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An Investigation of the Fiscal Dominance Hypothesis in the Brazilian Economy from 1999 to 2021

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Resumo: O presente artigo avalia se os déficits fiscais entre 1999 a 2006 e 2014 a 2021 impuseram algum tipo de dominância fiscal sobre a política monetária do Brasil. A definição de dominância fiscal utilizada foi a de Blanchard (2004) que ocorre quando a política monetária não é capaz de controlar a taxa de câmbio e a desvalorização cambial tende a elevar a inflação. Os resultados alcançados permitem concluir que no período de 1999 a 2006 não houve dominância fiscal. Por outro lado, posterior a 2006 há um tipo de dominância fiscal indireta do ponto de vista da política monetária: o BACEN deixa de utilizar os juros como variável de controle para o câmbio. Neste caso, os resultados fiscais acabam impactando os preços por canais indiretos via taxa de câmbio como o Emerging Market Bond Index (EMBI) e o spread de juros dos EUA.
Palavras-chaves: Dominância Fiscal, Política Monetária, Dívida Pública, Taxa de Câmbio.

Abstract: This article assesses whether the increase in fiscal deficits from 1999 to 2006 and from 2014 to 2021 led to a state of fiscal dominance in Brazil's monetary policy. The definition of fiscal dominance used here is that of Blanchard (2004), which refers to a scenario where monetary policy is unable to control the exchange rate, and currency depreciation tends to lead to inflation. The results allow us to conclude that there was no fiscal dominance from 1999 to 2006. However, after 2006, the country entered a state of indirect fiscal dominance from a monetary policy perspective, given that the Central Bank of Brazil (BACEN) ceased to use interest rates as a control variable for the exchange rate. In this scenario, fiscal outcomes influenced prices through indirect channels, such as the Emerging Market Bond Index and US interest spreads.
Keywords: Fiscal dominance, Monetary policy, Public Debt, Exchange Rate.
Classificação JEL: F13; F14; Q17.

1. INTRODUCTION

This article examines the concept of fiscal dominance, as defined by Blanchard (2004), in the Brazilian economy. Fiscal dominance refers to a situation in which a lack of fiscal control leads to an endogenous relationship between the increasing risk of default, as represented by the Emerging Market Bond Index (EMBI[1]), and exchange rate devaluation. Blanchard (2004) argued that this association results in the growth of public debt and a continuous increase in inflation driven by the exchange rate.

Favero and Giavazzi (2004) observed that the assessment of default risk for the Brazilian economy based on the EMBI is influenced in the short term by fluctuations in the US public deficit and interest spread. The interest spread represents the difference between BAA20Y[2] and TBOND10Y[3]. Both Blanchard (2004) and Favero and Giavazzi (2004) underscored the strong correlation between EMBI and spread variables. Such a correlation implies that a sustained increase in the public deficit could lead international markets to perceive the Brazilian public debt as unsustainable. Consequently, an association emerges between interest rate growth, exchange rate devaluation, and inflationary pressures. This dynamic contributes to a potentially explosive trajectory for public debt, with the monetization of public debt appearing as the only viable solution.

From a Keynesian perspective, the alternatives presented by Blanchard (2004) and Favero and Giavazzi (2004) could render expansionary fiscal policies to sustain aggregate demand unfeasible, especially during recessive economic cycles caused by endogenous or exogenous factors, as observed during the recent COVID-19 pandemic. Sanches and Carvalho (2022, 2023) conducted a structural vector autoregression (VAR) analysis to assess the role of fiscal multipliers in the Brazilian economy. The authors estimated that if public investments had maintained the same average growth rate as that during the 2006 to 2010 period, the post-2014 crisis would have resulted in a 6% higher gross domestic product (GDP)

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[1] The EMBI is calculated by J.P. Morgan.
[2] Moody's Seasoned Baa Corporate Bond Yield (20-year).
[3] Long-Term Government Bond Yields (10-year).

growth compared with the level observed in 2017. Furthermore, GDP growth would have been 2.53% lower if social benefits had not been raised in 2016 and 2017.

However, it is important to note that Blanchard (2004) and Favero and Giavazzi (2004) base their hypotheses on a public debt profile in which a high portion of the indebtedness is indexed to the dollar through government bonds. According to National Treasury Secretariat (STN) data, in December 2002, 32% of the Brazilian public debt was indexed to the dollar, resulting in increased domestic public debt owing to exchange rate depreciation (STN, 2021). However, in 2021, only 4.07% of the public debt was pegged to the dollar. As a result, exchange rate depreciations did not significantly affect the domestic public debt. More specifically, in 2021, most of the public debt consisted of fixed-rate and floating-rate securities. Another important aspect is that, since 2006, the Brazilian external debt has remained lower than international reserves. These factors have reduced the vulnerability of the Public Sector Net Debt (PSND) to potential exchange rate devaluations.

Based on these initial considerations, this article aims to assess the impact of increasing public deficits and, consequently, public debt on the conduct of monetary policy. The assessment will be based on the methodological proposals developed by Blanchard (2004) and Favero and Giavazzi (2004). The next section will provide a review of empirical studies examining the presence of fiscal dominance in the Brazilian economy. Section 3 will describe the methodology adopted in this study. Section 4 will present estimates and a discussion of the main results. Finally, the last section will provide conclusions drawn from the analysis.

2. LITERATURE REVIEW

The empirical literature on fiscal dominance in Brazil has gained importance since the implementation of the inflation-targeting regime in 1999. The traditional framework of fiscal dominance was proposed by Sargent and Wallace (1981)4. Some time later, Blanchard (2004)

[4] Sargent and Wallace (1981) proposed a fiscal dominance model based on the monetarist approach. In the face of an explosive trajectory of public debt, markets do not believe in the solvency capacity of the federal government. In this case, the monetary authority is forced to finance budget deficits through seigniorage and, consequently, must accept an increase in inflation.

and Favero and Giavazzi (2004) put forth their unique perspectives on fiscal dominance within the context of the Brazilian economy.

Blanchard (2004) defined fiscal dominance as a situation in which an increase in interest rates may lead to exchange rate depreciation owing to high initial debt or a higher level of investor risk aversion. When interest rates are raised to control inflation, there is a rise in the value of the debt, causing investors to perceive a greater likelihood of default. These conditions combined lead to a reduction in capital inflows and, consequently, result in exchange rate depreciation and higher inflation. Favero and Giavazzi (2004) examined a similar hypothesis. The variables analyzed in both studies include the Selic interest rate, inflation expectations, exchange rate, and the EMBI, which exhibits a non-linear relationship with the primary deficit (Favero and Giavazzi, 2004) or the net public debt (Blanchard, 2004). Both studies conducted their analyses using monthly data from 1999 to 2003.

Blanchard (2004) observed a significant correlation of default risk with PSND and the US interest rate spread. These factors contributed to the high level of risk aversion among investors, ultimately influencing EMBI. The findings also indicated that an increase in the Selic rate was associated with currency devaluation. The impact of the interest rate on the exchange rate is determined by the risk aversion of foreign investors, the initial debt-to-GDP ratio, and the proportion of dollar-denominated debt. Estimates conducted taking into account the indirect effects of these variables showed that a 1% increase in the interest rate resulted in a 2.58% depreciation. Blanchard (2004) concluded that Brazil experienced fiscal dominance from 2002 to 2003.

Literature findings may vary depending on the variables used. The most commonly used models for elucidation of economic dynamics are the VAR model and the vector error correction (VEC) model. According to Nobrega et al. (2020), studies that identified fiscal dominance in Brazil mostly focused on periods characterized by significant macroeconomic imbalances, rather than periods of economic stability.

Zoli (2005) examined the impact of fiscal policy on monetary policy in emerging countries. Using a VAR model, the study found that positive shocks in the primary fiscal balance led to an increase in public debt. Additionally, the results demonstrated that an increase in the interest rate was associated with exchange rate depreciation, lending support to the findings of Blanchard (2004) and Favero and Giavazzi (2004) regarding fiscal dominance in Brazil.

Gruben and Welch (2005) identified fiscal dominance in Brazil between 1995 and 2004 by using a VEC model. The results indicated that the primary surplus had a Granger-causal relationship with interest rate and growth rate but not with exchange rate. However, it was observed that the interest rate did not Granger-cause the exchange rate.

Marques Jr (2010) applied the AR(1) autoregressive model and the ordinary least squares (OLS) model, following the method of Blanchard (2004). Estimation of capital flows revealed that the exchange rate was predominantly influenced by the probability of default. In the estimation of default risk, a positive relationship was observed between the probability of default and the expected level of public debt, which was affected by the interest rate, the real exchange rate, and the initial level of public debt. Thus, according to Marques Jr (2010), fiscal dominance was present in Brazil from 2003 to 2008. An increase in interest rate resulted in higher debt and an elevated probability of default. As investors are risk-averse, this situation led to a flight of foreign capital and exchange rate depreciation.

Araújo and Besarria (2014), in a study using a VEC model, observed a correlation between an increase in interest rate and exchange rate appreciation, driven by a greater influx of capital into the country. Specifically, NFSP was negatively influenced by the debt-to-GDP ratio, implying that deficit generation was related to the stability of the public debt-to-

GDP ratio. NFSP also had an impact on EMBI and interest rate. In contrast to the findings of Marques Jr (2010), Araújo and Besarria (2014) concluded that an increase in interest rate and risk premium led to exchange rate appreciation, indicating a regime of monetary dominance from 2003 to 2008.

Souza and Dias (2016) adopted a VEC approach to investigate the extent to which public debt and default risk could be explained by macroeconomic imbalances. According to their findings, positive shocks in real exchange rate, public debt, and risk premium produced an increase in inflation rate. The increase in public debt contributed to higher interest rates, which in turn influenced the risk premium. In contrast to the results of Araújo and Besarria (2014), the authors found that the increase in interest rate and risk premium caused exchange rate depreciation. On the other hand, Nobrega et al. (2020), using a VAR model, concurred with the findings of Araújo and Besarria (2014), suggesting a regime of monetary dominance in the Brazilian economy from 2003 to 2015.

The literature review presented in this study reveals empirical divergences regarding the occurrence of fiscal dominance in Brazil over the past two decades. These differences might be attributed to the selected time periods or the utilization of linear estimates for variables that exhibit non-linear relationships with the dependent variables under analysis. The following section presents non-linear estimates for variables commonly used to test the fiscal dominance hypothesis in Brazil.

3. METHODOLOGY

Following the methodological approach of Blanchard (2004), Favero and Giavazzi

(2004) examined the significance of default risk within the framework of fiscal dominance. In their analysis, the authors applied a two-stage least squares (TSLS) model to capture the dynamics of the economy.

To investigate the relationship between the risk premium and relevant variables, Favero and Giavazzi (2004) adopted the logistic smooth transition autoregressive (LSTAR) model. This approach allows for examining non-linear interactions between EMBI and the US spread, providing insights into the behavior of the risk premium (Eq. 1):

$$\mathrm{EMBI}_t = \gamma_0 + \gamma_1 \mathrm{EMBI}_{t-1} + \gamma'_{2,t}\mathrm{Spread}_t^{\mathrm{US}} + \gamma_3 \Delta\mathrm{Spread}_t^{\mathrm{US}} + \epsilon_{1,t} \qquad (1)$$

where EMBI_t corresponds to the Brazilian risk premium, $\mathrm{Spread}_t^{\mathrm{US}}$ corresponds to the difference between the US corporate bond (BAA20Y) and the US Treasury bond (TBOND10Y), and $\Delta\mathrm{Spread}_t^{\mathrm{US}}$ is the first difference of the US spread. The response of EMBI_t with respect to $\mathrm{Spread}_t^{\mathrm{US}}$ is represented by the coefficient $\gamma'_{2,t}$, which is non-linear to the state of fiscal policy (Eq. 1.1):

$$\gamma'_{2,t} = \gamma_2\left(1 + e^{-(x_t^* - x_t)}\right)^{-1} \qquad (1.1)$$

where x_t corresponds to the primary deficit/surplus and x_t^* represents the level of primary surplus necessary to maintain a constant debt/GDP ratio. The larger the difference between x_t and x_t^*, the higher the value of the coefficient $\gamma'_{2,t}$, indicating an increase in the Brazilian risk premium.

Blanchard (2004) argues that the default risk premium, denoted as $p.\theta^*$, where p is the probability of default and θ^* represents the degree of risk aversion of investors, exhibits a non-linear relationship with the magnitude of the public debt. Beyond a certain debt threshold that the international market would perceive as increasing the likelihood of insolvency, the value of $p.\theta^*$ would tend toward infinity as the public debt continues to grow. In the current study, this possibility was investigated by the following equation (Eq. 1.2):

$$\gamma'_{2,t} = \gamma_2\left(1 + e^{-(net\_debt_t - net\_debt_t^*)}\right)^{-1} \quad (1.2)$$

where $net\_debt_t^*$ is a constant estimated using the LSTAR model.

According to the method proposed by Favero and Giavazzi (2004), the exchange rate can be estimated based on uncovered interest rate parity (UIRP). The model comprises three equations that capture the effects of the interaction between exchange rate, risk premium, and the monetary policy rule (Eqs. 2–4):

$$i_t = \rho i_{t-1} + (1-p)\left(\beta_0 + \beta_1(E_t\pi_{t+12} - \pi^*)\right) + \epsilon_{2,t} \quad (2)$$

$$E_t s_{t+1} - s_t = (i_t - i_t^*) + \xi_t \quad (3)$$

$$E_t\pi_{t+12} - \pi^* = \delta_1(E_{t-1}\pi_{t+11} - \pi^*) + (1-\delta_1)[\delta_2(s_t - s_{t-1}) - \pi^*] + \epsilon_{3,t} \quad (4)$$

where i_t is the interest rate, i_t^* the foreigner interest, $E_t\pi_{t+12}$ the 12-month inflation expectation, π^* the Central Bank inflation target, and s_t the exchange rate. Eq. (2) represents the monetary policy rule. Eq. (3) depicts the UIRP condition incorporating the exchange rate risk premium (ξ_t). Eq. (4) describes the relationship between inflation expectations and the variables of Eq. (2).

Under the assumption of $\beta_0 = \delta_1 = \epsilon_{2,t} = \epsilon_{3,t} = i_t^* = \pi^* = 0$, Eqs. (2), (3), and (4) can be reformulated as follows (Eqs. 5–7):

$$i_t = \rho i_{t-1} + (1-p)\beta_1(E_t\pi_{t+12}) \quad (5)$$

$$E_t s_{t+1} - s_t = i_t + \xi_t \quad (6)$$

$$E_t \pi_{t+12} = \delta_2 (s_t - s_{t-1}) \quad (7)$$

In Eq. (5), the monetary policy rule is determined by the previous period's interest rate and inflation expectation, disregarding the inflation target. Eq. (6) disregards the international interest rate, resulting in the determination of UIRP[5] by the domestic interest rate and the risk premium. Finally, in Eq. (7), inflation expectations are dependent on exchange rate fluctuations.

Thus, Favero and Giavazzi (2004), by substituting Eqs. (5) and (6) into Eq. (7) obtained Eq. (8):

$$E_t s_{t+1} - s_t = \rho i_{t-1} + (1 - p)\beta_1 \delta_2 (s_t - s_{t-1}) + \xi_t \quad (8)$$

Assuming that $\Delta s_t = s_t - s_{t-1}$ and $\lambda = (1 - p)\beta_1 \delta_2$, Eq. (8) can be rewritten as follows (Eq. 9):

$$E_t \Delta s_{t+1} = \lambda \Delta s_t + \rho i_{t-1} + \xi_t \quad (9)$$

Under these assumptions, there is a direct relationship between the interest rate and exchange rate, without including inflation expectations, as shown by Eqs. (8) and (9). By solving Eq. (9), the following reduced form is obtained (Eq. 10) (Favero and Giavazzi, 2004)):

$$\Delta s_t = -\frac{\rho}{\lambda} i_{t-1} + \frac{1}{\lambda + \rho} \xi_t \quad (10)$$

Given that the exchange rate risk premium is equal to EMBI, UIRP can be expressed in the following manner (Eq. 11):

[5] UIRP postulates that the difference in nominal interest rate between two countries is equal to the relative changes in the exchange rate over the same period.

$$\Delta s_t = \alpha_1(\text{Selic}_{t-1} - i_{t-1}^{\text{US}}) + \alpha_2\text{EMBI}_{t-1} + \alpha_3\Delta(\text{EMBI})_t + \epsilon_{4,t} \quad (11)$$

To evaluate the relationship between the primary deficit, public debt, exchange rate, interest rate, and inflation expectations, we performed the estimation of Eqs. (1), (2), (4), and (11). The LSTAR specification was applied, and estimates were compared using the weighted non-linear least squares (NLS) method and the generalized method of moments (GMM). The GMM approach uses lagged variables as instruments, following the methodology adopted by Favero and Giavazzi (2004)[6].

In this article, fiscal dominance is defined as the occurrence of exchange rate depreciation owing to an increase in the interest rate, coupled with an increase in the risk premium. This pattern is typically observed in countries facing elevated levels of debt or persistent primary deficits. Within the framework of fiscal dominance, there exists a positive correlation between interest rate and risk premium, primarily driven by factors such as the primary deficit, debt level, and exchange rate dynamics.

3.1. Data Source

The variables used in the analysis have a monthly frequency and cover the period from January 1999 to December 2021. As for the foreign variables related to the United States, we used the Federal Funds Rate as the basic interest rate and the spread calculated as the difference between BAA20Y and TBOND10Y[7].

Public debt was measured by the ratio of total PSND to GDP, which are published by

[6] The econometric methodology used in this article can be found in Bates and Chambers (2017).
[7] Data available on the website of the Economic Research Federal Reserve Bank of St. Louis: https://fred.stlouisfed.org/, accessed in September 2022.

the Central Bank of Brazil (BACEN[8]). The primary result in relation to GDP (Primary Surplus/GDP), which is published by the STN[9], measures the primary surplus.

The variable x_t^*, which represents the level of primary surplus that maintains the debt/GDP ratio constant, was calculated as $x_t^* = (r - g).(\text{PSND/GDP})_t$, where *r* denotes the ex-post real rate deflated by IPCA and *g* represents the real GDP growth. The interest rate in Brazil (represented by the Selic rate), the nominal exchange rate dataset, the real GDP growth, and the IPCA were obtained from the Institute of Applied Economic Research (IPEADATA[10]). The country risk, represented by EMBI, is published by JP Morgan and is also available through IPEADATA.

In light of the macroeconomic changes occurring in Brazil since 2006, such as the significant growth of international reserves surpassing external debt, we chose to perform estimations in different subperiods. The aim was to examine potential shifts in the pattern of estimated coefficients. We evaluated the 1999 to 2006 period and compared estimates with those for the 2014 to 2021 period. The latter period (2014 to 2021) witnessed a significant increase in public deficit compared with the former period (2006 to 2013).

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[8] Data available on the BACEN website, https://www.bcb.gov.br/estatisticas/tabelasespeciais, accessed in September 2022.

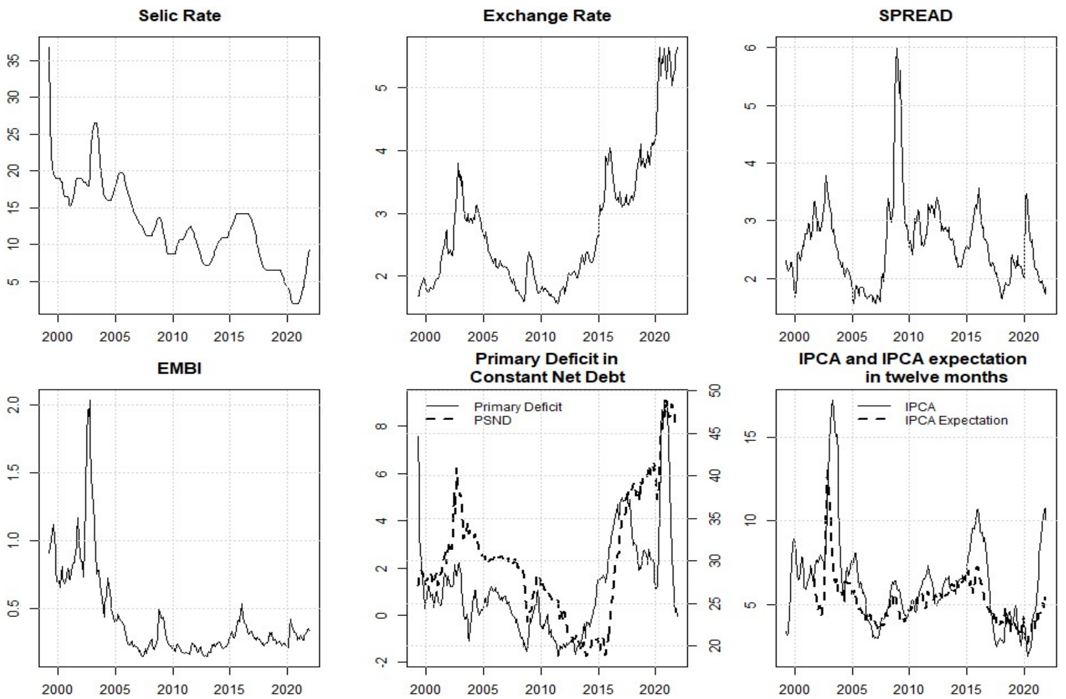
[9] Data available on the STN website, https://www.tesourotransparente.gov.br/publicacoes/boletim-resultado-do-tesouro-nacional-rtn/, accessed in September 2022.

[10] Data available on the IPEADATA website, http://www.ipeadata.gov.br/Default.aspx, accessed in September 2022.

4. RESULTS AND DISCUSSION

The variations in the evaluated economic variables are depicted in Figure 1. Firstly, the Selic rate exhibited a downward trend since 2004, whereas both the exchange rate and the primary deficit increased simultaneously from 2010 onward. A brief impact on the exchange rate was observed in 2008, attributed to the subprime crisis, as reflected on the US spread. However, this effect was short-lived, possibly due to the country's favorable fiscal situation. From 2013 onward, there was a sustained devaluation of the exchange rate. Notably, 2015 and 2020 witnessed simultaneous shocks in primary deficit, spread, EMBI, IPCA, and exchange rate devaluation.

Figure 1. Variables used for econometric analysis of the Brazilian economy from 1999 to 2021.



Source: Own elaboration based on research data.

Expectations for IPCA did not align with the changes observed in the variables, and the index seemed to act as a smoothing factor for price trends. Visually, the Selic rate exhibited a strong correlation with IPCA; however, until 2014, it also showed a correlation with exchange rate. Although the exchange rate devaluated after 2014, the Selic rate continued its downward trajectory. The year 2021 was important in terms of interest rate behavior relative to the IPCA. Despite a price level growth of over 10%, the Selic rate remained at 9.25%. Historically, when faced with a 10% increase in IPCA, BACEN's response was to raise the interest rate by approximately 15%.

Table 1 presents the estimates of the variable $EMBI_t$ based on Eq. (1) and evaluates the suggested non-linearities in Eqs. (1.1) and (1.2). Models (1) and (2) examine the presence of a non-linear relationship, following the approach of Favero and Giavazzi (2004), between $EMBI_t$ and the $Spread_t$ of US interest rates. The estimate captures the impact of $Spread_t$ according to a non-linear model, represented by the difference between the primary surplus level that would keep the net debt constant and the actual primary deficit, as denoted by the variable $(x_t^* - x_t)$ in Eq. (1.1).

For the full sample, the estimated coefficient for the NLS model without instrumental variables was significant at 0.13 percentage points (pp). However, the specification using instrumental variables (GMM) suggests that the $Spread_t$ coefficient is not significant at the 10% level. The other variables with linear specifications exhibited the expected results. The autoregressive coefficient was estimated at 0.968, indicating a strong persistence of shocks. Additionally, the variations in spread, represented by $D.Spread_t$, had a positive effect on $EMBI_t$, with an estimated coefficient of 1.25 pp for a 1 pp change in $D.Spread_t$.

Models (3) and (4) test the hypothesis proposed by Blanchard (2004), examining the non-linear relationship according to Eq. (1.2). In these models, the focus is on the size of PSND/GDP ($net\_debt_t^*$), which determines the extent to which shocks in Spread$_t$ affect EMBI$_t$. However, the coefficients for PSND/GDP and Spread$_t$ were not statistically significant at the 10% level in model (4). It is worth noting that the observed relationship between Spread$_t$ and EMBI$_t$ was contrary to the expected. In this specification, an increase in Spread$_t$ implies a negative relationship with EMBI$_t$.

Table 1. Non-linear estimates of determinants of the Emerging Market Bond Index (EMBI) in Brazil, as determined from Eq. (1).

Time	1999:04 a 2021:12				1999:04 a 2002:12				1999:04 a 2006:12			
	Favero&Giavazzi		Blanchard		Favero&Giavazzi		Blanchard		Favero&Giavazzi		Blanchard	
	nlinear	GMM	*nlinear*	GMM	*nlinear*	GMM	*nlinear*	GMM	*nlinear*	GMM	*nlinear*	GMM
Models	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Const.	-0.063	0.047	0.078	0.196**	-0.419	-0.343	3.108***	10.03	-0.455	-0.488	0.393	-2.024**
(γ_0)	(0.092)	(0.098)	(0.064)	(0.082)	(0.723)	(0.661)	(0.814)	(6.872)	(0.300)	(0.350)	(0.288)	(1.004)
EMBI$_{t-1}$	0.957***	0.968***	0.965***	0.946***	0.816***	0.850***	0.600***	-0.225	0.843***	0.856***	0.911***	0.748***
(γ_1)	(0.013)	(0.025)	(0.012)	(0.024)	(0.085)	(0.083)	(0.093)	(0.820)	(0.045)	(0.077)	(0.038)	(0.084)
D.SPREAD$_t$	1.266***	1.254***	1.245***	1.009***	3.254**	3.527***	2.926***	5.655	2.644***	2.649***	3.596***	10.385***
(γ_3)	(0.183)	(0.176)	(0.185)	(0.148)	(1.215)	(1.236)	(0.997)	(4.539)	(0.790)	(0.940)	(0.779)	(2.348)
SPREAD$_t$	0.134**	0.037	0.049	-0.024	1.061*	0.89*	1.208***	3.524	0.924***	0.895*	0.266*	1.67**
(γ_2')	(0.058)	(0.050)	(0.038)	(0.022)	(0.563)	(0.522)	(0.281)	(2.673)	(0.296)	(0.499)	(0.149)	(0.674)
DLSP/PIB$_t$			31.893***	31.429			32.971***	34.073***			32.923***	25.261***
			(4.662)	(21.698)			(0.752)	(1.347)			(2.023)	(1.666)
J-Test		0.272		7.347		1.874		1.337		1.337		1.365
p-value		0.873		0.025		0.392		0.248		0.248		0.505
LR Test		53.518		1.457		14.272		11.148		17.69		6.93
p-value		0.000		0.483		0.001		0.004		0.000		0.031

*** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$

Table 1 (Continued)

Time	2007:01 a 2014:12				2015:01 a 2021:12			
	Favero&Giavazzi		Blanchard		Favero&Giavazzi		Blanchard	
	nlinear	GMM	*nlinear*	GMM	*nlinear*	GMM	*nlinear*	GMM
Models	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Const.	0.176**	0.13	0.213***	0.232***	0.099	0.202	0.253	-0.270
(γ_0)	(0.068)	0.134	(0.070)	(0.069)	(0.130)	(0.13)	(0.171)	(0.224)
$EMBI_{t-1}$	0.897***	0.912***	0.914***	0.898***	0.925***	0.901***	0.954***	1.074***
(γ_1)	(0.043)	0.094	(0.029)	(0.031)	(0.054)	(0.059)	(0.056)	0.068
$D.SPREAD_t$	0.84***	1.364***	0.833***	0.437**	1.005***	0.914***	1.008***	2.244***
(γ_3)	(0.080)	0.295	(0.075)	(0.212)	(0.148)	(0.092)	(0.148)	(0.706)
$SPREAD_t$	0.052	0.065	-1.828	-6.148	0.066	0.047	-0.051	0.096*
(γ_2')	(0.060)	0.111	(70.910)	(9221.658)	(0.065)	(0.073)	(0.031)	(0.057)
$N.DEBT/PIB_t$			33.422	35.235			23.934***	39.422***
			(40.183)	(1507.919)			(6.307)	(3.686)
J-Test		2.497		1.31		4.993		5.751
p-value		0.114		0.252		0.288		0.219
LR Test		33.928		1.314		127.584		1.764
p-value		0.000		0.518		0.000		0.414

*** p < 0,01; ** p < 0,05; * p < 0,1

Source: Own elaboration based on research data.

These inconsistencies in terms of signs may indicate various underlying issues. For instance, it is possible that changes in fiscal and monetary policies conducted over the analyzed period influenced the response of economic agents to shifts in fiscal policy. In this scenario, the NLS specification may suffer from endogeneity due to the omission of a variable that could account for changes in policy conduct throughout the period. Even in the GMM specification, endogeneity persists if the lagged instrumental variables are insufficient to control for potential omitted variables, as suggested by the *J* test in model (4).

Furthermore, the presence of correlations between the time series may introduce multicollinearity issues between $Spread_t$, $D.Spread_t$, and $(PSND/GDP)_t$, potentially resulting in the insignificance of the estimated parameters according to the *t*-test. To address this concern, we used the likelihood ratio test. The null hypothesis tests whether the combined effect of the estimated non-linear parameters associated with $Spread_t$ (γ_2') and $D.Spread_t$ (γ_3) (Favero and Giavazzi methodology) or $Spread_t$ (γ_2') and $(PSND/GDP)_t$ (Blanchard methodology) is statistically insignificant.

For assessment of different trajectories in the economic policy conduct, models (5) to (8) focus on the same analysis period used by Blanchard (2004) and Favero and Giavazzi (2004), spanning from 1999 to 2002. Estimates of NLS and GMM parameters indicated that the proposed non-linearities are statistically significant and consistent in terms of signs. With regard to the non-linearity specified in model (8), proposed by Blanchard (2004), which involves the variables $Spread_t$ and $(PSND/GDP)_t$, the likelihood ratio test rejected the hypothesis that both variables are equal to zero at the 1% significance level. The estimated threshold for EMBI growth in response to PSND/GDP growth was 34%.

Models (9) to (12) expand the sample period to include data from 1999 to 2006, as the dynamics of external debt and international reserves changed after 2006, with the latter surpassing the former. The results support the previous analysis conducted for 1999 to 2002, indicating that the proposed non-linearity in the Blanchard (2004) and Favero and Giavazzi (2004) models is indeed significant for explaining the effects of $Spread_t$ on $EMBI_t$.

Models (13) to (16) cover the period of the new economic matrix (NME)[11], spanning

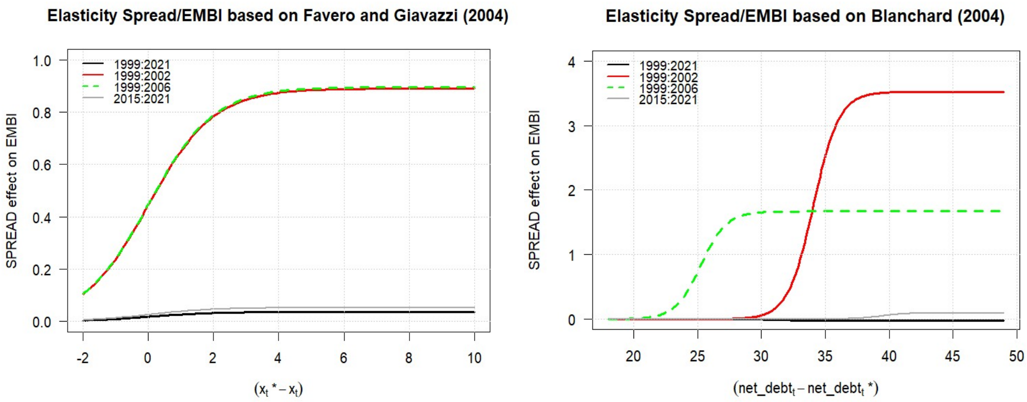
[11] According to Pastore (2015), starting from 2011 under the Dilma government, there were changes in the approach to economic policies with the implementation of the new economic matrix (NME). The NME was characterized by an expansionary fiscal policy based on increased government spending and tax exemptions, low interest rates, a devalued exchange rate, deviation from inflation targets, and achievement of a primary surplus. It was anticipated that the NME would stimulate an increase in the domestic investment rate, leading to economic growth and employment expansion, but this expectation did not materialize.

from 2007 to 2014. However, during this period, the results of non-linear parameters showed inconsistencies from an economic perspective. The adjustments made to the *J* test in the Favero and Giavazzi (2004) model did not adequately account for lagged variables, indicating that changes in fiscal and monetary policy paths might have resulted in specification issues during model adjustment. The estimated non-linear coefficients in the GMM specification, in both Favero and Giavazzi (2004) and Blanchard (2004) models, suggest insignificance according to the *t*-test. Additionally, the likelihood ratio test does not reject the hypothesis that the non-linear parameters in this specification are equal to zero.

Models (17) to (20) focus on estimates for the post-NME period. The adjustments made to the *J* test using the GMM method improved in both specifications, and the estimated coefficients exhibited the expected signs, indicating a positive relationship between $Spread_t$ and $EMBI_t$. However, non-linear coefficients had a minimal impact on EMBI. It is important to note that linear coefficients indicated a decrease in the effect of $D.Spread_t$ on $EMBI_t$. For instance, the estimated coefficient for $D.Spread_t$ was 10.38 in 1999–2006 and only 2.09 in 2015–2021. These results suggest that Brazil's international vulnerability decreased as a result of the expansion of international reserves and the reduction of government bonds indexed to the dollar.

Figure 2 illustrates the elasticity of $Spread_t$ on the variable $EMBI_t$ according to data presented in Table 1, providing a more comprehensive analysis of the observed non-linearities. The coefficients are derived from the GMM specification, excluding the 2006–2014 period because of the statistical insignificance of the parameters. In Figure 2, within the Favero and Giavazzi (2004) specification, the Spread/EMBI elasticity demonstrates consistent results between 1999–2002 and 1999–2006. The findings indicate that a surplus of approximately 2%, relative to the surplus required to maintain the debt constant $(x_t^* - x_t)$, resulted in a 0.1 pp increase in EMBI for every 1 pp growth in Spread. However, when the deficit exceeded 2 pp, the impact on EMBI amplified to 0.9 pp from 1999 to 2006. By contrast, in 2015–2021, the observed non-linearity was statistically insignificant, suggesting a constant effect throughout the observed range of $(x_t^* - x_t)$.

Figure 2. Non-linear relationships of primary deficit and public debt with spread and their effects on the Emerging Market Bond Index (EMBI) in different sample periods.



Source: Own elaboration based on research data.

The Blanchard (2004) specification provided similar results to those reported by Favero and Giavazzi (2004). From 1999 to 2002, the impact of public debt exceeding 34% of the PSND/GDP amplified the elasticity of spread on EMBI by a factor of 3.5 for every 1 pp increase in spread. However, from 1999 to 2006, this effect diminished to a factor of 1.8. Interestingly, after 2015, such an effect was not statistically significant, suggesting that the relationship between spread and EMBI became linear, similarly to that observed by Favero and Giavazzi

(2004).

Table 2 describes the impact of the exchange rate, Selic rate, and inflation expectations, according to the sample subdivisions used in Table 1. Detailed analysis of the factors influencing exchange rate adjustments in Table 2 revealed that models (1) to (6) indicate the variable (SELIC-FED.FUN)$_{t-1}$ as the direct driver of exchange rate appreciation until 2006. Models (7) to (10) suggest that, after 2007, the influence of interest rates on the exchange rate became statistically insignificant or that there might have been a positive relationship between the Selic rate and the exchange rate from 2007 to 2014. Furthermore, the estimated effect of EMBI variations (D.EMBI$_t$) increased markedly from one period to the other: whereas the effect of D.EMBI$_t$ was 2.18 in 1999–2006, it increased to 14.62 in 2014–2021, indicating that the exchange rate became more responsive to EMBI fluctuations.

Models (11) to (16) (Table 2) were used to examine the response of the Selic rate to changes in inflation expectations and the reaction of inflation expectations to fluctuations in the exchange rate. During the NME period, there was a decrease in the responsiveness of monetary policy to changes in inflation expectations. Until 2006, a significant effect of the exchange rate on inflation expectations was observed, as evidenced by the likelihood ratio test for the estimated coefficient δ_2. However, after 2007, expectations were no longer significantly influenced by fluctuations in the exchange rate.

Comprehensive evaluation of the results of Tables 1 and 2 suggests that the NME period (2007–2014) was marked by a decrease in fiscal policy commitment. However, it cannot be definitively concluded whether there was a dominance tax during the evaluated period.

Table 2. Estimates and non-linear analysis of determinants for the exchange rate, Selic rate, and inflation expectations in Brazil, as estimated by Eqs. (2), (4), and (11).

Time	1999:04 a 2021:12		1999:04 a 2002:12		1999:04 a 2006:12		2007:01 a 2014:12		2015:01 a 2021:12	
	nlinear	GMM	*nlinear*	GMM	*nlinear*	GMM	*nlinear*	GMM	*nlinear*	GMM
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dep. Var.	Exchange	Exchange	Exchange	Exchange	Exchange	Exchange	Exchange	Exchange	Exchange	Exchange
Const.	0.602	0.677	0.475	0.57	0.684	0.534	-3.729***	-5.113***	2.072	0.49
	(0.426)	(0.455)	(1.348)	(1.409)	(0.865)	(0.859)	(1.342)	(1.756)	(1.507)	(2.046)
(SELIC-FED.FUN)$_{t-1}$	-0.111**	-0.107**	-0.243***	-0.181**	-0.199***	-0.186***	0.333	0.352*	-0.024	-0.067
(α_1)	(0.045)	(0.049)	(0.077)	(0.087)	(0.057)	(0.062)	(0.166)	(0.206)	(0.079)	(0.095)
EMBI $_t$	0.267***	0.206**	0.459***	0.361**	0.385***	0.375***	0.317**	0.886	-0.352	0.26
(α_2)	(0.071)	(0.085)	(0.112)	(0.175)	(0.069)	(0.089)	(0.438)	(0.795)	(0.557)	(0.791)
D.EMBI $_t$	3.663***	2.975***	2.515***	1.563***	2.681***	2.188***	9.259***	14.483***	9.496***	14.627***
(α_3)	(0.277)	(0.748)	(0.272)	(0.411)	(0.240)	(0.551)	(0.877)	(4.524)	(1.031)	(2.662)
J-Test		3.665		0.674		0.425		8.547		0.316
p-value		0.16		0.714		0.808		0.014		0.854

*** p < 0.01; ** p < 0.05; * p < 0.1

Table 2 (continued)
Source: Own elaboration based on research data.

Time	2001:08 a 2021:12	2007:01 a 2014:12	2015:01 a 2021:12	2001:08 a 2006:12	2007:01 a 2014:12	2015:01 a 2021:12
	GMM	GMM	GMM	GMM	GMM	GMM
Models	(11)	(12)	(13)	(14)	(15)	(16)
Dep. Var.	Selic	Selic	Selic	Exp. IPCA	Exp. IPCA	Exp. IPCA
ρ	0.969*** (0.005)	0.967*** (0.017)	0.930*** (0.010)			
β_0	4.661*** (1.173)	7.685*** (1.48)	5.924*** (0.479)			
β_1	10.332*** (1.622)	3.814* (2.267)	5.168*** (0.491)			
Const.				0.534 (0.492)	-0.203 (0.300)	0.34* (0.193)
δ_1				0.920*** (0.096)	1.048*** (0.058)	0.924*** (0.040)
δ_2				2.468 (3.782)	-0.01 (0.752)	-0.096 (0.277)
J-Test *p-value*	0.950 0.330	0.000 1.000	0.973 0.323	2.668 0.263	2.985 0.225	1.608 0.205
LR Teste *p-value*				5.782 0.016	0.632 0.427	0.166 0.683

*** p < 0.01; ** p < 0.05; * p < 0.1

The estimates shown in models (14) and (15) (Table 2) for 2001–2006 and 2007–2014, respectively, indicate that BACEN based its monetary policy on changes in inflation expectations rather than on the exchange rate or current prices, as depicted in Figure 1. In other words, the estimates suggest a decrease in the exchange rate pass-through to inflation expectations. As BACEN responded to inflationary expectations, there was a tendency for monetary policy to exert less influence on exchange rate appreciation.

Models (11) to (16) (Table 2) were used to examine the response of the Selic rate to changes in inflation expectations and the reaction of inflation expectations to fluctuations in the exchange rate. During the NME period, there was a decrease in the responsiveness of monetary policy to changes in inflation expectations. Until 2006, a significant effect of the exchange rate on inflation expectations was observed, as evidenced by the likelihood ratio test for the estimated coefficient δ_2. However, after 2007, expectations were no longer significantly influenced by fluctuations in the exchange rate.

Comprehensive evaluation of the results of Tables 1 and 2 suggests that the NME period (2007–2014) was marked by a decrease in fiscal policy commitment. However, it cannot be definitively concluded whether there was a fiscal dominance during the evaluated period.

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Analysis of the estimated coefficients allowed us to assess the changes in the impact of international variables on EMBI and the exchange rate, as well as the potential shifts in the behavior of domestic monetary policy in response to changes in inflation expectations. The observed alterations in domestic debt composition, such as reduced indexation to the exchange rate and accumulation of international reserves, indicated a reduction in exchange rate vulnerability. Concurrently, the monetary policy exhibited a reduced response to fluctuations in inflation expectations, as indicated by model (13) in Table 2.

The relationship between interest rate growth and exchange rate depreciation, as shown in model (8) of Table 2, can be attributed to the NME period (2007–2014). During this time, BACEN chose to reduce the responsiveness of the monetary policy to fluctuations in inflation expectations, rather than allowing it to be driven by a potential fiscal dominance. This behavior remained consistent after 2015, as there is no evidence of exchange rate effects on inflation expectations (Table 2, model 16), unlike in 2001–2006 (Table 2, model 14). Consequently, the results of Table 2 suggest that the impact of exchange rate appreciation resulting from Selic rate growth depends on the extent to which inflation expectations are influenced by the current exchange rate depreciation.

The lack of statistical significance of $(\text{SELIC-FED.FUN})_{t-1}$ indicates that BACEN did not utilize interest rates as a means of exchange control, as previously discussed. A broader implication of this result is that the potential effects of the exchange rate on IPCA may become more pronounced. As demonstrated in the literature, in the case of pass-through effects, exchange rate fluctuations impact price levels[12].

Furthermore, with the rise in fiscal deficits and PSND/GDP, the increase in EMBI exerted pressure on exchange rate devaluation. In this specific context, it appears that Brazil, from an econometric standpoint, may exhibit a form of indirect fiscal dominance. In other words, the potential occurrence of fiscal dominance, as suggested by econometric analyses, is not driven by the perception of international markets that higher interest rates heighten the insolvency risk of domestic net debt. Instead, it is attributed to the monetary policy

[12] For a survey on exchange rate pass-through to inflation, see Santolin and Carvalho (2019).

decisions of BACEN, which, since 2006, has prioritized inflation expectations over the effects of exchange rate devaluation on domestic prices.

On the basis of estimate trends, it is anticipated that the potential effect of fiscal dominance in Brazil, assuming a continuous growth in public debt, will not translate into a non-linear relationship between PSND/GDP and spread. The effect will likely manifest as a one-time impact. In other words, once Brazil's indebtedness reaches an unsustainable level, there could be an explosive effect on EMBI, rendering Brazilian bonds unmarketable in the international market.

In such cases, econometric models based solely on macroeconomic data from Brazil may not fully capture the potential for the explosive growth of EMBI. To analyze such scenarios, it becomes necessary to employ models that incorporate comparisons with data from other countries. For instance, in 2021, Brazil's total debt-to-GDP ratio was 93.68%, whereas EMBI was recorded at 2.7%, 2.56%, and 2.97% in January, June, and September, respectively. By contrast, Venezuela, which has experienced significant economic turmoil, reported a debt-to-GDP ratio of 306.95% in 2021. The EMBI of Venezuela during the same period was considerably higher, namely of 248.3%, 310.91%, and 311.43% in January, June, and September, respectively[13]. Such comparisons help illustrate the potential implications of

[13] Data available in October 2022 at:

1. https://www.statista.com/statistics/1086634/emerging-markets-bond-index-spread-latin-america-country/
2. https://www.statista.com/statistics/372075/national-debt-of-venezuela-in-relation-to-gross-domestic-product-gdp/
3. https://www.statista.com/statistics/271041/national-debt-of-brazil-in-relation-to-gross-domestic-product-gdp/

different levels of debt and their impact on market perceptions and risk assessments.

5. FINAL CONSIDERATIONS

This study analyzed the theoretical proposals of Blanchard (2004) and Favero and Giavazzi (2004) regarding the possibility of fiscal dominance in the Brazilian economy from 1999 to 2021. Econometric estimates were conducted for different subperiods, considering the changes in macroeconomic conditions after 2006, such as the growth of international reserves, surpassing external debt, and a significant increase in public debt after 2014.

From 1999 to 2006, contrary to the propositions of Blanchard (2004) and Favero and Giavazzi (2004), fiscal dominance was not observed. The increase in Selic rate kept the exchange rate under control, and the fiscal surpluses were sufficient to control EMBI, which was the main factor influencing exchange rate fluctuations during the observed period.

However, from 2014 to 2021, a shift in monetary policy orientation was observed, whereby changes in Selic rate no longer had an impact on the exchange rate trajectory. This result suggests two possibilities. The first and less plausible is that, since 2014, monetary policy has been under fiscal dominance, and the growth of the Selic rate relative to the Federal Fund rate had no effect on international capital flows. The second, which is more plausible, is that the domestic monetary policy no longer uses interest rates as an instrument for exchange rate control.

The decisions regarding changes in domestic interest rates have been based solely on variations in inflation expectations concerning the inflation target, as advocated by the hypotheses of the New Macroeconomic Consensus[14], which posit that the exchange rate has no significant role in inflation dynamics. In general, after 2006, monetary policy was not used to control the exchange rate or prevent inflation growth through exchange rate pass-through.

Overall, the findings suggest that fiscal dominance did not prevail in the Brazilian economy during the analyzed period, and recent monetary policy has shifted its focus away from exchange rate control and toward inflation management based on inflation expectations.

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[14] See Clarida et al. (1999).

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