SUSTAINABILITY OF BRAZILIAN FISCAL POLICY, ONCE AGAIN: CORRECTIVE POLICY RESPONSE OVER TIME

AUTOR: Viviane Luporini, Universidade Federal do Rio de Janeiro (UFRJ)- Instituto de Economia (IE)

ANPEC ÁREA 4- Economia do Setor Público

Classificação JEL: H62, H63, E62

Resumo: O artigo revisita a questão da sustentabilidade da política fiscal brasileira analisando as respostas fiscais do governo a alterações na razão dívida-PIB, com vistas a avaliar qual tem sido a resposta fiscal média do governo brasileiro, como essa resposta fiscal tem variado ao longo do tempo e qual o impacto sobre a estabilidade da razão dívida-PIB. Utilizando dados mensais e controlando para variações no produto e na participação relativa de títulos indexados, estimamos funções de reação sequenciais com uma janela móvel de 12 observações para o período de 1991 a 2011. Os resultados indicam uma resposta fiscal forte do governo consolidado (um aumento de 1% na relação dívida-PIB tende a ser acompanhado por um incremento do superávit primário de aproximadamente 0.09% do PIB). Verificamos ainda que a função de reação tornou-se mais estável, porém menos responsiva a aumentos da relação dívida/PIB após o ano de 2000 e assumiu uma tendência declinante após 2006. A avaliação da relação entre a resposta fiscal e a taxa de crescimento da dívida sugere que a estabilidade da relação dívida/PIB é altamente dependente da taxa de crescimento da economia brasileira, dadas as atuais metas estabelecidas para o superávit primário.

Palavras-chave: função de reação fiscal, sustentabilidade fiscal, Brasil

Abstract: This paper estimates a fiscal reaction function for Brazil, investigates how the government´s fiscal reaction has changed over time when controlling for cyclical variations in output and the relative participation of indexed debt, and analyzes the relationship between the fiscal reaction parameter and the growth rate of the debt-income ratio. Using monthly data over the period 1991-2011, we estimate a rolling reaction function with a one observation step and a sample-window of 12 observations. Our results indicate that the government´s fiscal response has been strong (a 1 percent increase in the debt-GDP ratio can be associated to an average increase in the primary surplus of approximately 0.09% of GDP); fiscal reaction has become more stable but less responsive to the debt-income level after 2000 and assumed a declining trend after 2006. The analysis of the relationship between the fiscal reaction parameter and the growth rate of the debt-income ratio suggests that the stability of the debt/GDP is highly dependent on the growth rate of the economy, given the government´s targets for the primary surplus.

Keywords: fiscal reaction function, fiscal sustainability, Brazil

1. INTRODUCTION

Most of the applied literature on fiscal sustainability are based on the econometric implications of a government following an intertemporally balanced budget constraint. Compliance or not to the budget constraint is usually tested as a cointegrating relationship between revenues and interest-inclusive government expenditures or, equivalently, as a mean-reverting process for the debt-GDP ratio series. Articles by Hamilton and Flavin (1986), Trehan and Walsh (1991), Wilcox (1989), Hakkio and Rush (1991), Ahmed and Rogers (1995), Uctum and Wickens (2000), amongst others, have all analyzed sustainability in this fashion. For Brazil, following the international literature, Rocha (1995), Tanner (1995), Luporini (2000), Issler and Lima (2000), all tested sustainability through the econometric properties of the debt, revenue and expenditure series, supporting sustainability. More recently, Bicalho (2005) finds that Brazilian fiscal policy was sustainable for the period 1997-2004, while Giambiagi and Ronci (2004) conclude for an unsustainable policy between 1995 and 2002. Using a probabilistic approach, Mendoza and Oviedo (2004), Garcia and Rigobon (2004), Tanner and Samake (2008), and Luporini and Licha (2009) also give evidence of a fiscally sustainable public debt for Brazil.

Bohn (2007) shows, however, that an intertemporally balanced budget imposes very weak econometric restriction on the series of debt or revenues and expenditures. In proving his bold statements, Bohn shows how a broader class of stochastic processes may comply with an intertemporaly balanced budget constraint and yet violate mostly used conditions for sustainability, namely stationarity and cointegration. A more promising approach would be, according to the author, analyzing fiscal sustainability through a fiscal reaction function.

A fiscal reaction function checks whether the government´s behavior has been sufficiently "responsive" to increments in debt. Luporini (2002) and De Mello (2005), and more recently, Mendonça , Santos and Sachsida (2009) have estimated fiscal reaction functions for Brazil. The later, using a Markov switching model over the period 1995-2007, has found that Brazilian fiscal policy was more responsive to accumulating debt prior to the year 2000.

This paper also estimates a fiscal reaction function for Brazil, but we further investigate the evolution of the fiscal reaction function, analyzing how the government´s fiscal reaction has changed over time when controlling for cyclical variations in output and the relative participation of floating rate indexed debt. Specifically, we pose ourselves two questions:

a) What has been the average fiscal response of the Brazilian government to variations in its public debt?
b) How has the Brazilian fiscal response changed over time?

Our results indicate that the government´s fiscal response has been strong (a 1 percent increase in the debt-GDP ratio can be associated to an average increase in the primary

surplus of approximately 0.09% of GDP); fiscal reaction has become more stable but less responsive to the debt-income level after 2000 and assumed a declining trend after 2006. The analysis of the relationship between the fiscal reaction parameter and the growth rate of the debt-income ratio suggests that the stability of the debt/GDP is highly dependent on the growth rate of the economy, given the government´s targets for the primary surplus.

The article is organized as follows. Section 2 presents the government´s budget constraint, the problems for assessing fiscal sustainability and present the fiscal reaction function. The results for the corrective policy responses by the Brazilian government and its evolution through time are presented in section 3. Section 4 concludes the article.

2. THE GOVERNMENT´S BUDGET CONSTRAINT AND BOHN´S FISCAL REACTION FUNCTION

The theory of government finance states that a fiscal policy is fiscally sustainable when the government follows an intertemporally balanced budget. In the absence of monetary financing and shocks, the government's budget constraint in real terms and as a ratio to income can be written as:

$$b_t - b_{t-1} = g_t - t_t + (r_{t-1} - k_{t-1})b_{t-1} \quad (1)$$

where,

b is the par value of the stock of government debt;

g and t are net of interest government expenditures and tax revenue, respectively;

r is the *ex post* after-tax real rate of interest;

k is the growth rate of income.

As the budget constraint above indicates, the evolution of the debt-income ratio depends mainly on the primary deficit $(g - t)$ and on the product of the accumulated debt-income ratio and the difference between the rate of interest paid on government's securities and the growth rate of the economy. If the difference is positive, the government needs a

primary surplus to keep the debt/income ratio from rising; if it is negative, the debt/income ratio may be stable even in the presence of some level of primary deficit. [1]

Assuming no growth and a constant interest rate just for mathematical simplicity, applying forward substitution to the budget constraint, taking expectations as of time *t* and applying the limit gives the well-known *no-Ponzi* scheme condition:

$$\lim_{n\to\infty} B_{t+n} = 0 \quad \text{with} \quad B_{t+n} \equiv 1/(1+r)^n b_{t+n} \quad (2)$$

That is, in the absence of uncertainty, sustainability requires that the government debt be offset by expected future primary surpluses of equal present-value.

Empirically, the *no Ponzi* condition has been tested in one of two ways: as a cointegrating relationship between revenues and interest inclusive government expenditures or, equivalently, as a mean-reverting process for the debt/income ratio series [Hamilton and Flavin (1986), Trehan and Walsh (1988), Wilcox (1989), Hakkio and Rush (1991), Ahmed and Rogers (1995), Uctum and Wickens (2000), amongst others].[2]

In a stochastic environment, the real return on government bonds commonly used as a discount rate will actually depend on how the overall level of government debt is distributed across states of nature and, as a result [3].

Bohn (2007) argues that, although mathematically correct, the results used in most empirical work on sustainability restrict the class of admissible alternative stochastic processes "in a way that rules out higher-order integration" [Bohn, (2007) p. 1838). In fact, the author shows that if the debt series is integrated of any finite order, $B_t \sim I(m)$ for any finite $m \geq 0$, it will satisfy the transversality or no-Ponzi condition (2), implying that any finite order of integration is compatible with the intertemporal budget constraint. Empirically his proposition means that one should not conclude for compliance or not to the no-Ponzi condition based on unit root and cointegration tests. Yet, a non-stationary debt means that the series does not have an upper bound, which clearly has economic implications for the government´s credibility and the debt management conditions.

[1] In fact, the budget constraint is not binding when *k* is greater than *r*.
[2] For analysis of the Brazilian case, see for example Rocha (1995), Tanner (1995), Issler and Lima (1997), Luporini (2000). For a probabilistic treatment of the sustainability of the Brazilian public debt see Mendoza and Oviedo (2004), Tanner and Samake (2008), and Luporini and Licha (2009).
[3] See Bohn (1995) and (2005) for a detailed discussion of this point.

The fiscal reaction function

Given the possible shortcomings of the unit root and cointegration sustainability tests, Bohn (1998, 2005) thus proposes a simple linear fiscal reaction function that ensures sustainability in a variety of stochastic situations. The function consists of searching for evidence of corrective action by the government in response to changes in its debt-income ratio:

$$s_t = \rho b_{t-1} + \mu_t \qquad (3)$$

where, s_t and b_{t-1} stand for the primary surplus and debt-income ratios. The "error term" μ_t is bounded as a share of income and represents other determinants of fiscal surplus.

The main hypothesis tested when estimating a fiscal reaction function is that the government has been responding to increases in its debt by adjusting its primary surplus or, equivalently, reducing its deficit. A strictly positive coefficient on b_{t-1} implies that a negative shock that results in an increase in the debt-income ratio, regardless of its nature, leads eventually to an increase in the primary surplus, ensuring compliance to an intertemporal budget constraint and thus fiscal sustainability.

In order to understand the relationship between the fiscal reaction function and the government´s budget constraint, we may rewrite (1) as:

$$b_t = -s_t + (1 + r_{t-1} - k_{t-1})b_{t-1} \qquad (4)$$

where $s_t = g_t - t_t$ defines the primary surplus. Combining equation (4) with the reaction function (3), we may establish a relationship between the government´s fiscal policy and the behavior of the debt-income ratio:

$$b_t = [1 + r_{t-1} - k_{t-1} - \rho]b_{t-1} - \mu_t \qquad (5)$$

Stabilizing the debt-income ratio requires that $[1 + r_{t-1} - k_{t-1} - \rho] < 1$ or $\rho > r_{t-1} - k_{t-1}$. That is, in order to keep the debt-income rate from rising, fiscal policy must be such that the fiscal response to a debt increment has to be greater, on average, than the real rate at which the debt-income itself is growing *(r – k)*. In other words, the fiscal reaction has to

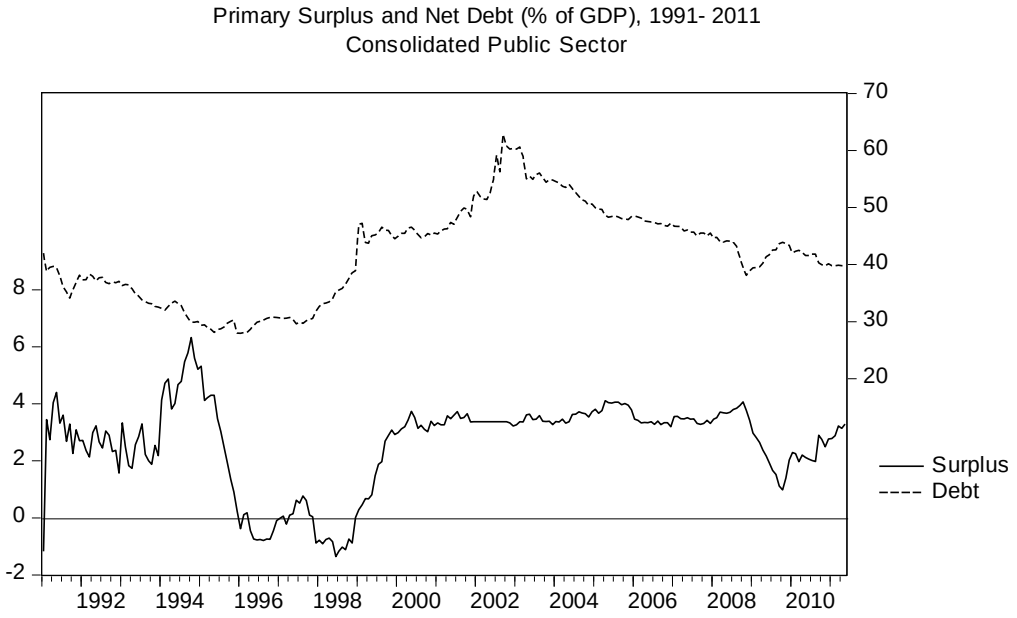
overcome the positive difference between real rate of return paid on government securities and the economy´s growth rate.[4]

3. CORRECTIVE POLICY RESPONSES BY THE BRAZILIAN GOVERNMENT

Fiscal sustainability will be analyzed by the relationship between the primary surplus and the debt-income ratio for the consolidated public sector. The evolution of these data for Brazil is presented in Figure 1.

The primary result indicates surpluses for most of the period analyzed. Between 1991 and the Real Plan of June 1994, the primary result averaged 2.9% of GDP but the fiscal stance deteriorated between 1995 and 1998. As prices stabilized after 1994, the possibility of reducing real government expenditures through inflation to balance the budget was no longer possible and bad budget practices were uncovered. Because revenues were price-indexed while expenditures were not, delaying payments helped the budget. Also during this period, the so-called hidden liabilities began to be properly included in the government´s account, contributing to the deterioration of the government´s fiscal stance.

Figure 1



Source: Central Bank of Brazil

[4] This is provided that the economy is operating on the dynamically eficiente region. In fact, if this is not the case (r < k, with probability one), the government´s budget is not binding and the fiscal reaction would be irrelevant.

At the end of 1998, the crawling peg exchange rate system used to support the domestic prices came under attack. Facing an external and fiscal crisis, the government floated the currency and implemented important institutional changes: fiscal targets for the primary surplus, ceilings on debt and personnel spending, and the approval of the Fiscal Responsibility Law in 2000. This represented a change in the fiscal regime and resulted in a persistent downward trend for the debt/GDP level since 2002. This benign evolution of the debt-income level was temporarily interrupted by the international crisis of 2008. The effects of the crisis on the overall growth rate of Brazil were relatively mild until 2011, in spite of the poor performance of the industrial sector. Active fiscal policy by the federal government has kept aggregate consumption afloat, but for 2012, the growth rate of GDP is expected to be below 2%.

In order to assess fiscal sustainability, we will search for a systematic relationship between the primary surplus and the debt-income rate by estimating the following regression equation:

$$s_t = \beta_1 + \rho b_{t-1} + \beta_j X_{jt} + \varepsilon_t \text{ , } j = 2,\ldots,m \quad (6)$$

where X_{jt} is a set of $j= 2,\ldots,m$ control variables that may also influence the government´s surplus, such as the business cycle and debt management actions by the Treasury.

Tax smoothing considerations suggests that budget deficits might be higher than normal during economic downturns. As indicated by Barro (1979), the deadweight loss from taxation would be minimized when the government acts counter-cyclically increasing its budget deficits during economic recessions while saving up during periods of economic growth. Empirically, a measure of the economic cycle (*ygap*) is added to the fiscal reaction function as a control variable. We should expect a positive coefficient if the government follows a tax smoothing policy.

A second control variable (*index*) used in the estimations is the percentage of government securities formally indexed to the baseline interest rate, the *Selic* rate. For a given debt-income level, the higher the relative participation of indexed securities in the total debt, the lower the market´s appetite for securities sold at a discount (nominal securities). This would in turn require a higher fiscal response by the government in order to increase fiscal credibility and improve the conditions for debt management.

For the fiscal policy, as previously discussed, the government may be considered fiscally sustainable if the coefficient on the debt-income ratio, ρ , is strictly positive.

The method of estimation depends on the stochastic nature of the data. The output gap, calculated as deviations of output from a *hodrick-prescott* filter, and the relative

participation of indexed securities on total debt are stationary by construction. Results for unit root tests are presented in Table 1.

Table 1: Unit Root and Stationarity Tests [a/]

Variable	ADF [b/]	ADF-GLS	KPSS
s_t	-2.094	-0.798	0.294
b_t	-0.997	-0.997	0.914*

a/ ADF (Augmented Dickey-Fuller) and ADF-GLS (Generalized Augmented Dickey-fuller Test); KPSS (Kwiatkowski, Phillips, Schmidt and Shin, 1992, stationarity test).
b/ * indicates rejection of the null of a unit root (in the case of ADF and ADF-GLS tests) or the null of stationarity (in the case of KPSS test) at the 5% level.

The unit root tests indicate that both the primary surplus and the net public debt may have stochastic trends. As such, the search for a sustainable relationship between the primary surplus and the public debt will rely on a possible cointegrating vector relating these two fiscal variables. Cointegration tests are presented in Table 2.

Table 2: Cointegration tests [a/]

	Trace Statistic	p-value [b/]	Max Eigen Statistic	p-value [b/]
None	74.645*	0.000	74.170*	0.000
At most 1	0.475	0.554	0.475	0.554

a/ s and b endogenous, allowing for a constant term in the cointegrating vector and VAR. No exogenous variables included to control for possible bias in the results as critical values assume no exogenous variables.
b/ MacKinnon, Haug and Michelis (1999) p-values, Eviews- version 7.1.

As Table 2 indicates, both the trace and maximum eigenvalue cointegration tests reject the null of no cointegration and do not reject the presence of one cointegrating relation between the primary surplus and the debt-income ratio.

When the variables are cointegrated, the coefficients may be estimated using a system of equations (vector error correction model proposed by Johansen, 1991) or a single equation model (Banerjee, Dolado, Galbraith, and Hendry, 1993). Johansen´s method departs from a vector auto regression system (VAR) and jointly estimates both the cointegrating vector (the long run relation between the variables) and the parameters of the error correction vector (temporary deviations from the long run relation); as such, Johansen´s method is asymptotically more efficient than single equation methods. But VAR systems are known for their sensitivity to alternative specification and instability in finite samples, which makes single equation models more attractive in finite sample contexts.

Here, we are interested in the long-term relation between primary surpluses and debt. Hamilton (1994) shows that if the variables are cointegrated, the cointegrating vector can be consistently estimated by OLS and, as long as the explanatory variables are weakly exogenous, standard *t* or *F* statistics may be used to test any hypothesis about the cointegrating vector.

a) The average fiscal response of the Brazilian government

As discussed previously, a fiscally sustainable policy implies a positive coefficient on the debt-income ratio indicating corrective measures in the primary surplus. What has been the average fiscal response by the Brazilian government to variations in the debt-income ratio over the period 1991 through 2011?

To answer this question we estimate the cointegrating vector implied by equation (6) using both, the Johansen´s method (the vector error correction model), and the uniequational method (results not reported). The results for the cointegrating vector are reported in Table 3 below.

The results for the long-run relationship between the fiscal variables as shown in the cointegrating equation ($s_{t-1} - \rho b_{t-1}$) indicate a positive and systematic response of the primary surplus to the debt-income ratio, suggesting a sustainable fiscal policy. According to Models I and II, a 1 percent increase in the debt-GDP ratio can be associated with an average increase in the primary surplus of approximately 0.09% of GDP. Coefficients are positive and statistically significant. The cointegration coefficient is smaller for Model III, which controls for the relative participation of indexed securities, but it is not statistically significant.

The short-term dynamics of the primary surplus as a ratio to income is reported in the second part of Table 3. We observe that for all Models, the coefficient on the error correction term (see Cointegrating . Eq.) is negative and statistically significant in the primary surplus equation. This indicates that temporary deviations from the long-term surplus-debt relationship are compensated by changes in the primary surplus. That is, when shocks imply a primary surplus above the debt-income ratio as determined by the long-term coefficient ($s_{t-1} > \rho b_{t-1}$), there is a negative change in the primary surplus in the next period so that its value tends to return to its long term estimated equilibrium.

Similarly, if a shock induces a surplus below the long-term relationship with the debt-income ratio, there will be a compensating positive change in the surplus-income ratio. In fact, one percentage point deviation from the estimated long-term surplus-debt relation induces, approximately, a 0.05 percentage point correction in the primary surplus. Cyclical variations in output have the expected positive sign in the surplus equation, but it is not statistically significant.

Table 3: Vector Error Correction Estimates a/

		Model I		Model II		Model III
Cointegrating Eq:						
s_{t-1}		1		1		1
b_{t-1}		-0.092847*		-0.096165*		-0.075523
		(0.04013)		(0.04133)		(0.05143)
		[-2.31360]		[-2.32701]		[-1.46857]
Error Correction	Ds_t	Db_t	Ds_t	Db_t	Ds_t	Db_t
Cointegrating Eq:	-0.048659*	-0.133100*	-0.049856*	-0.122097*	-0.045354*	-0.128173*
	(0.01861)	(0.04953)	(0.01871)	(0.04947)	(0.01896)	(0.04995)
	[-2.61424]	[-2.68729]	[-2.66463]	[-2.46790]	[-2.39193]	[-2.56611]
Ds_{t-1}	-0.069938	0.144979	-0.068746	0.126713	-0.070076	0.126410
	(0.05238)	(0.13938)	(0.05257)	(0.13902)	(0.05305)	(0.13975)
	[-1.33520]	[1.04015]	[-1.30761]	[0.91150]	[-1.32090]	[0.90454]
Db_{t-1}	0.021759	-0.023568	0.022026	-0.030477	0.023718	-0.031775
	(0.02475)	(0.06587)	(0.02484)	(0.06569)	(0.02487)	(0.06551)
	[0.87901]	[-0.35780]	[0.88655]	[-0.46392]	[0.95369]	[-0.48502]
C	0.002143	-0.016781	0.001940	-0.013979	-0.021763	-0.068936
	(0.02520)	(0.06705)	(0.02524)	(0.06674)	(0.05767)	(0.15191)
	[0.08504]	[-0.25028]	[0.07688]	[-0.20945]	[-0.37738]	[-0.45378]
YGAP			0.001318	-0.016548	0.001148	-0.016640
			(0.00337)	(0.00891)	(0.00339)	(0.00893)
			[0.39121]	[-1.85792]	[0.33864]	[-1.86406]
Index					0.000615	0.001422
					(0.00135)	(0.00355)
					[0.45589]	[0.40028]
Adj. R-squared	0.031473	0.063020	0.028594	0.072052	0.021181	0.072008
F-statistic	2.310671	3.712772	2.017648	3.684372	1.654605	3.347260
Det. resid cov. (dof adj.)		0.160144		0.159168		0.160364
Log likelihood		-459.9523		-458.1772		-458.0507
Akaike info criterion		3.917303		3.919154		3.934574
Schwarz criterion		4.147299		4.177899		4.222068
Observations		243		243		243
LM(12), p-values b/		0.5817		0.6512		0.6375
White Test, p-values c/		0.4976		0.5995		0.0005*

a/ Estimation assumed a constant term in the VAR system; Dummies (2001m12, 2002m11, 1991m12) included to control for Central Bank primary surplus series.(*) Indicates significance at the 5% level, asymptotic critical value of 1.96.

b/ Null of no serial correlation up to lag 12.

c/ Null of homocedasticity, no cross-terms.

b) Fiscal Reaction Over Time

The results above indicated that a 1 percent increase in the debt-GDP ratio can be associated with an average increase in the primary surplus of approximately 0.09% of GDP. But how has the fiscal response changed over the period analyzed?

In order to answer this question, we estimate a rolling regression equation (6) with a one observation step and a sample-window of 12 observations. Equation (6) involves the primary surplus and the debt-income ratios (both with stochastic trends) and stationary variables used as controls. As indicated in Sims, Stock, and Watson (1990) and Banerjee et. alli (1993), regressions involving a set of cointegrated variables along with stationary variables may be consistently estimated by OLS and inference on the coefficients can be made based on standard *t* tests (Hamilton, 1994). [5]

The evolution of the fiscal response by the Brazilian government is displayed in Figure 2.

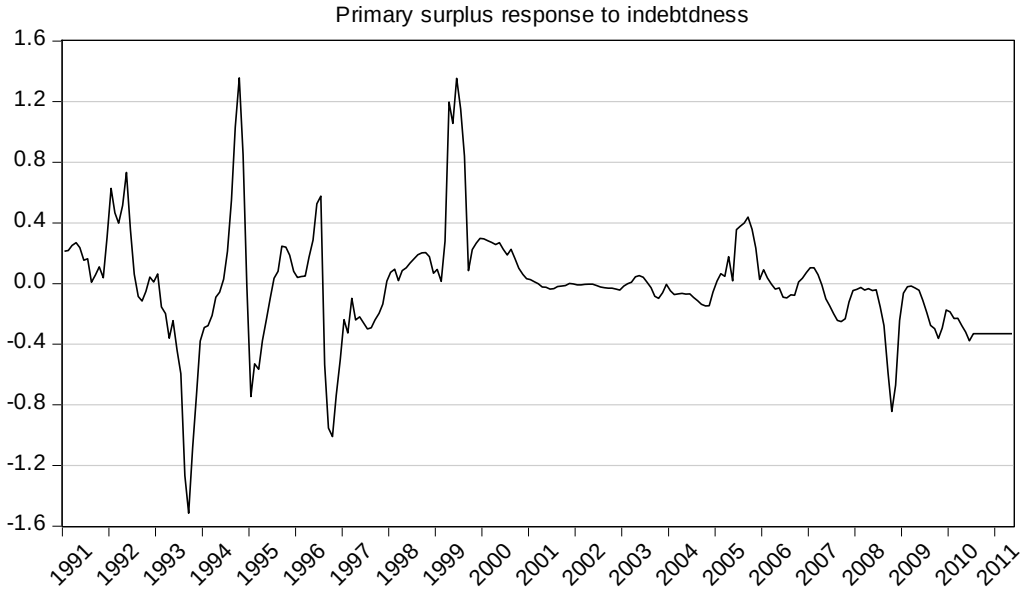
The values for the fiscal parameter observed in the graph represent the rolling regression coefficients over a 12-month window, so that each point estimated actually reflects the fiscal response for the 12-month period ahead. We observe a high variation of the fiscal parameter during the high inflation period (1991:01 through 1994:06) and the collapse of the crawling-peg regime in January of 1999. Along with the fiscal efforts implemented by the government after 1999 and the approval the Fiscal Responsibility Law in 2000, we observe an improvement in the fiscal response to debt.

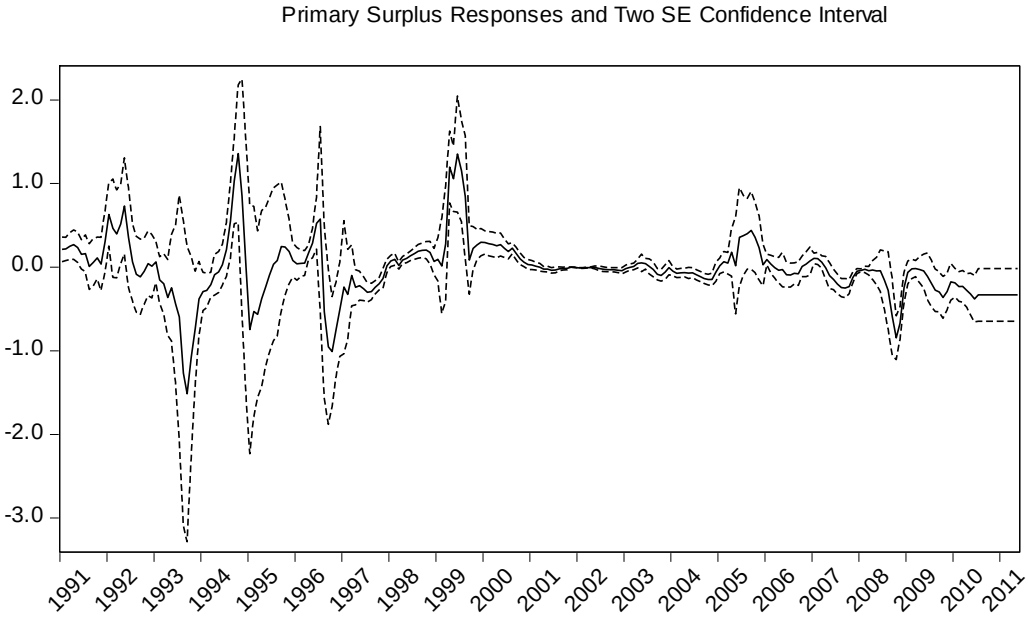
Fiscal reaction becomes weaker but relatively stable after 2001; it increases again during 2005 and reaches a high 0.4% for the point estimated for September of that year, reflecting the fiscal policy of 2006. After that, the fiscal parameter became more volatile and assumed a declining trend. There is a clear change in the fiscal regime after 2000. These results are in line with those obtained by de Mello (2005) and by Mendonça, Santos and Sachsida (2009).

[5] The program for the rolling regressions is available from the authors uppon request (Eviews 7.1).

Figure 2

Fiscal Reaction Parameter Over Time: 1991-2011 a/





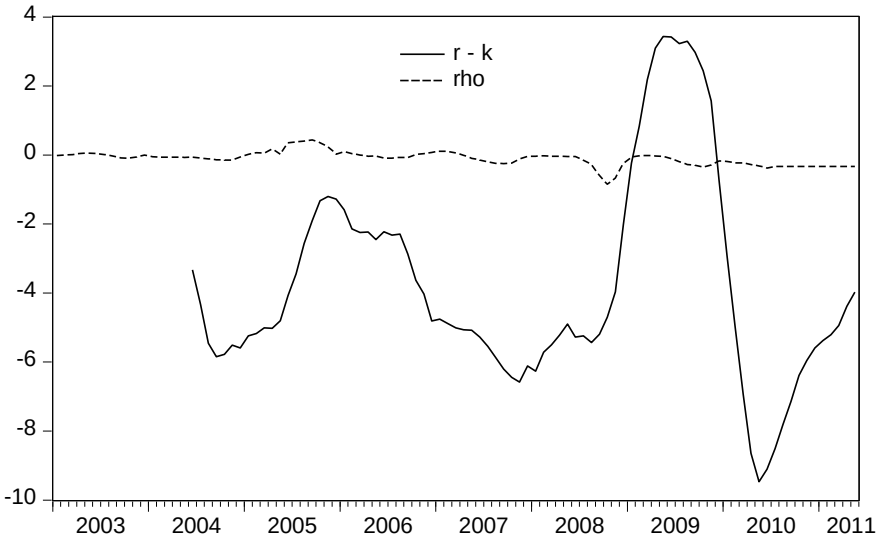
Source: Author´s calculations based on data from Banco Central do Brasil.
a/ Twelve-month rolling regressions

As previously discussed, stabilizing the debt-income ratio requires that the fiscal reaction parameter overcome the positive difference between the real rate of return paid on government securities and the economy´s growth rate: $\rho > r_{t-1} - k_{t-1}$.

Obtaining an empirical counterpart of the rate paid on government debt is not easy, as it reflects the distribution of securities over different maturities and indexation clauses. Ideally, this rate should also be net of taxes, complicating even more an empirical measurement. But, in order to have a rough idea about the relationship between the fiscal parameter and (r – k), we plot a proxy for (r – k) based on the IPCA-Adjusted SELIC rate and the growth rate of the economy based on the IBC-Br index. This economic activity index produced by the Brazilian Central Bank on a monthly basis since 2003 has proved to be good leading indicator of the actual GDP. Figure 3 shows that the fiscal reaction has been more than enough to maintain the debt-income ratio stabilized. Not surprisingly, the wide gap between rho and (r – k) is reflected in the downward trend of the government´s net debt. It is interesting to note, however, the importance of the economy´s growth rate for the fiscal performance (-0.2% in 2009 and 7.5% in 2010): low economic growth suggests a quick shift to an unstable debt. It is true that the debt-income level was relatively low (around 40% of the GDP). Still, considering that Brazil´s fiscal consolidation has relied heavily on revenues (highly dependent on the level of economic activity) and that expenditure are mostly earmarked, one may question the real fiscal capacity of the government to respond to negative unexpected shocks.

Figure 3

Fiscal Response to Stabilize the Debt/GDP a/



a/ Six-month rolling moving average for (r - k) .
Source: Author´s calculation based on Selic Rate and IBC_Br (Central Bank of Brazil)

4. FINAL REMARKS

This paper provides estimates of the fiscal reaction function of the Brazilian government over the period 1991 through 2011. Using monthly data, we present evidence of a fiscally sustainable policy defined as a positive response of the primary surplus to increases in the debt-income level. The paper also analyses the evolution of the fiscal reaction function through time, controlling for cyclical variations in output and the relative participation of floating rate indexed debt. Specifically, we answered two questions:

a) what has been the average fiscal response of the Brazilian government to variations in its public debt?
b) how has the Brazilian fiscal response changed over time?

According to our results, a 1 percent increase in the debt-GDP ratio is associated with an average increase in the primary surplus of approximately 0.09% of GDP, indicating a strong fiscal response and an overall fiscally sustainable policy.

Analyzing the evolution of the fiscal response through time and the relationship between the fiscal reaction parameter and the growth rate of the debt-income level, we find that the policy became more stable but less responsive to the debt-income level after 2000 and seems to have assumed a declining trend after 2006. Our results are in line with those previously obtained by the literature, but suggest a deterioration of the government´s fiscal stance after 2006. The analysis of the relationship between the fiscal reaction parameter and the growth rate of the debt-income ratio suggests that the stability of the debt/GDP is highly dependent on the growth rate of the economy, given the government´s targets for the primary surplus.

References

Ahmed S. & Rogers J. (1995). Government budget deficits and trade deficits: are present value constraints satisfied in long-term data? *Journal of Monetary Economics* 36:351-374.

Banerjee, A., Dolado, J.J., Galbraith, J.W. and Hendry, D.F. (1993):Co-integration, Error Correction, and the Econometric Analysis of Non-Stationary Data. Oxford: Oxford University Press.

Bicalho, A. (2005). Teste de sustentabilidade e ajuste fiscal no Brasil Pós-Real. Master Thesis, EPGE/FGV, Rio de Janeiro.

Bohn, H. (1998). The behavior of U.S. public debt and deficits. *The Quarterly Journal of Economics* 113(3).

Bohn, H. (2005).The sustainability of fiscal policy in the United States, *CESifo Working Paper Series* 1446, CESifo Group Munich.

Bohn, H. (2007). Are stationarity and cointegration restrictions really necessary for the intertemporal budget constraint?. Journal of Monetary Economics 54: 1837-1847.

de Mello, L. (2005). Estimating a fiscal reaction function: the case of debt sustainability in Brazil. OECD Economics Department Working Papers, n. 423.

Garcia and Rigobon (2004). A risk management approach to emerging market´s sovereign debt sustainability with an application to Brazilian data. NBER Working Papers 10336, National Bureau of Economic Research.

Giambiagi, F. and M. Ronci (2004): Fiscal Policy and Debt Sustainability: Cardoso's Brazil, 1995-2002, IMF Working Paper WP/04/156, Washington, D.C.

Hakkio, C. & Rush M. (1991). Is the budget deficit 'too large'? *Economic Inquiry* 39 (July):429-445.

Hamilton, J. (1994). Time Series Analysis. Princeton: Princeton University Press

Hamilton, J. & Flavin, M. (1986). On the limitations of government borrowing: a framework for empirical testing. *The American Economic Review* 76(4):809-19.

Issler, J. V. and Lima, L. R. (2000). "Public Debt Sustainability and Endogenous Seigniorage in Brazil: Time Series Evidence from 1947-1992". Journal of Development Economics, v.62, 131-147.

Johansen, S. (1991). “Estimation and hypothesis testing of cointegrated vectors in Gaussian VAR models.” *Econometrica*, 59 (6): 1551-1580.

Luporini, V. (2000). “Sustainability of the Brazilian fiscal policy and central bank independence”. Revista Brasileira de Economia, v.54(2).

_____ (2002). The behavior of the Brazilian federal domestic debt. Revista de Economia Aplicada, 6:713–733.

Luporini, V. and A. Licha (2009). “Espacio fiscal para el crecimiento em Brasil”, in J. Fanelli (org.) *Espacio Fiscal para el crecimiento el Mercosur*. Red Mercosur de Investigaciones Económicas, Zonalibro, Uruguay.

Mendonça, M., C. Santos and A. Sachsida (2009). Revisitando a função de reação fiscal no Brasil pós-Real: uma abordagem de mudanças de regime. Estudos Econômicos vol. 39(4): 873-894.

Mendoza, E. and P. Oviedo (2004). “Public debt, fiscal solvency and macroeconomic uncertainty in Latin American: the case of Brazil, Colombia, Costa Rica and Mexico.” NBER, Working Paper 10637.

Rocha, F. (1995). Monetary regimes and macroeconomic policy: an empirical analysis of the Brazilian economy. *PhD Dissertation*, University of Illinois at Urbana-Champaign.

Sims, Christopher A., James H. Stock, and Mark W. Watson. 1990. Inference in Linear Time Series Models with Some Unit Roots. Econometrica 58 (1): 161–82.

Tanner, E. (1995). Intertemporal solvency and indexed debt: evidence from Brazil, 1976-1991. *Journal of International Money and Finance*, 14 (4): 549-73.

Tanner, E. and I. Samake (2008). “Probabilistic sustainability of public debt: a vector autoregression approach for Brazil, Mexico, and Turkey” *IMF Staff Papers*, vol. 55 n. 1.

Trehan, B. & Walsh, C. (1991). Testing intertemporal budget constraints: theory and applications to U.S. federal budget and current account deficits. *Journal of Money, Credit, and Banking* 23(2):206-23.

Uctum, M. and M. Wickens (2000). “Debt and deficit ceilings, and the sustainability of fiscal policies: an intertemporal analysis.” Oxford Bulletin of Economics and Statistics, 62(2).

Wilcox, D. (1989). The sustainability of government deficits: implications of the present-value borrowing constraint. *Journal of Money, Credit, and Banking* 21(3):291-306.

Appendix:

DATA SET:

S : Surplus is the negative of the Borrowing Requirements of the Public Sector (% of GDP)

Source: Central Bank of Brazil, series 17127 and 5364.

17127 - NFSP sem desvalorização cambial (% PIB) - Fluxo mensal corrente - Resultado primário - Total – Setor público consolidado com Petrobras - %

5364 - NFSP sem desvalorização cambial (% PIB) - Fluxo mensal corrente - Resultado primário - Total – Setor público consolidado - %

B: Net Public Debt of the Consolidated Public Sector (% of GDP)

Source: Central Bank of Brazil, series 4513.

4513 - Netpublicdebt (% GDP) - Total - Consolidatedpublic sector - %
Banco Central

Ygap: Deviations from a hendrick-prescott filter applied to industrial production index (quantum)

Source: Central Bank of Brazil, 11064

Index: Relative participation of interest Indexed federal securities

Source: Ipeadata (www.ipeadata.gov.br), series

Títulos - federais - indexados à Over / Selic - fim período - (%) –
Banco Central do Brasil, Boletim, Seção Finanças Públicas (BCB Boletim/F. Públ.) - BM12_TPFOVER12

Títulos - federais - indexados à Over / Selic - mercado aberto - fim período - (%) –
Banco Central do Brasil, Boletim, Seção Finanças Públicas (BCB Boletim/F. Públ.) - BM12_TPFOVERMA12

R: Real interest rate (Selic – IPCA inflation)

Source: Ipeadata (www.ipeadata.gov.br), series

Taxa de juros - Over / Selic - (% a.m.) - Banco Central do Brasil, Boletim,
Seção mercado financeiro e de capitais (BCB Boletim/M. Finan.) - BM12_TJOVER12
Inflação - IPCA - (% a.m.) - Instituto Brasileiro de Geografia e Estatística,
Sistema Nacional de Índices de Preços ao Consumidor (IBGE/SNIPC) - PRECOS12_IPCAG12

IBC-Br: Economic Activity Index (Central Bank)

Source: Ipeadata (www.ipeadata.gov.br), series

Índice de Atividade Econômica do Banco Central (IBC-Br) - dessazonalizado (2002=100) –
- Banco Central do Brasil, Sistema Gerenciador de Séries Temporais (BCB outras/SGS) - SGS12_IBCBRDESSAZ12