THE QUALITY OF FISCAL ADJUSTMENT AND THE LONG-RUN GROWTH IMPACT OF FISCAL POLICY IN BRAZIL[1]

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Abstract

This paper describes the main trends of Brazil's fiscal policy during the last decade, and analyzes empirically three key aspects: 1) the ability to raise the primary surplus in response to external shocks: 2) the procyclical nature of fiscal policy; and 3) the long run impact of government expenditure composition and taxation. The use of the primary balance as a policy tool is analyzed within the Drudi-Prati (2001) model, according to which, the government uses the primary balance as a signaling tool to reveal its commitment to serve its debt. As the debt increases, the dependable government will use more actively its primary balance. We verify that both the debt ratio and the primary balance are determinants of spreads (ratings) in Brazil. However, the relationship is non-linear, as the impact of the primary balance on spreads is amplified as the debt ratio increases.

The relationship between the primary balance and economic activity is analyzed by means of the Autoregressive Distributed Lag (ARDL) approach (Pesaran and Shin, 1999). Results indicate a positive correlation of the primary balance and output in the long run, but negative in the short run. Fiscal expansions are associated with primary balance reduction and vice-versa during output contractions, verifying the pro-cyclical nature of fiscal balances.

The impact of public expenditure composition and taxation on growth is analyzed in a modified production function framework, in which private and public capital are inputs, jointly with different types of public expenditure. The tax level is included to incorporate the government's budget constraint and to capture its potential negative effect on output. The paper uses two complementary approaches: a single equation method (the ARDL) and a multiple equation method (the cointegratng VAR) useful to analyze the interaction between the variables. Similar results are obtained: large elasticities of output with respect to capital stocks, a significant negative impact of taxation on long-run GDP, and a negative impact on GDP of increasing government consumption and transfer payments. These results shed light on the role of fiscal policy contribution to a disappointing growth performance in Brazil during the past decade.

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I. Introduction

Throughout the 1990s, Brazil started a process of economic reform including liberalizing trade, relaxing price controls, and privatizing public enterprises. Although some problems remained at first, such as higher public sector deficits and limited exchange rate flexibility, the country corrected most of these and steered a course toward stability by the end of the millennium. In fact, since 1999, Brazil has made substantial efforts to adjust its fiscal accounts. The country has moved in the direction of credible rules that govern the outcome of the budget process and procedures that contribute to providing incentives and constraints to promote fiscal discipline and increase transparency. The hallmarks of these measures include the Fiscal Responsibility Law and the impressive primary surplus targets achieved between 1999 and 2005.

Despite the impressive results some vulnerabilities still remains. In particular, the quality of the fiscal adjustment brings doubts about growth prospects and the own continuity of the hard fiscal stance. The fiscal adjustment has been accomplished through strong revenue increases (the tax burden has grown from 29 percent of GDP in 1998 to 35 percent in 2004) and by curtailing public investment (investments by federal government fell from 1.1 percent of GDP in 1998 to 0.5 percent in 2005). The increase of the tax burden and the compression of public investment are harming growth prospects which can make more difficult debt dynamics in the future On the other hand, the permanent increase of current expenditures and the impossibility to maintain the tax burden growth are negatively affecting the sustainability of the current fiscal adjustment effort. To sustain growth while re-orienting public finance towards investment therefore represents the next chapter of Brazil's national economic reforms.

The paper is organized in four sections following this introduction. The first describes the main fiscal trends since the nineties, focusing mostly on the period 1999-2005. The second section focuses on a mechanism that would allow fiscal policy to be more responsive to shocks, by permitting automatic stabilizers to operate throughout the business cycle to mitigate the pro-cyclicality of Brazilian fiscal accounts. This section computes the long run effects of different variables on the primary balance and estimates the cyclical component of the primary surplus. The third section examines the long-term impact of public finance on growth, using a modified production function approach, in which private and public capital are considered inputs, jointly with different types of public expenditure. Results indicate large elasticities of output with respect to capital stocks, negative impact of public consumption and transfers in the long run, and a significant negative impact of taxation on long-run GDP. The fourth section summarizes the results and concludes.

I. Background: Brazilian Fiscal Policy during 1990-2005

This section is divided into four parts. The first one describes fiscal outcomes during the last fifteen years, focusing on the fiscal adjustment of 1999-2005. The second section highlights the flexibility of fiscal policy during this volatile period, and examines the role of the primary surplus as a signaling device in a world of imperfect information. The third section assesses the quality of the fiscal adjustment identifying the type of adjustment carried out-revenue increasing or expenditure cutting. The fourth section attributes the type of fiscal adjustment to the high budget rigidity.

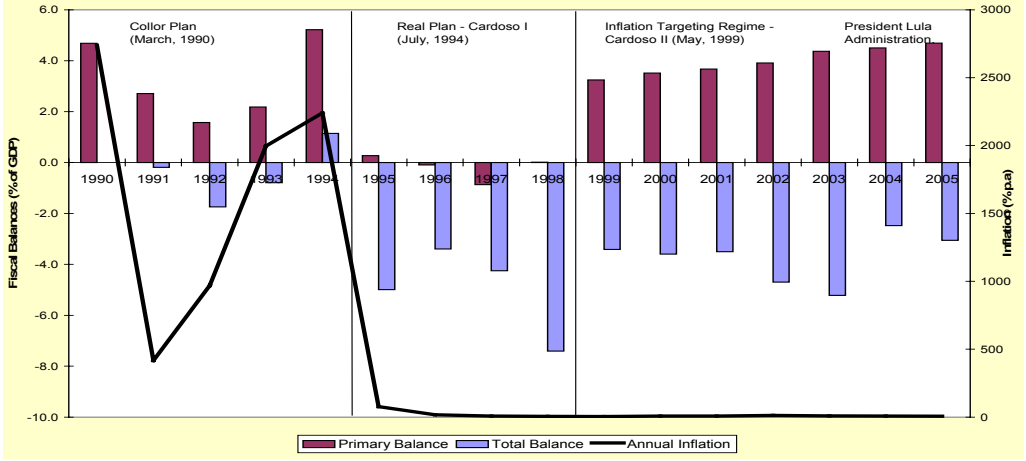
A. Fiscal Policy Trends in Brazil

During the last years of the military regime, the Brazilian public sector showed signs of financial fragility. Slower growth combined with the external shocks, led to a fall in public sector savings. The re-democratization process deepened the fiscal disequilibria, because the new democratic government set out to satisfy repressed social demands for redistribution. The 1988 Constitution expanded the social responsibilities of the state, guaranteed free access to social services, established higher social security benefits, and defined a generous regime for public sector employees (Bevilaqua and Werneck, 1998). The new Constitution also modified the federal fiscal system, creating an imbalance between resources and responsibilities among levels of government. Finally, the 1988 Constitution increased the rigidity of public spending through the earmarking of an important part of fiscal revenues.

These measures had a very perverse effect on public finances, but inflation postponed the collapse of the fiscal regime. During this high-inflation period, the asymmetric indexation to inflation of revenues and expenditures, higher for revenues than for expenditures, produced artificially positive balances (Cardoso, 1998). Additionally, the negative real interest rates and the inflation tax generated soft budget constraints and positive fiscal outcomes.

The evolution of fiscal accounts during 1990-2005 can be divided into three sub-periods, as shown in Figure 1. The first one, 1990-1994, registers positive primary outcomes and operational equilibriums. In the second one, from 1995 to 1998, the primary surplus vanishes, while the last sub-period, 1999-2003, corresponds to the fiscal adjustment years and shows a permanent improvement of the primary surplus from –0.2% of GDP in 1998, to 4.7% in 2005.

Figure 1
Brazil: Fiscal Results and Inflation 1990-2005



The end of the inflationary process in the mid nineties coincided with deteriorating fiscal outcomes in 1995-98. Inflation was not only a revenue source, but was also a useful mechanism to control government spending in real terms during the high inflation era (Cardoso, 1998). This loss of flexibility, combined with a lack of decisive fiscal reform, produced rising public sector deficits. The excess spending relative to national income was financed in liquid international capital markets, with public debt rising from 29% of GDP in 1994 to almost 42% in 1998.

The central bank sterilized these capital inflows through open market operations to avoid monetary expansion and maintain a pegged exchange rate. This response complicated the situation even more because it entailed rising central bank (domestic) debt and climbing interest rates that raised the cost of servicing public debt. High interest rates combined with the pegged exchange rate attracted even more capital, worsening the state of affairs. The higher debt and the rigid fiscal, monetary, and exchange rate policies, left the economy vulnerable and with no capacity to absorb shocks. When the Asian and Russian financial crises occurred in 1997-1998, Brazil was severely affected due to its sizeable external financing requirements. In January 1999, the central bank abandoned its crawling peg exchange rate regime in favor of a flexible rate and adopted an inflation-targeting framework for managing monetary policy.

In 1999, the country tackled its fiscal imbalance by launching the Fiscal Stability Program, which consisted not only in raising taxes, but also in designing a legal framework for fiscal policy management. The government set and met stringent targets for the primary fiscal surplus; the public sector primary surplus increased permanently from 3.3 percent of GDP in 1999 to 4.7 percent of GDP in 2005.

However, the high interest rates and the exchange rate devaluations of 1999, 2001 and 2002 prevented a more accentuated reduction of operational deficits. Consequently, the primary surpluses were not sufficient to truncate the rising path of public debt. Table 1 compares the three periods. During 1995-98, the operational balance deteriorated by almost 5% of GDP in comparison with the period 1990-94. This was a result of a rise of 1.5% of GDP in interest payments and a fall of the primary surplus of 3.5% of GDP. The Federal government was responsible for 60% of fall in the operational balance, and for more than 40% in the decrease of the primary surplus. States and local governments and public enterprises were responsible for 30% each for the worsening of the results.

Table 1: Fiscal Balances*, 1990-2005

	Annual Averages (% of GDP)			
	1990-1994 *(A)*	**1995-1998** *(B)*	**1999-2002** *(C)*	**2003-2005** *(D)*
I Operational Balance (III - II)	-0.05	-5.01	-1.52	-1.40
Federal Government	0.52	-2.48	-1.55	-1.93
States and Municipalities	-0.25	-1.98	-0.37	-0.22
Public Enterprises	-0.31	-0.55	0.41	0.70
II Real Interest Payments	3.33	4.84	5.09	5.96
Federal Government	1.26	2.78	3.67	4.71
States and Municipalities	0.86	1.64	0.98	1.21
Public Enterprises	1.20	0.42	0.07	0.08
III Primary Balance	3.27	-0.17	3.58	4.56
Federal Government	1.78	0.30	2.11	2.78
States and Municipalities	0.61	-0.34	0.61	0.99
Public Enterprises	0.89	-0.13	0.85	0.79

*** (+) Surplus (-) Deficit**

B. The Flexible Primary Surplus as a Device to Signal Fiscal Sustainability

How do governments that are not fully credible signal regime sustainability? Based on the Drudi-Prati (2000)2 model that rationalizes debt accumulation and delayed stabilization, we analyze the Brazilian case. The main testable implication of the Drudi-Prati (DP) model is the existence of a positive relationship between the spreads and the debt level and a negative association between spreads and primary balances. This relationship is conditioned on the debt level: Given uncertainty about the likelihood of default, the government will use the primary balance as a signaling tool to reveal to investors its true type. As the debt level rises, the dependable government (though not fully credible) will use more actively its primary balance as a signaling tool.

Spreads on sovereign debt are crucial determinants of the nominal exchange rate in Brazil and on domestic interest rates. What is the relation between these rates and the fiscal variables? For Brazil, primary balances and spreads show a non-stable association (Figure 2). From 1994 to 1998, when fiscal balances deteriorated, spreads declined. After 1999, when fiscal balances improved, spreads declined further. Drudi and Prati verified this non-monotonic relationship in their study of several European countries. The relationship between public debt and spreads is also non-monotonic. From 1994 –1997, when the debt ratio was low and slightly rising, spreads fell. Since 1999, however, Brazilian spreads and debt ratios appear to have settled at a higher level (Figure 3). Drudi and Prati (DP) described a similar phenomenon for the European countries.

Figure 2
Primary Fiscal Balances and Sovereign Spreads in Brazil
1994-2003

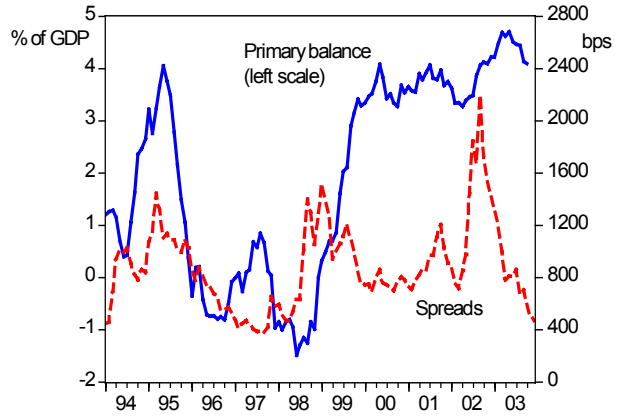
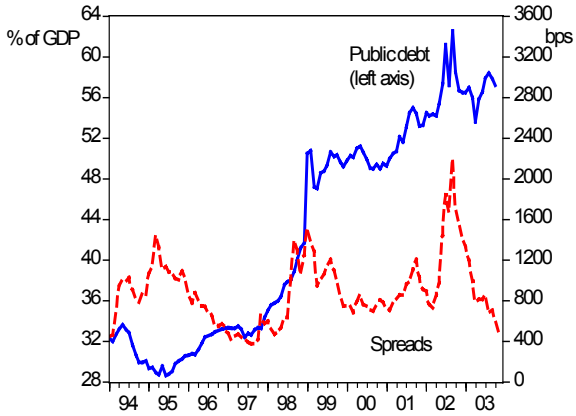


Figure 3
Public Debt Ratio and Sovereign Spreads in Brazil
1994 - 2003



The DP model predicts that the primary fiscal balances and public debt ratios enter the rating (spreads) function, and that the primary balance has a more influential role when debt ratios are high. This section verifies econometrically the following three testable implications of the DP model: 1) Debt ratios and primary balances are complementary in the spreads function; 2) The signaling role of the primary balance

[2] Drudi, F. and A. Prati (2000), "Signaling fiscal regime sustainability," *European Economic Review*, Vol. 44 pp. 1897-1930.

increases with the debt ratio; and, 3) If the government is dependable, then the primary balance will rise when the debt ratio increases.

To verify the complementary role of fiscal balances and debt ratios in the spreads function, we regressed the sovereign spreads on the first two variables (lagged). Table 3 shows that both variables enter significantly in the spreads function with the expected signs.

Table 3
Complementary Roles of Debt Ratios and Primary Balances as Spreads' Determinants

Dependent Variable: EMBORLAT
Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.26	0.06	-4.45	0.00
DEBTY(-1)	0.01	0.00	4.48	0.00
PRIMBAL(-1)	-0.02	0.01	-2.40	0.02

R-squared	0.454	Mean dependent var	-0.011
Adjusted R-squared	0.441	S.D. dependent var	0.083
S.E. of regression	0.062	Akaike info criterion	-2.698
Sum squared resid	0.309	Schwarz criterion	-2.611
Log likelihood	116.295	F-statistic	33.723
Durbin-Watson stat	0.362	Prob(F-statistic)	0.000

EMBORLAT= Brazil EMBI spreads orthogonalized from Latin EMBI average
DEBTY= Debt to GDP ratio
PRIMBAL= Primary fiscal balance

The second implication of the DP model, namely the changing nature of the signaling role of primary balances, is captured by the inclusion of an auxiliary which reflects the interaction of the primary balances with the debt ratio. If this variable is significant, then the hypothesis of the difference in the signaling role cannot be rejected. Results in table 4 shows that the primary balance coefficient rose with the debt ratio, implying that signaling takes time and is not a once-and-for-all event.

Table 4
The changing role of primary balances- Test 2

Dependent Variable: EMBORLAT
Method: Least Squares

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.530713	0.071481	-7.424499	0.0000
DEBTY(-1)	0.014446	0.001826	7.912960	0.0000
PRIMBAL(-1)	-0.024688	0.003926	-6.288602	0.0000
PRIMBAL(-1)*(DEBTDEV)	-0.002630	0.000572	-4.593340	0.0000

R-squared	0.632718	Mean dependent var	-0.011316
Adjusted R-squared	0.618945	S.D. dependent var	0.082535
S.E. of regression	0.050949	Akaike info criterion	-3.069552
Sum squared resid	0.207661	Schwarz criterion	-2.953799
Log likelihood	132.9212	F-statistic	45.93872
Durbin-Watson stat	0.632039	Prob(F-statistic)	0.000000

DEBTDEV=Deviation of the debt ratio from the sample mean

The third and final implication of the DP model, the positive association between the primary balance and the debt ratio if the government is dependable is reflected in Table 5.

Table 5
Primary Balances and Debt Ratios

Dependent Variable: PRIMBAL
Method: Least Squares
White Heteroskedasticity-Consistent Standard Errors & Covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.921112	1.048574	-2.785795	0.0066
DEBTY(-1)	0.112549	0.022527	4.996247	0.0000

R-squared	0.247189	Mean dependent var	1.631294
Adjusted R-squared	0.238119	S.D. dependent var	2.060787
S.E. of regression	1.798774	Akaike info criterion	4.035336
Sum squared resid	268.5538	Schwarz criterion	4.092810
Log likelihood	-169.5018	F-statistic	27.25346
Durbin-Watson stat	0.049271	Prob(F-statistic)	0.000001

C. The Type of Brazilian Fiscal Adjustment, 1999-2005

During the first four years of the Real Plan (1995-98), fiscal accounts were imbalanced due mostly to the loss of inflation as an adjustment mechanism and to the lack of decisive fiscal reform. As Table 6 shows, the weaker fiscal stance of the 1995-98 is explained by rising expenditure, which grew by 16%, with personnel and social security benefits expanding the most. Revenue rose just 8% or 1.4% of GDP, with growth concentrated on taxes, while the revenues of the Social Security System remained stable. *In sum, the fiscal expansion of 1995-98 was caused by rising expenditure and not to revenue reduction.*

The adjustment of the federal fiscal accounts in the last six years has been based on revenue increases and investment cuts. During 1999-2005, tax revenue rose by 4.6 % of GDP. Spending also grew, but at a slower rate: it rose by 2.5 percentage points of GDP during 1999-2005 As in the 1995-98, current expenditure accounted for the bulk of the rise, while capital spending were reduced. In this case, personnel expenditures remained stable while social security benefits and intergovernmental transfers experienced more dramatic increases.

The revenue-increasing nature of the 1999-2003 fiscal adjustment raises concerns about its sustainability. International experience shows that revenue-based adjustments tend to be short-lived (Alesina and Peroti, 1996). As spending follows the rising revenue, the adjustment effort is weakened and the lasting effect is a larger government.

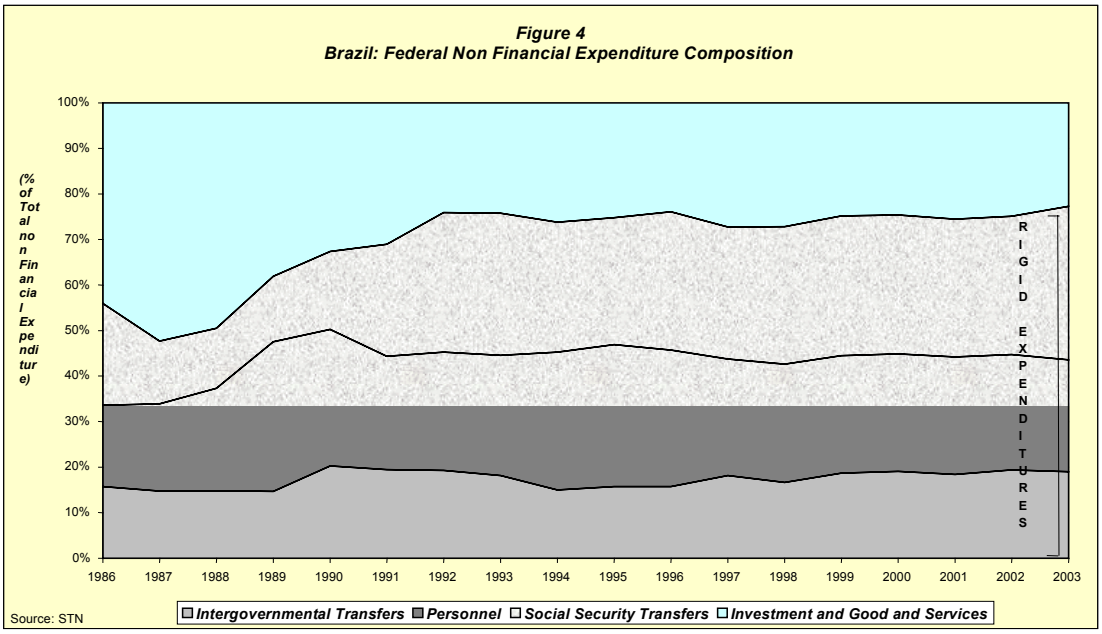
Table 6: Federal Government Primary Surplus Changes, 1990 - 2005

Categories	Annual Averages (% of GDP)			Variation 91/94 - 95/98				Variation 95/98 - 99/05			
	1990-1994 (A)	1995-1998 (B)	1999-2005 (C)	(B) - (A)	Percentual Variation	Decomp I	Decomp II	(C) - (B)	Percentual Variation	Decomp I	Decomp II
I Total Revenue	17.3	18.6	23.2	1.3	7.7	102	100	4.6	24.6	222	100
Treasury Revenue	11.9	13.6	18.0	1.7	14.6	132	130	4.3	31.8	210	95
Tax Revenue	11.0	12.0	16.6	1.1	9.9	83	81	4.5	37.6	219	99
Other Treasury Revenues	1.2	1.6	1.4	0.4	32.1	29	29	-0.2	-12.0	-9	-4
Social Security Revenue	5.0	5.1	5.3	0.1	2.7	10	10	0.2	3.3	8	4
II Total Expenditure	15.8	18.4	20.8	2.6	16.4	-198	100	2.5	13.5	-120	100
Personnel and Social Contributions	4.4	5.2	5.1	0.7	17.0	-57	29	-0.1	-1.3	3	-3
Social Security Benefits	4.2	5.4	6.7	1.2	30.0	-95	48	1.3	23.4	-61	51
Other Current and Capital Expenditures	4.3	4.8	5.2	0.5	11.1	-36	18	0.4	8.3	-19	16
Subsidies	0.1	0.2	0.3	0.1	98.2	-8	4	0.1	51.3	-5	4
FAT	0.2	0.6	0.6	0.3	138.7	-25	12	0.0	2.4	-1	1
Other- Goods and Services and Investment	4.0	4.0	4.3	0.0	1.1	-3	2	0.3	6.8	-13	11
Intergovernmental Transfers	2.9	3.0	3.9	0.1	3.9	-9	4	0.9	29.4	-43	36
Primary Balance (I - II)	**1.6**	**0.3**	**2.4**	**-1.3**	**-81.7**	**100**		**2.1**	**708.1**	**100**	

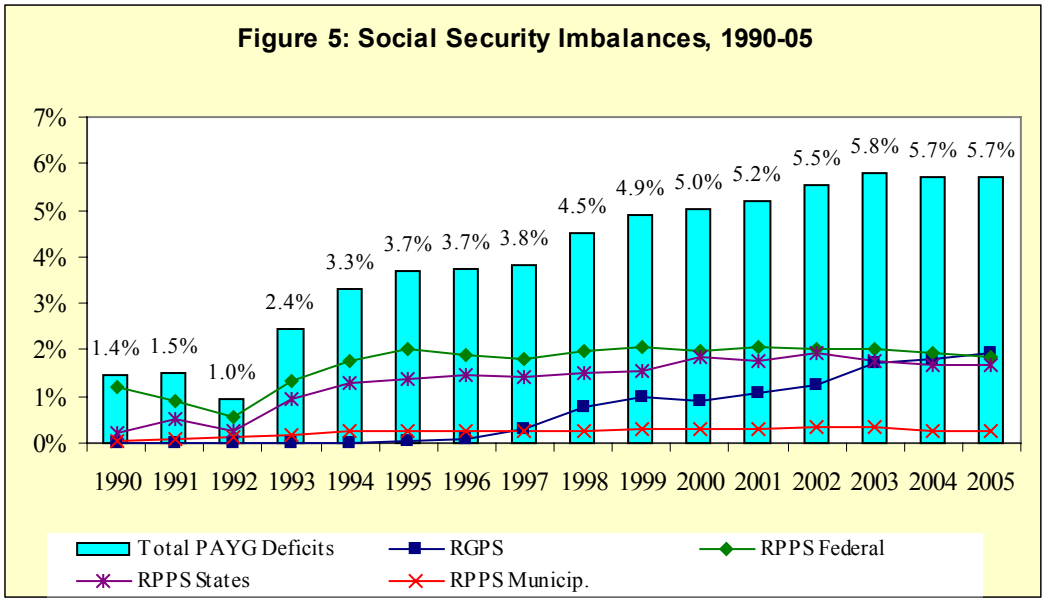
D. The rigidity of expenditures as the main explanation of the type of adjustment

Fiscal adjustment was revenue-based because of the rigidity of public spending. At the federal level, this rigidity is caused by three factors: i) the rise of social security and social assistance benefits; ii) the job tenure stability rules for public servants made impossible reducing the public sector payroll; and, iii) the constitutional earmarking of an important part of federal tax revenues.

The 1988 Constitution reinforced the three factors of expenditure rigidity through the concession of higher social security benefits and softening the eligibility criteria, defining a generous regime for official public employees which included job tenure and higher compensations and pension benefits equal to 100% of exit salaries, extending these benefits to all public sector employees and strengthening the intergovernmental transfers system. The 1988 Constitution favored the expansion of social responsibilities of the state, guaranteeing free access to social services, particularly health services, creating the unemployment insurance, establishing minimum social security benefits (1 minimum wage), and universalizing it by extending coverage to rural workers. Figure 4 shows the rising share of mandatory spending between 1986 and 2003. The increasing rigidity is due to the rise of personnel, social security and assistance transfers, and the intergovernmental transfers to states and municipalities that increased from 55% of non-financial expenditure in 1986 to almost 80% in 2001.



As a result of the growing share of mandatory spending, investment and other current expenditures decreased their share from around 51% of non-financial expenditures to less than 20% in 2001. Clearly, social security transfers are the fastest-increasing type of expenditure, generating a huge deficit that has to be covered by the Treasury. Figure 5 shows the evolution of the social security system imbalances during the period 1990-2005. While in 1990 the deficit was 1.4% of GDP, in 2005 it reached 5.7%.



III. Procyclical Fiscal Policy in Brazil

The vicious circle of procyclical fiscal policy, volatility and limited creditworthiness has been amply documented for Latin America (Gavin, Hausmann, Perotti and Talvi, 1996). Pro-cyclical fiscal policy is explained by the following factors: a) limited access to international credit markets during a shock implies that countries are unable to follow a tax-smoothing approach and have to tighten fiscal policy; b) tax structures that are heavily dependant on cyclical-sensitive income, such as indirect taxes (Gavin and Perotti, 1997); and c) weak institutional structures that do not allow generation of large enough primary surpluses in good times and lead to increased spending during expansionary phases (Talvi and Vegh, 2000). Several authors have attempted to documented the procyclical nature of Brazil's fiscal policy (IMF, WEO, 2002) but results are not very robust.

To examine the relationship between the primary balance and economic activity in the short and in the long run, we adopted the Autoregressive Distributed Lag (ARDL) approach (Pesaran and Shin, 1999, and Pesaran, Shin and Smith, 1999) because it is robust to the order of integration and cointegration of the regressors, hence the pre-testing procedures may be avoided. This approach also has the advantage that the lags in each of the regressors are allowed to be different, and the endogeneity problem can be eliminated by appropriate selection of the lag length (Pesaran and Shin, 1999).

This section follows closely Pesaran & Pesaran (1997) and Pesaran and Shin (1999), summarizing briefly the main points, and referring the interested reader to the original sources.

Consider the simplest autoregressive distributed lag ARDL (p, q_1, q_2,,...,q_k) model,

$$\phi(L, p)y_t = \sum_{i=1}^{k} \beta_i(L, q_i)x_{it} + u_t \qquad (1)$$

where

$$\phi(L, p) = 1 - \phi_1 L - \phi_2 L^2 ... - \phi_p L^p$$

$$\beta(L, q_i) = \beta_{i0} + \beta_{i1}L + ... + \beta_{iqi}L^{q_i}, \qquad i = 1,2,...,k,$$

L = lag operator such that $Ly_t = y_{t-1}$
A vector of deterministic variables (i.e. intercept term, seasonal dummies or time trend) can be included without problem.

The long run coefficients are calculated for the x_{it}[3] :

$$\hat{\theta}_i = \frac{\hat{\beta}_i(1, \hat{q}_i)}{\hat{\phi}(1, \hat{p})} = \frac{\hat{\beta}_{i0} + \hat{\beta}_{i1} + ... + \hat{\beta}_{i\hat{q}_i}}{1 - \hat{\phi}_1 - \hat{\phi}_2 - ... - \hat{\phi}_{\hat{p}}}, \qquad i=1,2,...,k$$

where $\hat{p}$ and $\hat{q}_i$, i=1,2,...,k are the selected values of p and q

[3] The model is first estimated by OLS method for all possible values of p=0,1,2,...,m, q_i=0,,1,2,...,m, i=1,2,...,k. A total of $(m+1)^{k+1.}$ .models are estimated. The maximum lag length might be chosen using alternative criteria: The R^2 criterion, the Akaike information criterion, Schwarz criterion, or Hannan-Quinn.

Rewriting equation 1 in terms of lagged values and the first differences of yt and xit derives the error correction model of the estimated ARDL.

$$\Delta y_t = -\phi(1,\hat{p})EC_{t-1} + \sum_{i=1}^{k}\beta_{i0}\Delta x_{it\,t} - \sum_{j=1}^{\hat{p}-1}\phi_j^*\Delta y_{t-j} - \sum_{i=1}^{k}\sum_{j=1}^{\hat{q}_i-1}\beta_{ij}^*\Delta x_{i,t-j} + \mu_t$$

where $EC_t = y_t - \sum_{i=1}^{k}\hat{\theta}_i x_{it} - \hat{\psi}' w_t$

The asymptotic variance of the long-run estimators obtained by OLS estimation of (1) can be computed by means of the delta-method, which involves complicated computational procedures (Pesaran & Pesaran, 1997). Fortunately, a statistical package (Microfit) provides this option for single equation estimation. Alternatively, a variant of the error-correction form can be estimated by instrumental variables.

Given this number of variables (6), and that the maximum lag was chosen to be 3, a total of $(3+1)^{6+1}$= 16,384 ARDL regressions were run. Hence we ran the primary balance as the dependent variable with the following regressors: public debt, spreads, output, real exchange rate, and real interest rates. The model selection process was based on four different criteria: Akaike Information Criterion (AIC), the R-Bar Squared (RBSC), Schwarz Bayesian (SBC) criterion, and Hannan-Quinn(HQ). Tables 7 and 8 summarize both the long-run coefficients and the short-run dynamics of the primary balance.

Table 7
Estimated Long-Run Coefficients for the Primary Balance
1991:01 – 2002:01

	AIC	RBSC	SBC	HQC
Debt to GDP ratio	.14* (.05)	.15* (.05)	.14** (.07)	.12*** (.07)
Output (in logs)	18.3* (5.6)	20.8* (5.6)	21.2* (6.9)	18.0* (6.5)
REER (in logs)	-7.6* (1.9)	-7.6* (1.8)	-8.96* (2.71)	-9.8*** (2.57)
Real interest rate	-.01*** (.004)	-.01** (.003)	-.01** (.008)	-.01* (.004)
Sovereign spreads (in logs)	.30 (.65)	.44 (.65)	.37 (.89)	.01 (.84)

Standard error in (). *Significant at the .01 level; ** Significant at the .05 level; *** Significant at the .10 level

Table 7 shows that, in the long run, output is positively correlated with the primary balance. However, Table 8 shows that, in the short run, the correlation is negative, implying that fiscal expansions are associated with primary balance reductions, and the primary balance increases during output contractions, verifying the pro-cyclical nature of fiscal balances. Another interesting result depicted in Table 7 is the positive and significant relationship between the primary balance and the public debt ratio. This fact may be interpreted as the result of a fiscally responsible sovereign that adjusts its primary to compensate changes in the debt ratio.

Finally, in this section we estimate the cyclical component of the primary balance by regressing this variable on the long-run components of each of the explanatory variables used in the previous exercise. The residual of such regression is the part of the

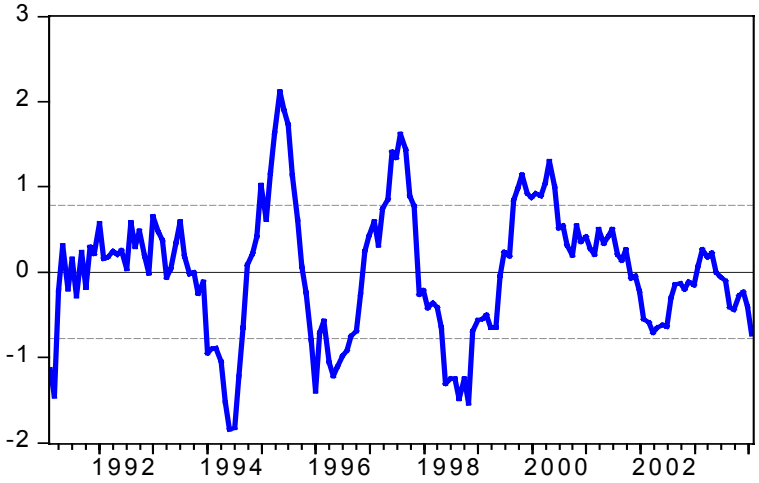
primary balance explained by the transitory or cyclical components of each of the explanatory variables. Hence, we interpret this residual as the cyclical component of the primary balance (Figure 6). In general, we observe that this component fluctuates between plus or minus 1 percent of GDP, with the most recent levels close to lower bound. That is, at the end of 2003, the economic slowdown and other transitory fluctuations of variables affecting the primary balance had a negative impact of close to one percent of GDP, compared to the positive impact of more than one percent of GDP in early 2000. Given that the observed primary balance improved by .5 percent of GDP during the period, the structural balance improved by close to 1.5 percent of GDP.

Table 8
Error-correction Representation for the Selected ARDL models 1991-2002
Dependent variable: d Primary Balance

	AIC	RBSC	SBC	HQC
Error-correction term(-1)	-.20*	-.21*	-.13*	-.14*
*d*Primary(-1)	.04	.02		
*d*Primary(-2)	.17**	.16**		
*d*Primary(-3)				
*D*debty	-.014	.007	.018**	.017***
*D*debty(-1)	-.038	-.013		
*D*debty(-2)	-.027	-.018		
*D*debty(-3)	-.081***	-.085*		
*D*Output	-1.87	-1.7	-1.27	-1.5
*d*Output(-1)	-2.36***	-3.1**		
*d*Output(-2)	-3.18**	-3.6*		
*d*Output(-3)	-1.98***	-2.27**		
*D*reer	-1.49*	-.39	-1.2*	-1.4*
*D*REER(-1)				
*D*REER(-2)				
*D*REER(-3)				
Dselicr	-.0004	-.004	-.001**	.006
dSelicr(-1)	-.001	-.009		
dSelicr(-2)	.001			
dSelicr(-3)				
Dembi	.44**	.45**	0.4**	.43**
dEmbi(-1)	-.66*	-.60*	-.67**	-.63*
dEmbi(-2)		-.30		
dEmbi(-3)				
$R\text{-Bar}^2$	.30	.30	.21	.23
D.W.	2.15	2.06	2.09	2.05

* Significant at the .01 level
** Significant at the .05 level
*** Significant at the .10 level

Figure 6: Cyclical Component of the Primary Balance
(in percent of GDP)



IV. Public Expenditure Composition and Growth

In this section we estimate the long run and short run impact of government expenditure on Brazilian growth using two related methods. First, we use the single-equation ARDL methodology described in the previous section, and then we use a multiple-equation co-integrating VAR approach to examine the relationship among the several variables.

Using data for 1950-2000, the Autoregressive Distributed Lag (ARDL) estimates a long run relationship and an error correction representation between income per capita, private and public capital stocks per capita and three components of government current expenditure (subsidies, social security and assistance transfers and consumption)[4]. The estimation also included tax revenues and public debt as a share of GDP to control for the government's budget identity and the potential negative effects of the government financing on economic activity. The data for the stocks of private and public capital was obtained from Reis et al (2002) and the flow data, that is income per capita and government current expenditures come from the National Accounts System - IBGE.

Tables 9 and 10 report the long-run coefficients and short-run dynamics estimated with this method.[5] Table 12 shows that, in the long run the elasticity of output with respect to the public capital stock is larger than in that of the private sector. The estimated elasticity seems high when it is compared with estimated values for the US or OECD economies (Sturn and de Haan, 1995; Hurlin, 2001), but similar to existing Brazilian estimates for infrastructure (Cavalcanti, 2004) However, the negative impact of the tax ratio is surprisingly large: an increase of 1 percentage point in the tax ratio lowers GDP per capita by 1 percent.

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[4] It also has the advantage that the lags in each of the regressors are allowed to be different, and the endogeneity problem can be eliminated by appropriate selection of the lag length (Pesaran and Shin, 1999)

[5] The tables report results for the different models: Akaika (AIC), Schwarz (SBC), R-Bar Squared (RBSQ) and Hanaan-Quinn (HQ). The production function was estimated in per capita terms, dividing all the arguments by the economically active population. There are 8 variables: GDP per capita, private capital stock per capita, public capital stock per capita, government subsidies, government consumption, government social security transfers, tax revenue ratio to GDP, and the public debt ratio to GDP. The maximum lag was 3. this produced a total of 262,144 possible combinations. THE AIC, SBC and HQC selected an ARDL (1,2,0,1,0,0,0,3) while the RBSC selected a (1,2,1,1,0,1,0,3)model.

Table 9 *Estimated Long-Run Coefficients for the GDP per capita* *1950 – 2002*				
	AIC	RBSC	SBC	HQC
Private Capital Stock per capita (in logs)	0.30* (0.10)	0.29* (0.10)	0.30* (0.10)	0.30* (0.10)
Public Capital Stock per capita (in logs)	0.71* (0.11)	0.72* (0.12)	0.71* (0.11)	0.71* (0.11)
Gov. Expenditures: subsidies per capita (in logs)	-0.04** (0.02)	-0.03*** (0.02)	-0.04** (0.02)	-0.04** (0.02)
Gov. Expenditures: consumption per capita (in logs)	0.11 (0.06)	0.10 (0.06)	0.11 (0.06)	0.11 (0.06)
Gov. Expenditures: social security and assistance transfers (in logs)	0.004 (0.061)	-0.04 (0.07)	0.004 (0.061)	0.004 (0.061)
Tax Revenue to GDP Ratio	-1.01** (0.37)	-0.82** (0.35)	-1.01** (0.37)	-1.01** (0.37)
Total Debt to GDP Ratio	0.30* (0.09)	0.32* (0.08)	0.30* (0.09)	0.30* (0.09)
Constant	-0.29 (1.00)	0.03 (1.12)	-0.29 (1.00)	-0.29 (1.00)
Trend	-0.002 (0.003)	-0.001 (0.003)	-0.002 (0.003)	-0.002 (0.003)
Standard errors in (). *Significant at the .01 level.** Significant at the .05 level. *** Significant at the .10 level				

Government expenditures in consumption or social security have no effect on per-capita GDP, while subsidies have a negative impact. The positive effect of public debt ratio is somewhat puzzling and could be reflecting an endogeneity problem i.e. that as GDP per capita increases there is a larger demand for financial assets and public bonds is one of those assets that domestic agents demand. To examine this hypothesis, we used Granger causality tests and the Wu-Hausman exogeneity test and both lead to the non-rejection of the exogenous public debt hypothesis.

In the short run (Table 5) private capital has a greater impact on GDP per capita than the public capital. Government expenditures have no effect on GDP, and tax rates have a negative impact on GDP. Public debt has also negative impact on GDP per capita in the short-run.

The long run results are puzzling for two reasons. First, because the high public capital elasticity and, second, because the fact that the public sector elasticity is higher than the private one. This fact is also present in several of the classic studies for the US and OECD economies, such as Aschauer(1989), Ram and Ramsey (1989), Eisner (1994), Sturn and de Haan (1995), Balmaseda (1997) and Viverberg (1997). Hurlin (2001a, 2001b) shows that, in general, papers based on time series analysis of variables in levels, like the present one, tend to find large output elasticities of public capital. Hurlin shows that there are two potential sources of bias for this finding: one the endogeneity of the factors of production, i.e. the fact that the productivity of private capital may depend on the level of public capital; and b) the fact that in most of those studies the output and the inputs are not cointegrated and the variables are non-stationary leading to the spurious regression problem.

The first source of bias may not be a serious problem in this specific case, given the ARDL methodology produces consistent estimates of the long run coefficients (Pesaran an Shin, 1997). We tested for the correlation between both private and public capital and the residual of the regression, and were unable to reject the exogeneity of these variables.

The second source of potential bias may be a problem, because based on the ARDL approach and the proposed method to test for long run relationships (Pesaran, Shin and Smith, 1999) the computed F-statistic between the upper and lower bounds that do not allow firm rejection or non-rejection of the null hypothesis of no long run relationship.

Table 10
Error-correction Representation for the Selected ARDL models 1952-2002
Dependent variable: d GDP per capita

	AIC	RBSC	SBC	HQC
Error-correction term (-1)	-0.52* (0.08)	-0.57* (0.09)	-0.52* (0.08)	-0.52* (0.08)
d(Private Capital Stock per capita)	1.66* (0.23)	1.87* (0.27)	1.66* (0.23)	1.66* (0.23)
d(Private Capital Stock per capita)-1	0.55*** (0.28)	0.63** (0.31)	0.55*** (0.28)	0.55*** (0.28)
d(Public Capital Stock per capita)	0.37* (0.05)	0.15 (0.23)	0.37* (0.05)	0.37* (0.05)
d(Gov. Expenditures: subsidies per capita)	0.004 (0.008)	0.004 (0.008)	0.004 (0.008)	0.004 (0.008)
d(Gov. Expenditures: consumption per capita)	0.06 (0.04)	0.06 (0.04)	0.06 (0.04)	0.06 (0.04)
d(Gov. Expenditures: social security and assistance transfers)	0.002 (0.032)	0.02 (0.03)	0.002 (0.032)	0.002 (0.032)
d(Tax Revenue to GDP Ratio)	-0.53* (0.17)	-0.46** (0.18)	-0.53* (0.17)	-0.53* (0.17)
d(Total Debt to GDP Ratio)	-0.17** (0.06)	-0.16** (0.06)	-0.17** (0.06)	-0.17** (0.06)
d(Total Debt to GDP Ratio)-1	0.06 (0.07)	0.04 (0.09)	0.06 (0.07)	0.06 (0.07)
d(Total Debt to GDP Ratio)-2	0.24* (0.06)	0.26* (0.06)	0.24* (0.06)	0.24* (0.06)
d(Constant)	-0.15 (0.52)	0.01 (0.64)	-0.15 (0.52)	-0.15 (0.52)
d(Trend)	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)	-0.001 (0.002)
R^2	0.88	0.89	0.88	0.88
D.W.	1.99	1.92	1.99	1.99

* Significant at the .01 level. ** Significant at the .05 level. *** Significant at the .10 level

To examine further this potential problem, we adopted a multiple equation cointegrating VAR approach. This approach will also allow examination of relationships between variables that the single-equation ARDL approach did not allow. With the same set of variables, we were unable to reject the hypothesis of up to four cointegrating vectors. To reduce the dimensionality of the problem (and based on the variance decomposition) we excluded the debt variable and were able to reduce the number of cointegrating vectors to two.[6]

With the specified system of six variables we examined the response of per capita GDP to multiple shocks with the Generalized Impulse Response Function. A one standard deviation shock to public capital (1.7 percent of GDP) that at the end of the

[6] See Appendix for the cointegration tests. One of the vectors, however, showed no persistence in the deviations from the equilibrium relationship to system-wide shocks. The other vector, on the opposite, showed temporary deviations from the equilibrium relationship returning after a few years. We arbitrarily eliminated the first one and remained with a single cointegrating vector.

simulation period (10 years) implies a higher public capital stock by almost 7 percent is associated with a 5 percent higher GDP (Figure 7); this fact implies a long run elasticity of about .7, almost identical to the long run elasticity estimated by the single-equation (ARDL) method. This approach, however, has the advantage of allowing examination of the impact of this shock on other variables. For instance, such a shock to public capital is also associated with an increase in private capital of almost 5 percent by the end of the forecasting horizon (Fig.8) verifying some degree of complementarity between both types of capital.

A shock to private capital stock, representing a rise of six percent (in the long run) is associated with a higher GDP by 4 percent (Fig. 9). This would imply a long run elasticity of about .6, much higher than the one estimated by the ARDL.

Figure 7

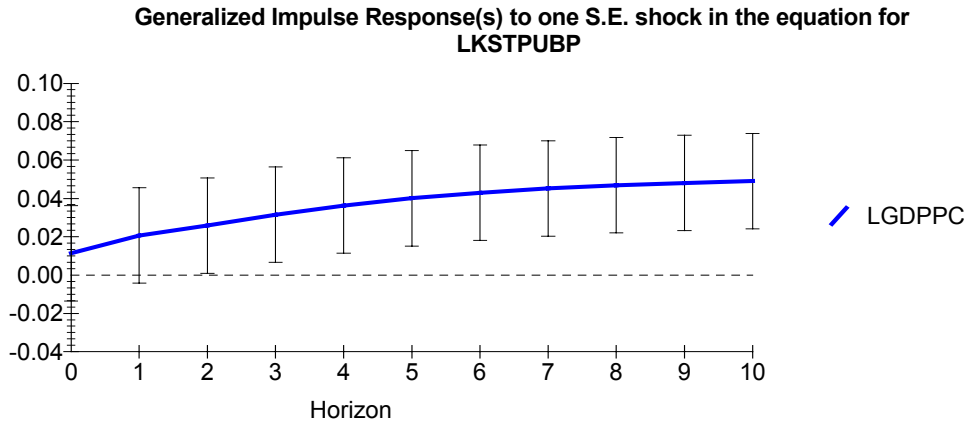


Figure 8

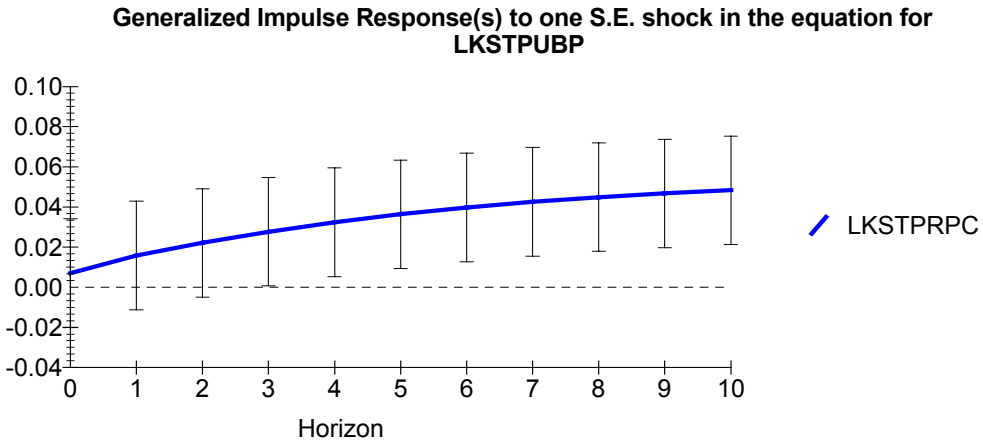
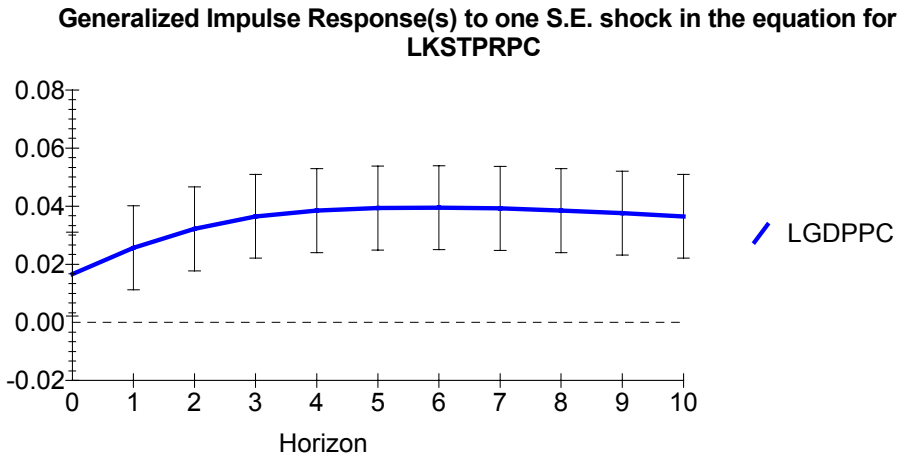


Figure 9



Another interesting result refers to the impact of a tax shock. A permanent increase of the tax ratio (of 1.5 percent of GDP) is associated with a lower GDP per capita of close to 1 percent (Figure 10), similar to the ARDL result. The same shock is associated with a lower private capital stock (Figure 11)

Figure 10

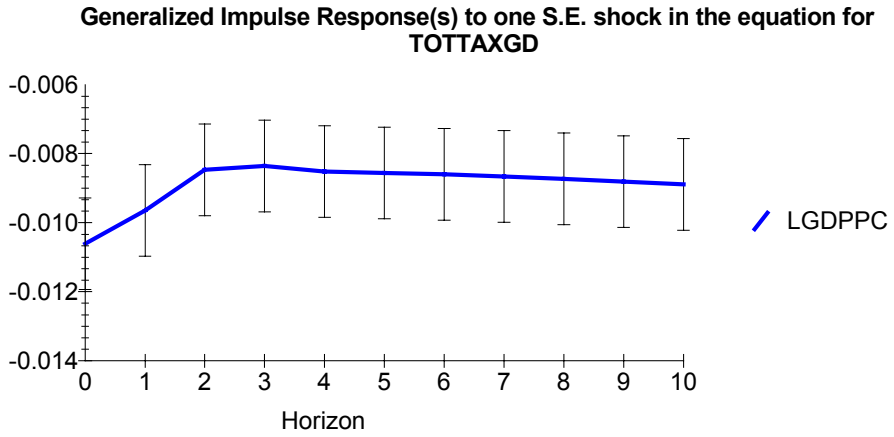
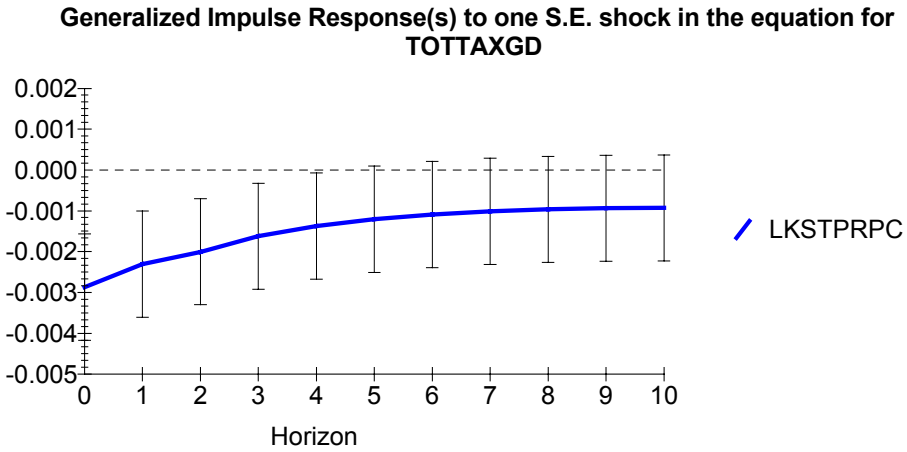


Figure 11



A shock that leads to a permanent rise of government consumption expenditure (of 7 percent in real terms) is associated with a fall in per capita GDP (Figure 12). This shock is associated with a higher tax ratio (Figure 13), lower private capital stock (Fig 14) and lower public capital stock as well (Figure 15).

Figure 12

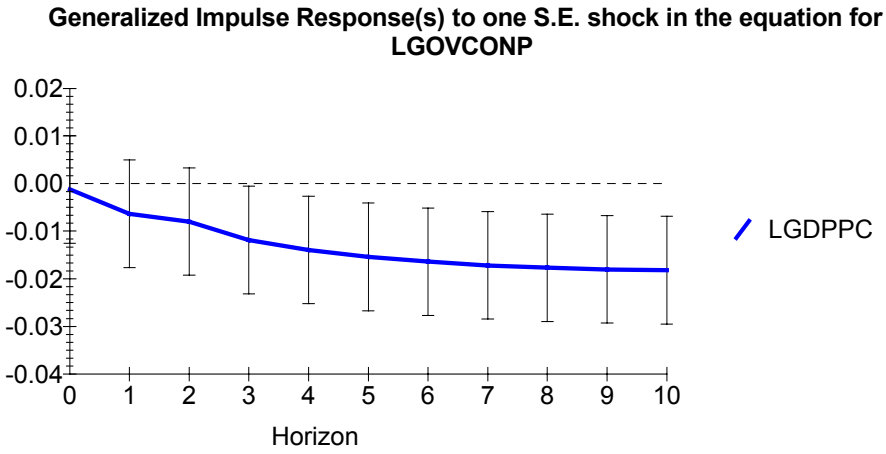


Figure 13

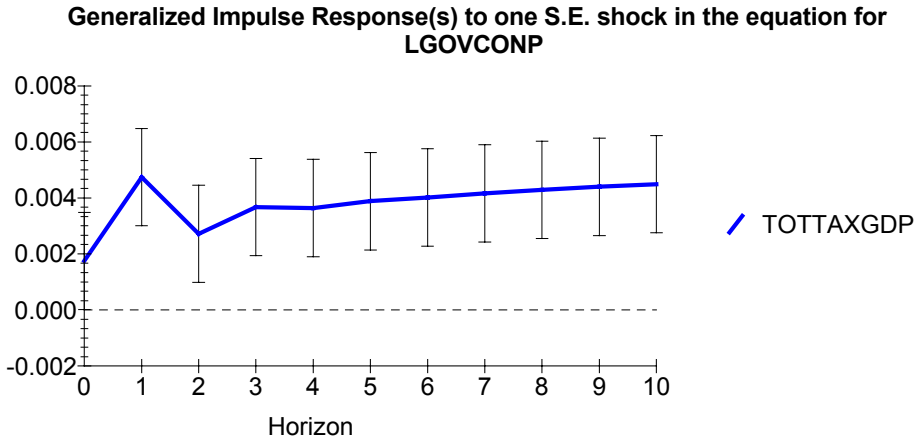


Figure 14

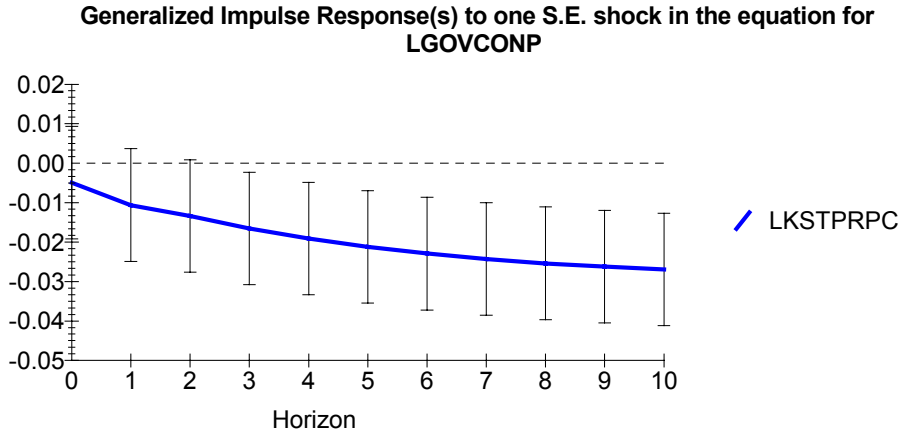
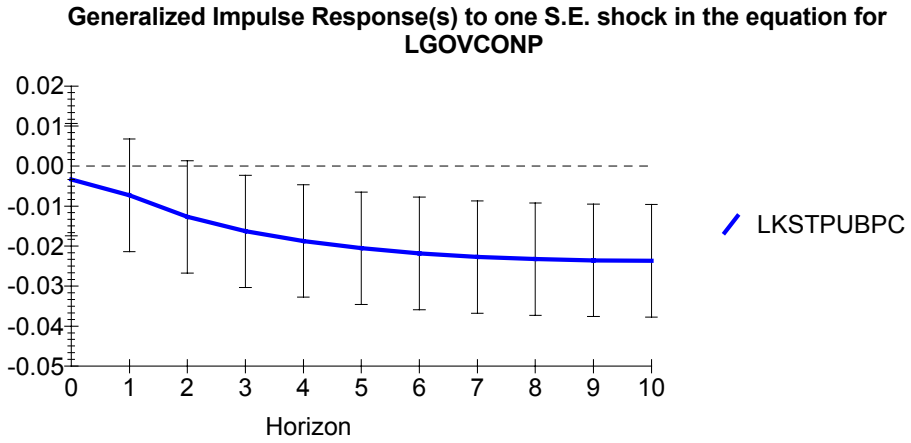


Figure 15



The other two types of government expenditures, namely the subsidies and social security transfers have negligible effects on GDP in the medium term and opposing effects in the long run. Given the small size of this type of expenditure, we will focus here on the effect of social security transfers. Social security transfers have a negative growth effect (Figure 16), primarily because of the associated reduction in the public sector capital (Figure 17). A 5 percent increase in the social security payments is associated with a fall of 3 percent in the public capital stock.

Figure 16

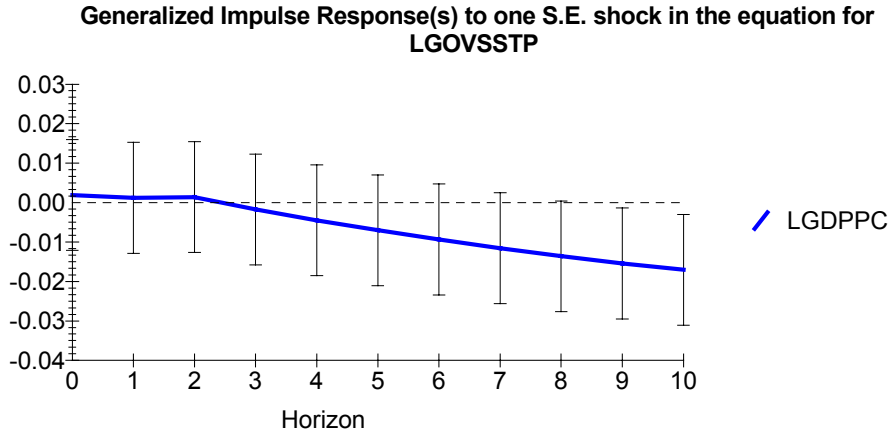
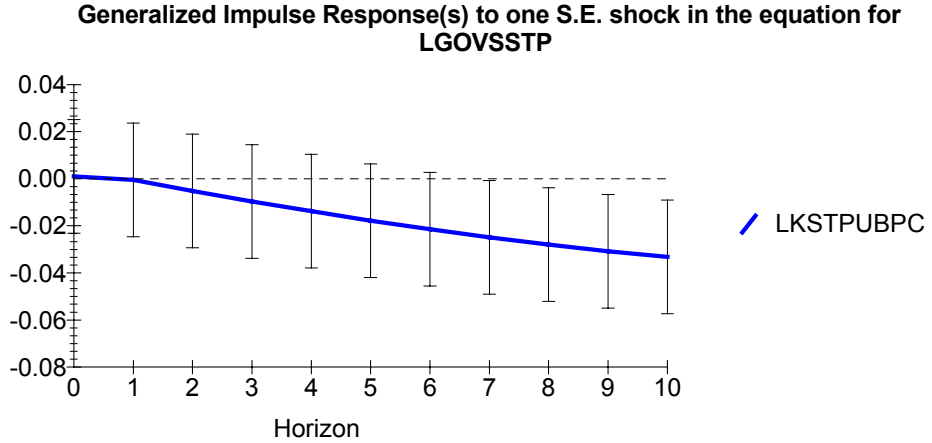


Figure 17



V. Conclusions and Policy Implications

During the past decade, the successful episodes of Brazilian stabilization coincide with those when fiscal policy was flexible to change the primary surpluses, while crises emerge when there is little flexibility to adjust to external shocks. For instance, the 1998-1999 episodes show the importance of the primary balance as a signaling tool in a world of imperfect information. In contrast to the 1998-1999 stabilization, fiscal policy was unresponsive to shocks in 2002, causing concerns of fiscal policy sustainability. Compounded by electoral uncertainty, the situation ended in the 2002 debt crisis

Brazilian fiscal adjustment has been of mixed quality. On one hand, most of the adjustment has been revenue-based and cutting capital expenditures. In the early nineties, the tax burden was 25% of GDP while in 2005 it reached 37%. In addition to the high level of taxation, the increasing share of indirect cumulative taxes and the over-taxation of a reduced tax base, generated distortions in economic decisions. On the other hand, the expenditure composition shows the rising trend in pension payments and the inequality that the pension regime originated in favor of the public servants.

Our findings show that Brazilian fiscal policy is procyclical in the short run: output expansions are associated with smaller primary balances, while output contractions with higher ones. In the long run, however, the evidence shows that fiscal policy is countercyclical, that is a 1% increase in output is associated with a higher primary balance of 0.2% of GDP.

The analyses presented in this chapter support the contention that Brazil may benefit from increased public spending in the area of economic infrastructure**.** The econometric analysis using historical data from Brazil indicate positive and strong growth effects of public physical capital stock and public investments. The analysis points out clearly the negative effects of increasing taxation on economic growth**.** Thus, it is not advisable for Brazil to pursue its need for increasing public investments via expansionary fiscal policy that results in a higher tax burden than the current level. Instead, a long-run solution to recovering an adequate level of public investments must be sought in reallocation of public spending within the fixed overall fiscal envelope. This means the need to re-examine the composition of the current expenditures, including those allocated to the social sectors that today consume a lion's share of Brazil's public expenditures.

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