volatility, state revenue volatility, and the ratio of intergovernmental transfers to current revenues). The results show that in the case of total expenditures [specifications (5)-(8)] the ratio of state debt to GSP has a negative sign in all specifications but is significant only in two of them, which suggest that states would be able to smooth expenditures by borrowing.¹⁴ Regarding the variables related to the voracity effect hypothesis, only the pro-cyclicality of the states' current revenues (the estimated β_i 's from equation 5) has a significant impact on the coefficient of total expenditure pro-cyclicality, suggesting that expenditure pro-cyclicality would mainly derive from pro-cyclical current revenues at the state level. However, state output volatility, state current revenue volatility, and the share of intergovernmental transfers do not have a significant impact on the coefficient of total expenditure pro-cyclicality.

¹⁴ Under the Fiscal Responsibility Law, approved in May 2000, states' debts were capped at a percentage of tax revenues established by the Senate. Currently, the debt stock is limited to 200 percent of net current revenue. Even with hard budget constraints, states would be able to smooth expenditures through borrowing. However, this option would need to be explored in greater detail.

Table 9: Sources of Procyclicalty

	Total Expenditures				Current Expenditure			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State GDP / Country GDP	-1.771 * [1.059]	-1.697 * [0.897]	-1.488 * [0.872]	-1.876 * [0.982]	-1.387 * [0.829]	-1.492 ** [0.654]	-1.103 ** [0.502]	-1.845 ** [0.773]
State Debt / State GDP	-1.312 ** [0.535]	-1.095 [0.664]	-0.687 [0.703]	-1.170 * [0.627]	0.307 [0.719]	0.562 [0.856]	1.087 [0.764]	0.417 [0.774]
State Current Revenues Procyclicalty	0.384 ** [0.165]				0.619 ** [0.130]			
State Output Volatility		0.283 [0.673]				0.031 [0.595]		
State Current Revenue Volatiltiy			3.013 [2.342]				3.403 [2.719]	
Intergov. Transfers / State Current Rev.				0.072 [1.395]				0.827 [1.374]
Observations	27	27	27	27	27	27	27	27
R-Squared	0.27	0.17	0.22	0.16	0.49	0.10	0.12	0.12
Addendum: Using State Tax Revenues								
State Tax Revenues Procyclicalty	0.263 [0.249]				0.494 *** 0.214			
State Tax Revenue Volatiltiy			3.895 *** 2.049				3.387 * 1.751	
Intergov. Transfers / State Tax Revenues				0.708 1.304				1.307 1.078

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. OLS estimation. Robust standard errors in brackets.

With respect to current expenditures, specifications (5)-(8), the results suggest that expenditure pro-cyclicality is mainly the product of pro-cyclical revenues at the state level. The ratio of state debt to GSP does not have a significant impact on the coefficient of current expenditure pro-cyclicality. In addition, as shown in the Table 9 the volatility of state tax revenues would also have a significant impact on the coefficient of expenditure pro-cyclicality, in terms of both total and current expenditures. In this sense the volatility of tax revenues rather than the state output volatility would generate pro-cyclical fiscal behavior in the Brazilian case. The results in Table 9 are sufficiently robust to accommodate the introduction of a political economy variable: coincidence of the presidential party with that of state governor, which is measured by the number of years in which the same political party held both the presidential and gubernatorial offices (see Table 10). This variable is consistent with the voracity effect hypothesis because when multiple power blocs compete for a share in fiscal revenues political links could be used to gain access to these resources. According to the results, this variable has a significant impact on the coefficient of current expenditure pro-cyclicality but not on that of total expenditures.

Table 10: Sources of Procyclicality: Including a Political Economy variable

	Total Expenditures				Current Expenditure			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
State GDP / National GDP	-1.616 [1.081]	-1.644 * [0.931]	-1.396 [0.900]	-1.866 * [0.994]	-1.033 [0.749]	-1.314 ** [0.650]	-0.868 * [0.482]	-1.798 ** [0.733]
State Debt / GSP	-1.498 ** [0.546]	-1.146 * [0.665]	-0.763 [0.697]	-1.239 * [0.636]	-0.116 [0.588]	0.389 [0.817]	0.893 [0.704]	0.101 [0.704]
No. of Years party Pres. = party Gov.	0.022 [0.024]	0.007 [0.021]	0.012 [0.025]	0.007 [0.024]	0.049 ** [0.020]	0.023 [0.020]	0.030 [0.019]	0.031 [0.026]
State Current Revenues Procyclicality	0.418 ** [0.180]				0.695 *** [0.117]			
State Output Volatility		0.295 [0.693]				0.071 [0.606]		
State Current Revenue Volatility			3.120 [2.447]				3.674 [2.837]	
Intergov. Transfers / State Current Revenue				0.161 [1.564]				1.236 [1.522]
Observations	27	27	27	27	27	27	27	27
R-Squared	0.29	0.17	0.22	0.16	0.58	0.12	0.24	0.15
Addendum: Using State Tax Revenues instead								
State Tax Revenues Procyclicality	0.264 [0.259]				0.496 ** [0.230]			
State Tax Revenue Volatility			3.904 * [2.119]				3.268 * [1.811]	
Intergov. Transfers / State Tax Revenues				0.739 [1.354]				1.412 [1.080]

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively. OLS estimation. Robust standard errors in brackets.

6. Conclusions

The empirical evidence provided in Sections 4 and 5 suggests the existence of pro-cyclical fiscal policy in Brazil at the state level, which is more pronounced during economic downturns. For the Brazilian states the main source of observed pro-cyclicality is the pro-cyclical behavior of those tax revenues directly collected by the state governments (ICMS). Similar to the findings by Sturzenegger and Werneck (2006) for the Argentine case, the tax structures of the Brazilian states—and not federal transfers—are the primary cause of state spending pro-cyclicality. However, the evidence also suggests that the introduction of the Fiscal Responsibility Law has implied some dampening of the Brazilian states' spending pro-cyclicality through the introduction of hard budget constraints.

The evidence further shows that smaller states are more pro-cyclical than larger states for all revenue and expenditure categories, with the exception of intergovernmental transfers where the evidence is inconclusive. In terms of geographic regions, the results are consistent with the analysis by state size. States in the North and Northeast (regions that include most of the smaller states) show high pro-cyclicality in tax revenues and spending, while total revenues from larger states of the southeast are less procyclical.

Intergovernmental transfers (federal transfers to the states) are not associated with changes in gross state product, but they are associated (pro-cyclically) with changes in national GDP, which could amplify the pro-cyclical behavior of sub-national expenditures. Nevertheless, it is clear that the Brazilian federal government must focus on creating and strengthening institutions that will allow it to play a stronger role in the (macroeconomic) stabilization of the states, particularly in the context of symmetric shocks to the regions. Automatic countercyclical fiscal policies designed to smooth resource transfers over the business cycle should be considered, though political economy issues would make them very difficult to implement (see World Bank 2008b for a comprehensive review of the issue of countercyclical fiscal policy in Brazil).

At the federal level, the empirical evidence shows that maintenance and capital expenditures (investment spending as opposed to current spending) have a higher degree of pro-cyclicality (i.e. are more volatile) when compared with personnel expenditure and mandatory spending (transfers). Expenditures excluding transfers react more to the business cycle than mandatory expenditures, which would imply a higher volatility in discretionary expenditures. This effect has been studied in the literature (e.g. Fatás and Mihov 2003b), which shows that the aggressive use of discretionary fiscal policy has a negative impact on economic growth and contributes to macroeconomic and budgetary volatility. In the case of Brazil this would explain why, in a downturn, fiscal adjustment relies mostly on capital expenditures, producing a negative effect on growth and exacerbating volatility.

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Annex 1: The Sensitivity of Central Government Revenues and Expenditures to the Business Cycle¹⁵

Based on monthly data for the period from January 1997 to January 2008¹⁶ the sensitivity of federal revenues and expenditures to the business cycle is assessed through the estimation of closed-form elasticities using the following specification:

$$\log\left(\frac{Rev_i}{Rev_i^{BK}}\right)_t = a_0 + \sum_{j=1}^{12} a_{1j} \log\left(\frac{Rev_i}{Rev_i^{BK}}\right)_{t-j} + \sum_{j=0}^{12} a_{2j} \log\left(\frac{IPI_i}{IPI_i^{BK}}\right)_{t-j} ; \quad (1)$$

$$\log\left(\frac{Exp_i}{Exp_i^{BK}}\right)_t = a_0 + \sum_{j=1}^{12} a_{1j} \log\left(\frac{Exp_i}{Exp_i^{BK}}\right)_{t-j} + \sum_{j=0}^{12} a_{2j} \log\left(\frac{IPI_i}{IPI_i^{BK}}\right)_{t-j} ; \quad (2)$$

Where Rev_i denotes: (i) Total Revenue, (ii) Gross Revenue, (iii) Tax Revenue, and (iv) Social Contributions. Exp_i denotes: (i) Total Expenditures (excluding interest payments) or Total Primary Expenditures, (iii) Personnel Expenditures, (iv) Pensions, and (v) Maintenance and Capital Expenditures (Non-Personnel Expenditure and Capital Spending). The sensitivity of constitutional transfers is also analyzed.¹⁷ IPI denotes the industrial production index. All variables are seasonally adjusted using the X-11 method. The BK superscript identifies the filtered series using the Baxter and King (Band-Pass) filter. The ratios of all variables in relation to their respective trends are stationary (see Table A1.1). The elasticity is calculated by assuming a long-run relationship between the variables.¹⁸ The elasticity could therefore be interpreted as the long-run elasticity. Under this methodology the sensitivity of revenue and expenditure variables is measured by an estimated elasticity that determines how much these variables could be expected to be affected by the business cycle. Consequently, the results cannot be interpreted as a measure of causality.¹⁹

¹⁵ We are thankful to Catalina Delgado and Conrado Garcia for excellent research assistance provided for this section.

¹⁶ The data sample selection has been determined by data constraints because consistent information on relevant budget aggregates is not available for a long enough time series. The source is the National Treasury and IPEA data (www.ipea.gov.br)

¹⁷ These are transfers from the federal government to the states and municipalities that are constitutionally mandated.

¹⁸ By a steady-state relationship between the variables it is meant that $\log(Exp_i/Exp_i^{BK})_t = \log(Exp_i/Exp_i^{BK})_{t-1} = \dots$ and $\log(Rev_i/Rev_i^{BK})_t = \log(Rev_i/Rev_i^{BK})_{t-1} = \dots$

¹⁹ There is no consensus in the literature on the methodology for a cyclically-adjusted measure of fiscal policy. Fatás and Mihov (2003b) point out that fiscal policy can be analyzed as consisting of three components: a) automatic stabilizers, b) discretionary fiscal policy that reacts to the state of the economy, and c) discretionary fiscal policy that is implemented independently of economic conditions. As the difficulty of measuring discretionary fiscal policy comes from the simultaneity in the determination of output and the budget, the analysis is centered on government spending.

Table A1.1: Unit Root Tests for the Revenue and Expenditure Variables (logs of the ratio of the variable over its trend)

Variables	Augmented Dickey Fuller (ADF)			Phillips - Perron (PP)		
	t-statistic	p-value	Ho: Unit Root	t-statistic	p-value	Ho: Unit Root
<u>Revenues:</u>						
Total Revenue	-3.991	0.002	No	-2.866	0.053	No
Gross Revenue	-4.359	0.001	No	-2.976	0.040	No
Tax Revenue	-3.441	0.012	No	-3.110	0.029	No
Contributions	-5.211	0.000	No	-3.031	0.035	No
Social Contributions	-3.580	0.008	No	-3.014	0.037	No
<u>Expenditures:</u>						
Expenditures excluding transfers	-5.983	0.000	No	-2.809	0.060	No
Personnel Expenditures	-5.983	0.000	No	-2.809	0.060	No
Pensions	-3.854	0.003	No	-3.024	0.036	No
Maintenance and capital.	-5.637	0.000	No	-2.877	0.051	No
Labor Subsidies (FAT)	-3.375	0.014	No	-5.224	0.000	No
Other maintenance and capital spending.	-5.871	0.000	No	-2.863	0.053	No
<u>Transfers:</u>						
Constitutional Transfers	-3.559	0.008	No	-2.445	0.103	No
<u>Addendum:</u>						
Industrial Production Index	-5.433	0.000	No	-5.413	0.000	No

Table A1.2 presents the results of estimations of the long-run elasticity for revenue and expenditure variables.²⁰ With respect to revenues the results suggest, as expected, procyclical behavior where the calculated elasticity for total revenue is 1.7, implying that

²⁰ At any level of government, revenue will be positively correlated with the business cycle. However, the purpose of this exercise is to assess the potential different degrees of cyclical behavior for different revenue categories.

total revenues would react more-than-proportionally to changes in output. Statistically, however, the calculated elasticity is equal to 1, which would imply proportionality in the reaction of fiscal revenues to output. The calculated elasticity for gross revenues is 1.9, a result that would be mainly driven by revenues derived from contributions whose elasticity is 1.1. As with the previous variable, the calculated elasticities are statistically no different from 1. Regarding tax revenues, the results suggest that they do not react to the business cycle at all.²¹

Table A1.2: Long-Run Elasticities of Revenue and Expenditure Variables

Variables	$\sum a_{1j}$ ^{1/}	$\sum a_{2j}$ ^{2/}	Elasticity (ϵ)	Ho: $\epsilon=0$	Ho: $\epsilon=1$
			$\sum a_{2j} / (1 - \sum a_{1j})$	P-value	P-value
<u>Revenues:</u>					
Total Revenue	0.797	0.339	1.666	0.014	0.315
Gross Revenue	0.810	0.370	1.949	0.032	0.289
Tax Revenue	0.894	0.473	4.438	0.134	0.244
Contributions	0.764	0.259	1.097	0.005	0.797
Social Contributions	0.865	0.083	0.615	0.191	0.411
<u>Expenditures:</u>					
Expenditures excluding transfers	0.764	0.307	1.298	0.002	0.454
Personnel Expenditures	0.838	0.169	1.043	0.424	0.974
Pensions	0.769	0.101	0.437	0.248	0.138
Maintenance and capital.	0.734	0.763	2.868	0.003	0.048
Labor Subsidies (FAT)	0.591	0.642	1.569	0.663	0.874
Other maintenance and capital spending.	0.821	0.548	3.056	0.020	0.112
<u>Transfers:</u>					
Constitutional Transfers	0.824	0.424	2.408	0.067	0.281

^{1/} Sum of coefficients of the dependent variable lags.

^{2/} Sum of coefficients of the contemporaneous value and lags of the industrial production index (IPI).

²¹ When looking at direct tax revenues, however, the elasticity for personal income tax revenue, not reported in the results, is 1.2. Conversely, when looking at indirect taxes the calculated elasticity for the COFINS tax (a consumption tax) is not statistically different from zero. Different results in the various subcategories of tax revenues could therefore explain the aggregate result for tax revenues

With respect to expenditures, the results suggest that expenditures excluding transfers are procyclical with an elasticity of 1.3. This result reflects the procyclicality of maintenance and capital expenditure, which reacts more-than-proportionally to the business cycle.²² Finally, constitutional transfers are also procyclical, which could potentially amplify the procyclical behavior of the states.

²²The results would also suggest that personnel expenditures do not react to the business cycle. De Mello and Moccero (2006) calculate an elasticity of 2.31 for personnel expenditures. Such estimation was done for the period January 1997- October 2005. Our data replicates such result for that sample period. However, the inclusion of the next two years changes the estimation results.