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Fiscal insurance and public debt management: Evidence for a large emerging economy

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Abstract

This paper is a contribution to the analysis concerning fiscal insurance and public debt management. We built fiscal indicators and present empirical evidence for the effect of the public debt management on the fiscal insurance based on the Brazilian economy. The analysis is based on two steps: the first builds fiscal indicators and analyzes their performance over time, and the second presents regressions of the main variables regarding public debt management on the fiscal insurance indicators. The findings denote that there was a reduction in the fiscal vulnerability, but the public debt management was not effective in increasing fiscal insurance.
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Resumo

Este artigo é uma contribuição à análise sobre a segurança fiscal e o gerenciamento da dívida pública. Com base na economia brasileira foram construídos indicadores fiscais e apresentadas evidências empíricas referentes ao efeito do gerenciamento da dívida pública sobre a segurança fiscal. A análise é realizada em duas etapas: a primeira constrói indicadores fiscais e analisa o desempenho ao longo do tempo; e a segunda apresenta regressões das principais variáveis relativas ao gerenciamento da dívida pública sobre os indicadores de segurança fiscal. Os resultados denotam que houve uma redução da vulnerabilidade fiscal, mas o gerenciamento da dívida pública não foi efetivo para aumentar a segurança fiscal.
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Palavras-chave: Segurança fiscal; Gerenciamento da dívida pública; Indicadores fiscais; Brasil

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1. Introduction

A recurring theme in the theory of fiscal policy is the fiscal imbalance due to an increase in the government debt. The increased level of indebtedness can imply negative impacts on the economy such as raising the cost of government funding, reduction of private investment and thus a decrease in the potential economic growth (Lojsch et al., 2011). Moreover, excessive debt can lead to a situation of fiscal vulnerability which, in turn, threatens liquidity conditions and public debt solvency (Hemming et al., 2003).

The fiscal vulnerability can be mitigated by a policy based on a tight fiscal policy (increase in taxes or decrease in government spending) as a way of generating primary surpluses. Another possibility for reducing fiscal vulnerability, such as pointed out by Giavazzi and Missale (2004), is the low cost government funding. Therefore, public debt management can be an important tool for reducing fiscal vulnerability (Angeletos, 2002). In particular, the dependence of term structure of interest rates to the state of the economy and the sensitivity of the market value of the government debt to the interest rate enables the public debt management to promote protection against shocks to the economy.

When the fiscal trajectories are modified by shocks on the economy, a fall in the prices of government securities helps keep the intertemporal budget constraint. In other words, the market value of government debt equals the net present value of future primary surpluses thus maintaining fiscal solvency. One difficulty for this analysis as pointed out by Faraglia et al. (2008) is that the standard indicators for evaluating the performance of the public debt management do not allow one to observe a possible reduction in the fiscal vulnerability. According to these authors the use of fiscal insurance indicators open the doors for studies concerning public debt stabilization against fiscal shocks.

This paper is a contribution for the analysis concerning fiscal insurance and public debt management through empirical evidence for one of the largest emerging economies. This analysis is especially important because traditionally the conduct of fiscal policy in emerging economies is considered permissive and thus the risk of a fiscal imbalance is high. Moreover, it is important to highlight that in a different way from Faraglia et al. (2008) who cannot use a time series approach due to a resulting problem of a lack of reliable inference, the analysis for Brazil is not subject to this problem. Since 1999, the Brazilian National Treasury announced a strategy for extending the maturity of federal securities and for improving the composition of government liabilities. As a result, key variables such as maturity and composition of debt change over time.

In short, this paper builds indicators and makes an empirical analysis that permits us for the first time to evaluate the fiscal performance of the Brazilian economy concerning the effect of the public debt management on the fiscal insurance. With this objective, the analysis is divided into two main parts. The first builds four fiscal indicators (coupon payments, ratio of market value of debt to GDP, relative persistence of debt, and covariance between the primary deficit and the rates of return on debt) and analyzes their behavior over time. The second makes regressions (Ordinary Least Squares – OLS – and Generalized Method of Moments – GMM) for observing the effect of the main variables regarding public debt management (on the average maturity of debt and public debt indexing factors) on the fiscal insurance indicators. The findings indicate that debt management was not effective in increasing fiscal insurance.

This article is organized as follows: Section 2 depicts the data and the fiscal indicators. Section 3 presents the empirical evidence through OLS and GMM models regarding the effect of the management debt on fiscal insurance. Section 4 concludes the article.

2. Data and methodology

As pointed out by Faraglia et al. (2008), most fiscal indicators in the literature fail in the analysis on the role of debt management in providing insurance against budget shocks as to stabilize the debt-to-GDP ratio. Under this view, a first indicator that is considered is the coupon payments (*cp*) and it is the result of the internal federal government nominal interest payments (*interest*) divided by federal domestic securities (*debt*), then

$$cp = interest/debt. \tag{1}$$

Public debt stability is very important. As highlighted by Nosbusch (2008) it is desirable that an increase (decrease) in the interest rate due to a shock in the economy is offset by a decrease (increase) in the market value of government

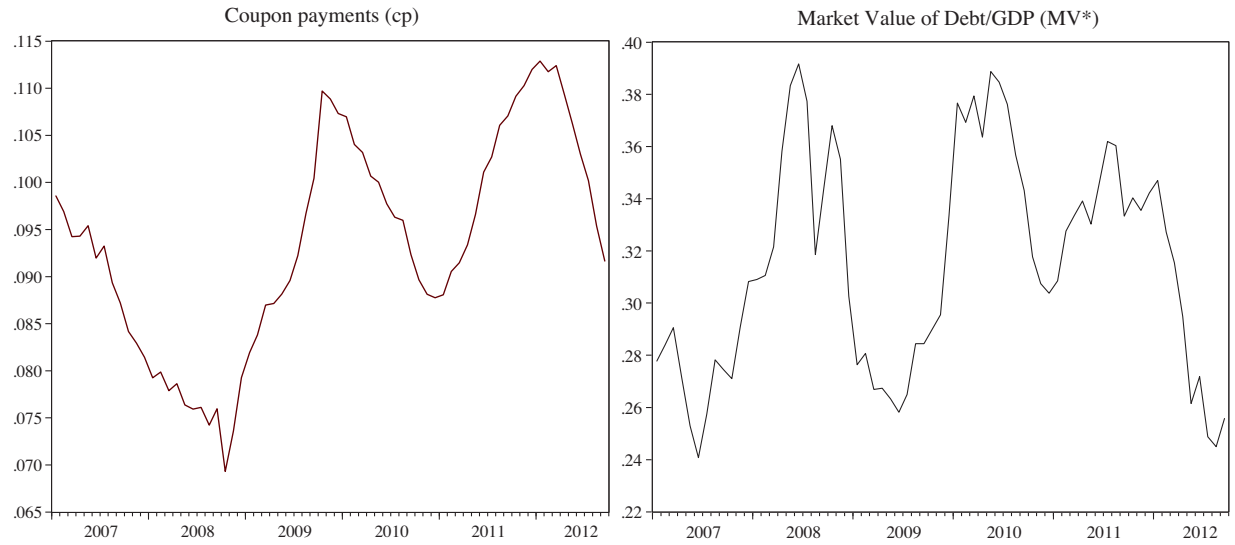

Fig. 1. Coupon payments and market value of debt/GDP.

debt in order to protect the budget from shocks. Therefore, a second indicator is given by the ratio of market value of debt (MV) to GDP (Y),

$$MV* = MV_t / Y_t. \tag{2}$$

In a general way, the market value of government debt is not available and it is common practice to use the par value of debt. However, as pointed out by Butkiewicz (1983), par value is a poor proxy for market value, especially when interest rates are changing rapidly. Hence, the market value is a result of $MV_t = [(1 + Mat{\cdot}c)/(1 + Mat{\cdot}r)]{\cdot}P$, where: Mat is the term to maturity, c is the coupon rate, r is the yield, P is the par value.

The third indicator takes into account the fiscal insurance and it is related with the persistence of debt. Based on the market value of government debt and the primary deficit (w), a measure of debt management is a result of

$$\Psi_{1k} = P^k_{MV} - P^k_w \quad \Psi_{2k} = \frac{P^k_{MV} - P^k_w}{P^k_w} \tag{3}$$

where $P^k_{MV} = Var(MV_t - MV_{t-k})/kVar(MV_t - MV_{t-1})$ and $P^k_w = Var(w_t - w_{t-k})/kVar(w_t - w_{t-1})$. The only difference between the indicators is that Ψ_{2k} is normalized by the degree of persistence in the primary deficit.

The greater Ψ the worse the performance of debt management and negative values are indicative of complete market outcomes. The persistence of public debt can be reduced by adjusting the primary deficit, a fact that hampers the measurement of the performance of debt management. The reduction of persistence must come from a change in the returns of securities, an effect that can be captured by the relative persistence of the market value of debt to primary deficit. The persistence of the indicator takes on, for example, outstanding reduction effects due to increases in the primary surplus.

Taking into account the concept of fiscal insurance that the debt management can offset the impact of the primary deficit on the market value of debt, thus minimizing debt fluctuations involves exploiting a negative covariance between the primary deficit to GDP ($w*$) and the rates of return on debt ($R*MV*$). Hence,

$$\rho_{w^*, R^*MV^*} = \frac{Cov(w^*_t, R^*_t MV^*_t)}{\sigma_{w^*}\sigma_{R^*MV^*}}, \tag{4}$$

where $MV*$ is the market value of government debt to GDP, and σ denotes the standard deviation.

With the aim of building the above-mentioned indicators for the Brazilian economy in a time series perspective, the variables listed below are used. All data is monthly, accumulated in the last 12 months, deflated by Extended National

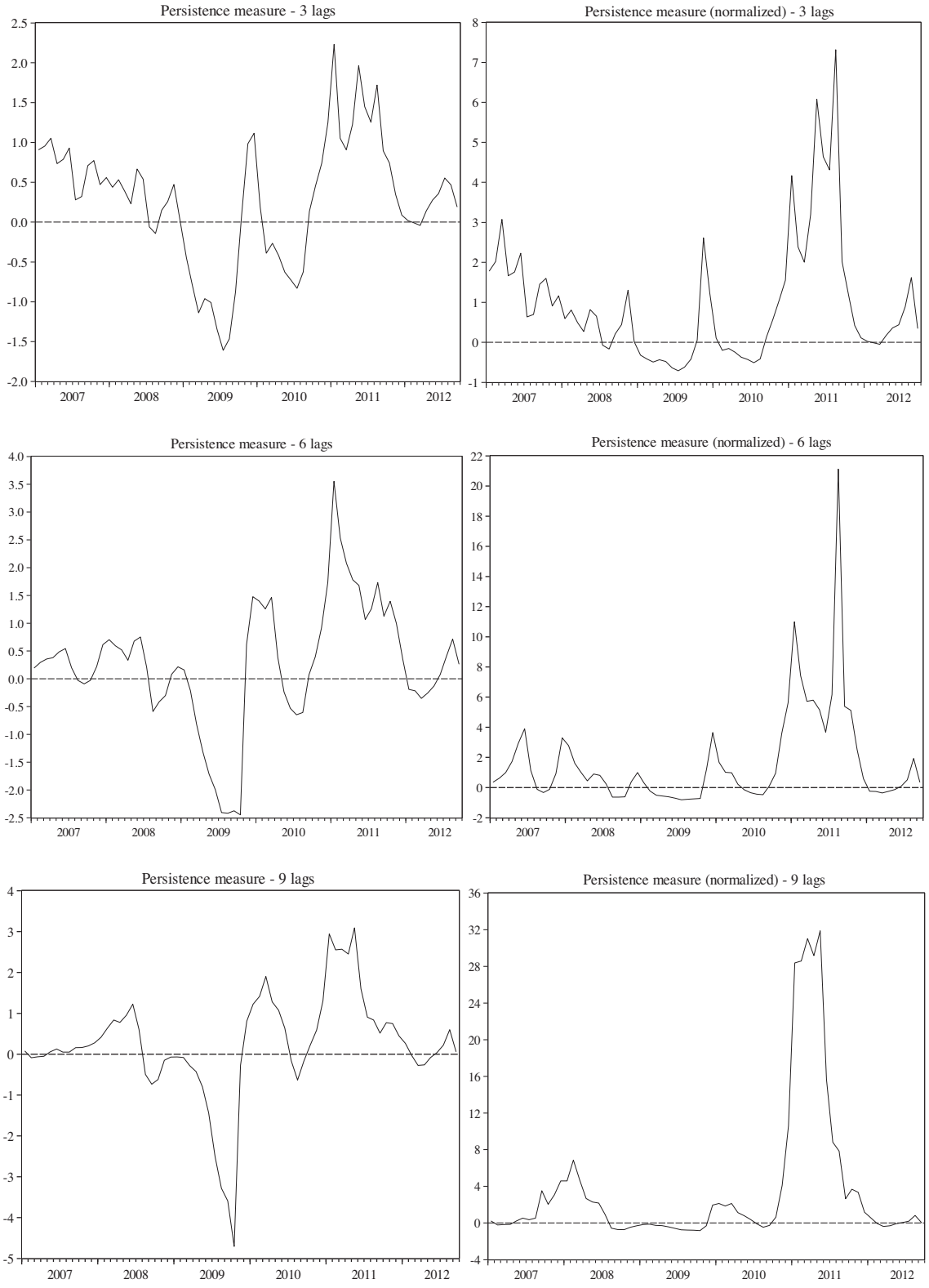

Fig. 2. Relative persistence of debt.

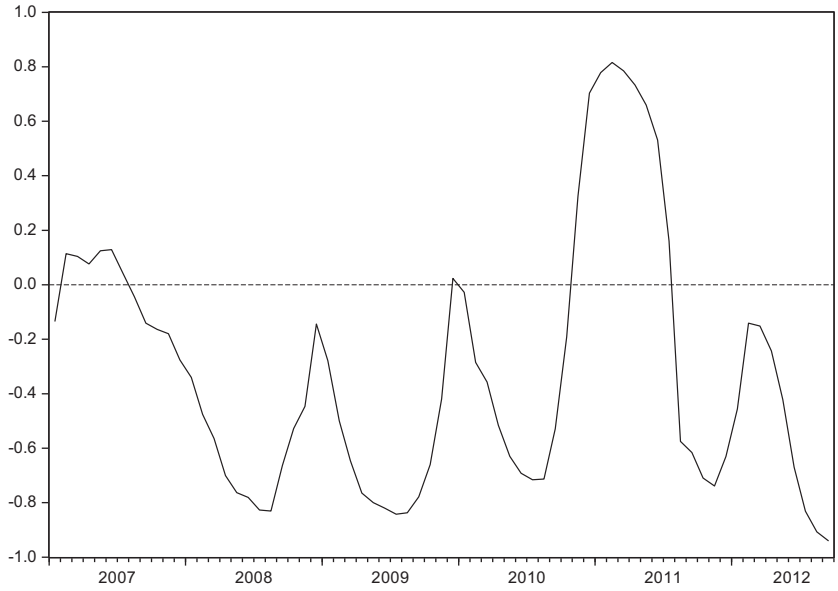

Fig. 3. Covariance between the primary deficit and the rates of return on debt.

Consumer Price Index (IPCA – official price index), beginning in January 2007 and ending in September 2012 (69 observations). The reason for this period is that the Anbima Market Index which is crucial for building the fiscal indicators does not consider the treasury bonds indexed to the exchange rate and the share of the federal government debt indexed to the exchange rate became negligible from 2006. Hence,

- Domestic federal debt (par value) – P – (excluding debt securitization and Agrarian Debt Securities) – averages of the last 12 months – available from the Brazilian National Treasury;
- Primary result – federal government – w – (available in Time Series Management System of Central Bank of Brazil – CBB);
- Gross Domestic Product – Y – (available in Time Series Management System of CBB);

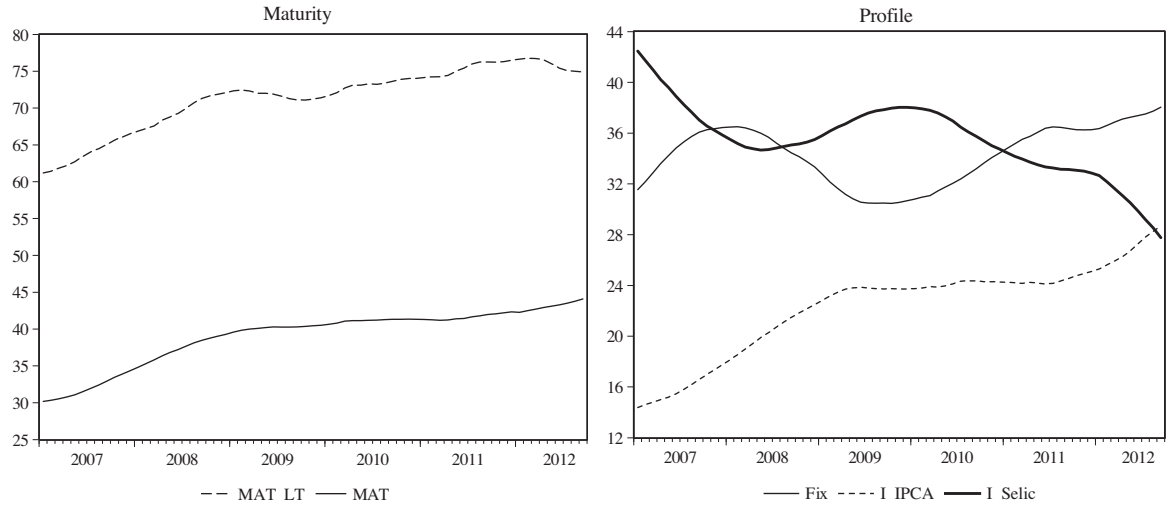

Fig. 4. Public debt – maturity (months) and profile.

- Coupon interest rate – *cp* – is a result of the ratio between the nominal interest – internal federal government (available in Time Series Management System of CBB) and the domestic federal debt (par value) – *P* (available from the Brazilian National Treasury);
- Yield – *r* – is the growth rate (12 months) of the general Anbima Market Index (IMA) (available in Time Series Management System of CBB). The IMA is a public bond portfolio benchmark. It is an index which comprises four sub-indexes, related to bond indexers – fixed rate, linked to IPCA, linked to General Price Index and floating (Selic rate). The IMA represents the evolution of prefixed treasury bonds market portfolio.
- Medium term securities issued – federal securities debt – *Mat* – average maturity of the last 12 months (available in Time Series Management System of CBB).

According to Giavazzi and Missale (2004) an increase in the sustainability of the public finance is a result of the combination of a reduction in coupon interest rate and the stabilization/reduction of the public debt. As can be seen in Fig. 1, the coupon interest rate fell in the beginning of the period, but after the subprime crisis it increased and began to oscillate at a higher level. Regarding the market value of debt, the trajectory shows that although there was considerable fluctuation in the period there was not an unsustainable path.

The graphs on the persistence of the federal government debt denote that from a perspective of short-term (3, 6, and 9 months), there was in a greater part of the period, a performance near zero (see Fig. 2). This observation suggests that a shock on the market value of debt was quickly absorbed. It is important to note that during the period after the subprime crisis (August 2008–September 2009) the relative persistence of debt was negative which, in turn, indicates a strong sustainability of the government budget in the period. Another period that deserves attention is from the last quarter of 2010 to the last quarter of 2011 due to the fact that the market value of debt has been more persistent than the primary result. The increase in the market value of debt can be a result of change in the expectations of government's fiscal discipline implying a higher risk premium. There was a loosening of fiscal and monetary policies in the years of 2009 and 2010 due to an unfavorable external environment. Furthermore, both inflation rate and interest rate (Selic) increased in the period and thus also caused a deterioration in the public debt management.

As can be seen through Fig. 3 there existed a negative covariance between the primary deficit and the rates of return on debt. This negative covariance is observed in almost all period under review. This result is in consonance with that observed by Angeletos (2002), Barro (2003), and Nosbusch (2008). In other words, management of the returns of the securities can protect the budget from changes in public sector's borrowing requirements.

It is important to highlight that the main objective of the Brazilian National Treasury is focused on two points: (i) gradually replacing floating rate bonds with fixed rate or inflation-linked instruments as a way of reducing market risk; and (ii) increasing the average maturity of outstanding debt as a manner of reducing the refinancing risk. As can be seen from Fig. 4 the average maturity, as well as the long term maturity debt (longer than 1 year – Mat_{LT}), is increasing over time.[2] Regarding the public debt profile, it is observed that the strategy of increasing the participation of securities indexed to the price index (IPCA – *I_IPCA*) and decreasing securities indexed to the Selic rate (*I_Selic*) is working. On the other hand the share of fixed-rate securities (*Fix*) remained relatively stable in the period.

With the objective of observing whether the strategy adopted by the Brazilian National Treasury of extending the average maturity of public debt and improving the public debt profile helped the fiscal insurance, an empirical analysis is made. The baseline model is a result of the relationship of the form:

$$X_t^i = \alpha_0 + \alpha_1 Mat_t + \alpha_2 Z_t^i + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma^2) \tag{5}$$

where $X_t^i = \psi_{i,k}, \rho_{W^*,R^*MV^*}$ is a vector of the performance indicators for the debt management; and Z_t^i is a vector of the main public debt indexing factors:

- *I_Selic* – share of the federal public debt indexed to the Selic rate (available from CBB – time series management system). It is the main indexing factor of the Brazilian public debt.
- *I_IPCA* – share of the federal public debt linked to the IPCA (available from CBB). This indexing factor deserves attention under an inflation targeting system because the control over inflation reduces the risk of public debt monetization.

[2] Data regarding long term maturity is available from the Brazilian National Treasury.

Table 1
Determinants of fiscal insurance and persistence (Maturity).

Regressor	Md	OLS							GMM							
		C	Mat	Fix	I_Selic	I_IPCA	R^2	DW	*C*	Mat	Fix	I_Selic	I_IPCA	J-Stat	NI	R^2
$\psi_{1,3}$	1	−0.014	0.298	−3.916	−4.503	−4.849	0.05	1.59	−0.057	1.009	−4.955	−5.095	−5.533	4.103	7	0.01
		(0.782)	(0.680)	(0.154)	(0.115)	(0.094)			(0.535)	(0.774)	(0.843)	(0.836)	(0.839)	(0.251)		
	2	−0.002	0.293	0.434			0.01	1.60	−0.022	0.361	0.655			3.819	5	0.00
		(0.969)	(0.675)	(0.485)					(0.666)	(0.796)	(0.227)			(0.282)		
	3	−0.003	0.174		−0.184		0.00	1.59	−0.018	0.262		−0.253		3.888	7	0.00
		(0.949)	(0.801)		(0.763)				(0.698)	(0.815)		(0.820)		(0.566)		
	4	−0.006	0.390			−0.583	0.01	1.64	−0.036	0.351			−0.190	4.650	8	0.00
		(0.905)	(0.590)			(0.416)			(0.474)	(0.740)			(0.750)	(0.590)		
$\psi_{2,3}$	1	0.949	2.214	2.740	8.381	6.656	0.09	0.83	0.983	3.814	3.799	9.536	9.514	2.960	8	0.07
		(0.000)	(0.411)	(0.787)	(0.427)	(0.532)			(0.001)	(0.718)	(0.851)	(0.625)	(0.620)	(0.565)		
	2	0.937	1.618	−4.589			0.07	0.76	0.766	0.120	−6.008			4.124	6	0.05
		(0.000)	(0.527)	(0.046)					(0.001)	(0.986)	(0.041)			(0.389)		
	3	0.939	3.166		4.013		0.06	0.75	0.862	7.828		4.286		1.197	9	0.01
		(0.000)	(0.216)		(0.076)				(0.000)	(0.073)		(0.011)		(0.977)		
	4	0.964	2.369			0.679	0.02	0.57	0.867	0.616			0.685	7.213	7	0.01
		(0.000)	(0.386)			(0.801)			(0.001)	(0.903)			(0.819)	(0.205)		
$\psi_{1,6}$	1	−0.005	0.824	−2.449	−2.260	−2.536	0.02	1.50	−0.068	1.138	−4.034	−4.024	−4.101	3.333	8	0.00
		(0.948)	(0.428)	(0.531)	(0.578)	(0.537)			(0.389)	(0.615)	(0.610)	(0.637)	(0.665)	(0.504)		
	2	0.002	0.795	−0.233			0.01	1.51	−0.052	0.920	−0.589			3.231	5	0.00
		(0.980)	(0.419)	(0.789)					(0.512)	(0.527)	(0.545)			(0.357)		
	3	0.002	0.879		0.237		0.01	1.52	−0.041	1.060		0.752		6.577	8	0.00
		(0.981)	(0.367)		(0.782)				(0.524)	(0.407)		(0.125)		(0.362)		
	4	0.003	0.905			−0.186	0.01	1.51	−0.030	0.711			−0.115	6.697	8	0.01
		(0.972)	(0.375)			(0.854)			(0.575)	(0.232)			(0.843)	(0.350)		
$\psi_{2,6}$	1	31.510	−1.656	14.394	24.039	31.510	0.11	1.00	1.454	−7.443	43.792	60.837	70.966	1.960	8	0.03
		(0.000)	(0.769)	(0.498)	(0.277)	(0.161)			(0.001)	(0.432)	(0.343)	(0.145)	(0.073)	(0.743)		
	2	1.628	−0.188	−10.650			0.07	0.95	1.260	−5.898	−18.849			1.206	7	0.01
		(0.000)	(0.972)	(0.030)					(0.008)	(0.549)	(0.064)			(0.944)		
	3	1.672	2.428		2.521		0.01	0.84	1.460	1.877		4.885		4.978	8	0.00
		(0.000)	(0.663)		(0.607)				(0.000)	(0.878)		(0.266)		(0.547)		
	4	1.720	−1.680			11.546	0.06	0.81	1.308	−2.810			6.105	4.861	7	0.03
		(0.000)	(0.767)			(0.043)			(0.012)	(0.693)			(0.327)	(0.433)		
$\psi_{1,9}$	1	0.222	0.411	−1.814	1.244	1.124	0.04	0.42	0.341	0.826	−3.803	0.624	1.828	5.042	8	0.01
		(0.171)	(0.856)	(0.832)	(0.889)	(0.901)			(0.156)	(0.867)	(0.783)	(0.965)	(0.899)	(0.283)		
	2	0.219	0.358	−2.945			0.04	0.42	0.387	1.904	−3.106			5.055	8	0.01
		(0.164)	(0.867)	(0.126)					(0.070)	(0.732)	(0.510)			(0.537)		
	3	0.225	1.247		1.855		0.02	0.36	0.392	0.799		1.455		3.107	8	0.00
		(0.158)	(0.561)		(0.327)				(0.109)	(0.884)		(0.666)		(0.795)		
	4	0.239	0.593			1.194	0.01	0.34	0.323	1.561			0.726	4.769	8	0.00

Table 1 (*Continued*)

Regressor	Md	OLS							GMM							
		C	Mat	Fix	I_Selic	I_IPCA	R^2	DW	*C*	Mat	Fix	I_Selic	I_IPCA	J-Stat	NI	R^2
		(0.136)	(0.793)			(0.593)			(0.028)	(0.597)			(0.847)	(0.574)		
$\psi_{2,9}$	1	3.649	11.238	39.069	53.638	49.389	0.04	0.27	2.415	6.004	39.805	64.146	58.517	1.829	8	0.00
		(0.000)	(0.420)	(0.456)	(0.326)	(0.371)			(0.128)	(0.816)	(0.830)	(0.736)	(0.781)	(0.767)		
	2	3.543	9.161	−10.037			0.02	0.24	3.703	14.099	−7.109			0.378	8	0.02
		(0.001)	(0.489)	(0.394)					(0.004)	(0.426)	(0.803)			(0.984)		
	3	3.540	12.741		10.131		0.02	0.23	2.652	14.881		4.845		2.222	6	0.01
		(0.001)	(0.331)		(0.380)				(0.098)	(0.494)		(0.437)		(0.695)		
	4	3.604	10.687			1.845	0.01	0.20	2.994	5.493			0.215	4.187	7	0.00
		(0.000)	(0.439)			(0.892)			(0.035)	(0.882)			(0.988)	(0.523)		
ρ_{W^*,R^*VM^*}	1	−0.320	1.085	1.780	3.297	2.735	0.09	0.29	−0.341	0.752	4.445	6.510	7.272	2.308	8	0.01
		(0.000)	(0.180)	(0.556)	(0.296)	(0.391)			(0.001)	(0.774)	(0.640)	(0.477)	(0.466)	(0.679)		
	2	−0.325	0.880	−1.141			0.07	0.26	−0.319	1.286	−2.506			6.276	8	0.00
		(0.000)	(0.252)	(0.097)					(0.000)	(0.608)	(0.059)			(0.393)		
	3	−0.325	1.282		1.115		0.07	0.28	−0.314	1.238		0.980		2.316	8	0.07
		(0.000)	(0.094)		(0.098)				(0.001)	(0.014)		(0.022)		(0.804)		
	4	−0.318	1.095			0.081	0.03	0.21	−0.323	0.059			0.541	7.034	8	0.01
		(0.000)	(0.179)			(0.920)			(0.000)	(0.973)			(0.458)	(0.318)		

Note: *Md* is the model. *C* is the constant term. *P*-values between parentheses. *NI* is the number of instruments in GMM models in a way to assure at least 60 observations in the regressions. The variables in the regressions are differentiated based on unit root tests (see Table A.1), when it is needed.

Table 2
Determinants of fiscal insurance and persistence (long-term maturity).

Regressor	Md	OLS							GMM							
		C	Mat_{LT}	Fix	I_Selic	I_IPCA	R^2	DW	C	Mat_{LT}	Fix	I_Selic	I_IPCA	J-Stat	NI	R^2
$\psi_{1,3}$	1	−0.008	−0.031	−3.988	−4.511	−4.797	0.05	1.59	−0.040	−0.040	−4.227	−4.707	−4.800	4.818	8	0.04
		(0.901)	(0.865)	(0.147)	(0.122)	(0.102)			(0.720)	(0.916)	(0.716)	(0.683)	(0.713)	(0.306)		
	2	0.012	−0.074	0.298			0.01	1.61	−0.009	−0.095	0.396			4.401	7	0.00
		(0.841)	(0.678)	(0.644)					(0.876)	(0.528)	(0.396)			(0.354)		
	3	0.015	−0.092		−0.080		0.01	1.62	−0.008	−0.105		−0.210		3.750	7	0.00
		(0.812)	(0.612)		(0.903)				(0.904)	(0.514)		(0.792)		(0.586)		
	4	0.016	−0.105			−0.475	0.01	1.65	0.042	−0.248			−0.406	3.468	6	0.00
		(0.797)	(0.533)			(0.484)			(0.528)	(0.099)			(0.425)	(0.483)		
$\psi_{2,3}$	1	0.758	0.952	0.239	4.326	4.098	0.10	0.70	0.522	0.964	4.949	13.467	9.969	2.173	8	0.03
		(0.002)	(0.162)	(0.981)	(0.684)	(0.701)			(0.206)	(0.689)	(0.859)	(0.632)	(0.715)	(0.704)		
	2	0.737	1.016	−3.659			0.10	0.67	0.516	0.578	−1.894			4.028	7	0.04
		(0.001)	(0.115)	(0.118)					(0.028)	(0.398)	(0.292)			(0.402)		
	3	0.724	1.120		2.157		0.08	0.60	0.418	2.109		−0.005		4.514	8	0.04
		(0.002)	(0.093)		(0.364)				(0.105)	(0.083)		(0.998)		(0.608)		
	4	0.692	1.358			1.631	0.07	0.54	0.570	1.320			0.716	4.225	5	0.07
		(0.003)	(0.030)			(0.512)			(0.045)	(0.040)			(0.761)	(0.646)		
$\psi_{1,6}$	1	0.014	−0.093	−2.638	−2.260	−2.373	0.01	1.50	−0.022	−0.113	−2.324	−2.105	−2.388	5.087	8	0.00
		(0.878)	(0.725)	(0.502)	(0.587)	(0.570)			(0.855)	(0.800)	(0.797)	(0.851)	(0.844)	(0.278)		
	2	0.024	−0.116	−0.503			0.01	1.52	0.060	−0.228	−0.545			2.151	8	0.00
		(0.781)	(0.644)	(0.580)					(0.520)	(0.162)	(0.540)			(0.828)		
	3	0.022	−0.099		0.272		0.00	1.52	0.007	−0.128		0.328		6.066	8	0.00
		(0.801)	(0.697)		(0.767)				(0.948)	(0.751)		(0.714)		(0.416)		
	4	0.018	−0.070	0.092			0.00	1.50	0.031	−0.092			0.164	2.121	5	0.00
		(0.836)	(0.768)	(0.924)					(0.736)	(0.684)			(0.810)	(0.548)		
$\psi_{2,6}$	1	1.670	0.247	14.675	23.839	31.036	0.11	1.00	0.858	2.479	0.030	8.542	14.109	1.414	8	0.06
		(0.001)	(0.863)	(0.490)	(0.291)	(0.172)			(0.521)	(0.624)	(0.999)	(0.942)	(0.915)	(0.842)		
	2	1.587	0.205	−10.377			0.07	0.95	1.107	−0.442	−5.260			3.018	8	0.01
		(0.002)	(0.882)	(0.042)					(0.032)	(0.744)	(0.094)			(0.697)		
	3	1.470	1.045		0.847		0.01	0.80	1.008	3.308		4.667		4.715	7	0.05
		(0.004)	(0.473)		(0.871)				(0.061)	(0.076)		(0.333)		(0.452)		
	4	1.467	1.233			11.192	0.07	0.83	1.144	0.871			4.924	3.102	6	0.04
		(0.003)	(0.346)			(0.037)			(0.041)	(0.537)			(0.255)	(0.541)		
$\psi_{1,9}$	1	−0.051	1.364	−4.246	−3.512	−2.309	0.12	0.40	−0.069	1.337	−19.810	−16.547	−13.628	1.861	8	0.02
		(0.786)	(0.016)	(0.604)	(0.685)	(0.791)			(0.893)	(0.475)	(0.471)	(0.595)	(0.653)	(0.602)		
	2	−0.029	1.265	−1.511			0.12	0.39	−0.078	1.249	−1.746			1.255	8	0.12
		(0.872)	(0.018)	(0.427)					(0.760)	(0.100)	(0.237)			(0.940)		
	3	−0.051	1.420		−0.191		0.11	0.36	−0.128	1.736		−0.376		2.715	8	0.10
		(0.780)	(0.010)		(0.921)				(0.610)	(0.020)		(0.728)		(0.844)		
	4	−0.047	1.414			1.590	0.12	0.39	−0.003	1.022			1.838	8.331	8	0.11

Table 2 (*Continued*)

Regressor	Md	OLS							GMM							
		C	Mat_{LT}	Fix	I_Selic	I_IPCA	R^2	DW	C	Mat_{LT}	Fix	I_Selic	I_IPCA	J-Stat	NI	R^2
		(0.795)	(0.005)			(0.427)			(0.992)	(0.095)			(0.118)	(0.304)		
$\psi_{2,9}$	1	3.477	0.869	32.946	46.418	46.274	0.03	0.25	2.599	2.461	14.277	24.509	34.275	1.501	7	0.01
		(0.006)	(0.807)	(0.531)	(0.406)	(0.409)			(0.214)	(0.812)	(0.960)	(0.915)	(0.907)	(0.682)		
	2	3.255	1.448	−9.860			0.02	0.22	2.246	1.351	−10.415			2.862	6	0.00
		(0.007)	(0.667)	(0.421)					(0.275)	(0.817)	(0.328)			(0.581)		
	3	3.231	1.656		6.488		0.01	0.20	2.901	0.769		8.057		3.169	7	0.01
		(0.008)	(0.631)		(0.600)				(0.107)	(0.821)		(0.254)		(0.674)		
	4	3.136	2.381			5.591	0.01	0.19	3.372	0.843			3.229	0.741	5	0.01
		(0.009)	(0.457)			(0.666)			(0.082)	(0.795)			(0.924)	(0.864)		
ρ_{W^*,R^*VM^*}	1	−0.376	0.281	0.862	1.935	1.943	0.09	0.21	−0.417	0.557	1.653	1.378	2.502	1.528	8	0.04
		(0.000)	(0.171)	(0.775)	(0.546)	(0.546)			(0.000)	(0.342)	(0.803)	(0.830)	(0.706)	(0.822)		
	2	−0.385	0.305	−0.928			0.09	0.20	−0.382	0.336	−1.001			2.573	7	0.09
		(0.000)	(0.118)	(0.188)					(0.000)	(0.217)	(0.049)			(0.632)		
	3	−0.389	0.333		0.524		0.07	0.19	−0.423	0.334		0.252		2.297	6	0.06
		(0.000)	(0.096)		(0.463)				(0.000)	(0.243)		(0.602)		(0.681)		
	4	−0.396	0.392			0.486	0.07	0.18	−0.450	0.524			0.785	4.230	8	0.06
		(0.000)	(0.036)			(0.515)			(0.000)	(0.025)			(0.106)	(0.646)		

Note: *Md* is the model. *C* is the constant term. P-values between parentheses. *NI* is the number of instruments in GMM models in a way to assure at least 60 observations in the regressions. The variables in the regressions are differentiated based on unit root tests (see Table A.1), when it is needed.

- *Fix* – share of the federal public debt with fixed rate bonds (available from CBB). A greater share of these bonds indicates a greater investor's confidence in the current political economy and thus an improvement in the management of the public debt.

Based on the equation above Ordinary Least Squares (OLS) and Generalized of Method of Moments are used for regressions. The reason for the use of these methods is that they permit observing the significance of each coefficient on each variable considered in the empirical model. Therefore, the identification of the relevant variables is crucial for recommendation for debt management. Contrary to the manner suggested by Faraglia et al. (2008) the use of time series for the analysis in the Brazilian case is not a drawback. Key variables such as maturity of debt change over time. In a general way OLS models are not efficient from macroeconomic time series.[3] The traditional problems of serial autocorrelation, heteroskedasticity, or non-linearity imply the necessity of the use of other methods such as GMM (see Hall, 2005).

3. Empirical evidence

Table 1 shows the results of regressing our performance indicators on the average maturity of debt and public debt indexing factors (*I_Selic*, *I_IPCA*, and *Fix*). Contrary to standard argument that issuing longer maturity debt helps to improve fiscal insurance, most of the results in both OLS and GMM regressions (see Table 1) present positive coefficients on maturity although without statistical significance. The results regarding the share of the federal public debt with fixed rate bonds are mixed in terms of the sign and only in a few cases the coefficients are significant. The sign of the coefficients on share of the federal public debt linked to both *IPCA* and *Selic* are positive in most of the models. Therefore, this result denotes that it does not matter if the government issues indexed to the inflation or the interest rate to improve fiscal insurance. In short, the results present very little relationship between fiscal insurance and public debt management (public debt profile and average maturity of public debt).

With the intention of checking if longer maturity debt can improve the fiscal insurance, the variable average maturity of public debt was substituted by average maturity longer than 12 months (see Table 2). As pointed out by Nosbusch (2008) a greater proportion of long-term government securities can provide a hedge against shocks to the economy due to the fact that these securities are more sensitive to changes in the interest rates. The results indicate that there was no difference regarding the statistical significance on the coefficients. However, the sign of the coefficients became mixed, which in turn suggests that an increase in longer maturity can affect the fiscal insurance. The results regarding the other variables in the models did not change considerably from those observed in the previous model.

4. Conclusion

The fiscal indicators applied to the Brazilian case indicate that there was a reduction in the fiscal vulnerability for the period from January 2007 to September 2012. Besides the stabilization of costs to service debt, the indicators of fiscal insurance show the protection of the government budget against shocks on primary deficit was increased. Nevertheless, the empirical evidence suggests that the public debt management had little effect in increasing fiscal insurance. A possible reason for this result is that the low volatility of the term structure of interest rates can become the strategy of lengthening the public debt maturity ineffective for fiscal insurance. Another explanation, such as pointed out by Faraglia et al. (2008), is the idea that policymakers are more concerned with minimizing costs instead of the risk.

Appendix A.

See Table A.1

[3] Unit root tests Augmented Dickey-Fuller (ADF) and Elliott-Rothenberg-Stock (DF-GLS) were performed for detecting the integration order of the series in the models (see Table A.1).

Table A.1
Unit root tests (ADF and DF-GLS).

Series	ADF				DF-GLS			
	Lag	Test	C.V. 5%	C.V. 10%	Lag	Test	C.V. 5%	C.V. 10%
MV	5	−3.63	−3.48	−3.17	5	−3.61	−3.13	−2.83
*MV**	5	−3.83	−3.48	−3.17	5	−3.79	−3.13	−2.83
P	5	−3.56	−3.48	−3.17	1	−3.08	−3.13	−2.83
*P**	5	−1.87	−3.48	−3.17	4	−1.74	−3.13	−2.83
d(P)*	3	−3.54	−3.48	−3.17	4	−2.94	−3.13	−2.83
Y	3	−2.67	−3.48	−3.17	3	−2.82	−3.13	−2.83
d(Y)	0	−3.82	−3.48	−3.17	0	−3.89	−3.13	−2.83
W	1	−1.82	−3.48	−3.17	1	−1.87	−3.13	−2.83
d(W)	0	−6.66	−3.48	−3.17	0	−6.74	−3.13	−2.83
*W**	1	−1.86	−3.48	−3.17	1	−1.90	−3.13	−2.83
d(W)*	0	−6.58	−3.48	−3.17	0	−6.66	−3.13	−2.83
ρ_{W^*,MV^*}	1	−3.48	−3.48	−3.17	1	−3.59	−3.13	−2.83
$\Psi_{1,3}$	1	−2.83	−3.48	−3.17	1	−2.85	−3.13	−2.83
$d(\Psi_{1,3})$	1	−6.20	−3.48	−3.17	0	−6.77	−3.13	−2.83
$\Psi_{2,3}$	0	−3.12	−3.48	−3.17	0	−3.17	−3.13	−2.83
$d(\Psi_{2,3})$	1	−7.49	−3.48	−3.17	0	−9.95	−3.13	−2.83
$\Psi_{1,6}$	1	−3.06	−3.48	−3.17	1	−3.11	−3.13	−2.83
$d(\Psi_{1,6})$	4	−5.41	−3.48	−3.17	4	−5.14	−3.13	−2.83
$\Psi_{2,6}$	0	−4.11	−3.48	−3.17	0	−4.17	−3.13	−2.83
$\Psi_{1,9}$	2	−3.37	−3.48	−3.17	1	−3.01	−3.13	−2.83
$\Psi_{2,9}$	2	−3.15	−3.48	−3.17	2	−3.21	−3.13	−2.83
I_IPCA	2	−1.43	−3.48	−3.17	2	−1.56	−3.13	−2.83
d(I_IPCA)	1	−2.05	−3.48	−3.17	1	−1.23	−3.13	−2.83
d(d(I_IPCA))	0	−6.75	−3.48	−3.17	3	−3.93	−3.13	−2.83
I_Selic	1	−1.29	−3.48	−3.17	1	−3.33	−3.13	−2.83
d(I_Selic))	0	−2.13	−3.48	−3.17	–	–	–	–
d(d(I_Selic))	0	−7.14	−3.48	−3.17	–	–	–	–
I_Fix	2	−2.96	−3.48	−3.17	2	−3.34	−3.13	−2.83
d(I_Fix)	1	−1.94	−3.48	−3.17	1	−1.31	−3.13	−2.83
d(d(I_Fix)	0	−5.73	−3.48	−3.17	0	−4.93	−3.13	−2.83
MAT_{LT}	2	−1.39	−3.48	−3.17	1	−1.35	−3.13	−2.83
$d(MAT_{LT})$	1	−3.56	−3.48	−3.17	1	−3.51	−3.13	−2.83
MAT	1	−2.39	−3.48	−3.17	2	−2.11	−3.13	−2.83
d(MAT)	0	−1.76	−3.48	−3.17	0	−1.92	−3.13	−2.83
d(d(MAT))	0	−9.56	−3.48	−3.17	0	−9.44	−3.13	−2.83
IPCA	1	−4.45	−3.48	−3.17	1	−4.48	−3.13	−2.83
Selic	3	−2.61	−3.48	−3.17	3	−1.52	−3.13	−2.83
d(Selic)	2	−4.13	−3.48	−3.17	2	−3.85	−3.13	−2.83
cp	3	−2.75	−3.48	−3.17	3	−2.33	−3.13	−2.83
d(cp)	1	−2.90	−3.48	−3.17	1	−2.80	−3.13	−2.83
d(d(cp))	1	−9.22	−3.48	−3.17	0	−11.26	−3.13	−2.83

Note: Intercept and trend are included. The final choice of lag was made based on Akaike criterion.

References

Angeletos, G., 2002. Fiscal policy with non-contingent debt and the optimal maturity structure. Q. J. Econ. 117 (3), 1105–1131.

Barro, R.J., 2003. Optimal management of indexed and nominal debt. Ann. Econ. Financ Soc. AEF 4 (1), 1–15.

Butkiewicz, J.L., 1983. The market value of outstanding government debt: comment. J. Monet. Econ. 11 (3), 373–379.

Faraglia, E., Marcet, A., Scott, A., 2008. Fiscal insurance and debt management in OECD economies. Econ. J. 118 (527), 363–386.

Giavazzi, F., Missale, A., 2004, March. Public Debt Management in Brazil. In: NBER Working Paper 10394.

Hall, A., 2005. Generalized method of moments. Oxford, Oxford.

Hemming, R., Kell, M., Schimmelpfennig, A., 2003. Fiscal vulnerability and financial crisis in emerging market economies. In: Ocasional Paper IMF No. 218.

Lojsch, H., Rodrigues-Vives, M., Slavik, M., 2011, October. The size and composition of the debt in European area. In: ECB Occasional Paper, No. 132.

Nosbusch, Y., 2008. Interest costs and the optimal maturity structure of government debt. Econ. J. 118 (527), 477–498.