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CHAPTER 7

AN ANALYSIS OF THE DYNAMICS OF FISCAL AND MONETARY POLICY IN BRAZIL AFTER THE IMPEACHMENT OF PRESIDENT DILMA ROUSSEFF

UMA ANÁLISE DA DINÂMICA DA POLÍTICA FISCAL E MONETÁRIA NO BRASIL APÓS IMPEACHMENT DA PRESIDENTE DILMA ROUSSEFF

UN ANÁLISIS DE LA DINÁMICA DE LA POLÍTICA FISCAL Y MONETARIA EN BRASIL TRAS EL IMPEACHMENT DE LA PRESIDENTA DILMA ROUSSEFF

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ABSTRACT

This study aims to analyze whether there was a regime of fiscal dominance in Brazil between September 2016 and December 2021, covering the Temer administration and the first three years of the Bolsonaro administration. Using an econometric methodology based on bivariate and multivariate Granger causality tests, the study examines the relationship between the interest rate, public debt, primary surplus, real exchange rate, and country risk. The results indicate that, during the analyzed period, the Brazilian economy was under a regime of monetary dominance, where fiscal policy did not impose significant constraints on monetary policy, and variations in the primary surplus were crucial in stabilizing the debt-to-GDP ratio.

Keywords: Fiscal Dominance. Granger Causality Test. Impeachment of Dilma Rousseff.

RESUMO

Este estudo tem como objetivo analisar se houve um regime de dominância fiscal no Brasil entre setembro de 2016 e dezembro de 2021, compreendendo os governos Temer e os três primeiros anos do governo Bolsonaro. Utilizando uma metodologia econométrica baseada em testes de causalidade bivariada e multivariada de Granger, o estudo analisa a relação entre a taxa de juros, a dívida pública, o superávit primário, a taxa de câmbio real e o risco país. Os resultados indicam que, durante o período analisado, a economia brasileira esteve sob um regime de dominância monetária, onde a política fiscal não impôs restrições significativas à política monetária, e as variações no superávit primário foram determinantes na estabilização da relação dívida/PIB.

Palavras-chave: Dominância Fiscal. Teste de Causalidade de Granger. Impeachment de Dilma Rousseff.

RESUMEN

Este estudio tiene como objetivo analizar si existió un régimen de dominancia fiscal en Brasil entre septiembre de 2016 y diciembre de 2021, abarcando los gobiernos de Temer y los primeros tres años del gobierno de Bolsonaro. Utilizando una metodología econométrica basada en pruebas de causalidad de Granger bivariadas y multivariadas, el estudio analiza la relación entre las tasas de interés, la deuda pública, el superávit primario, el tipo de cambio

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real y el riesgo país. Los resultados indican que, durante el período analizado, la economía brasileña estuvo bajo un régimen de dominancia monetaria, donde la política fiscal no impuso restricciones significativas a la política monetaria y las variaciones en el superávit primario fueron decisivas para estabilizar la relación deuda/PIB.

Palabras clave: Dominio Fiscal. Prueba de Causalidad de Granger. Impeachment de Dilma Rousseff.

1 INTRODUCTION

On August 31, 2016, then-President Dilma Rousseff was removed from office through an impeachment process conducted by Congress, because of the crime of fiscal responsibility known as fiscal pedaling[3]. Between the end of Dilma Rousseff's first term and Dilma Rousseff's second term, the Brazilian economy presented, according to IPEA data (2022), low economic growth, high inflation, high interest rates, expansion of the debt/GDP ratio, drop in international investor confidence, increased country risk, and growth in unemployment. This scenario indicated that monetary policy was being dominated by fiscal policy, characterizing a regime of fiscal dominance (Latif, 2021).

Fiscal dominance is a macroeconomic scenario where fiscal policy prevails over monetary policy, requiring revenue to finance budgets (via seigniorage or sale of bonds that results in the issuance of currency), monetization of public debt, and ineffective monetary policy (rising interest rates raise inflation). In this context, a restrictive monetary policy loses its ability to control inflation, amplifying it, since the increase in interest rates increases the domestic public debt, expands the debt/GDP ratio, and causes capital flight, currency devaluation, and inflationary pressure. Among the main factors that contribute to a scenario of fiscal dominance are: the level of public debt, the proportion of public debt in foreign currency and risk aversion on the part of foreign investors (Sargent and Wallace, 1981).

The opposite scenario is called the regime of monetary dominance. According to Sargent and Wallace (1981), this scenario is characterized by a passive fiscal authority that promotes a primary surplus, stabilizing the debt/GDP ratio, while the active monetary authority is not forced to monetize the public debt, maintaining control of the price level determined by the supply and demand of money.

After the impeachment, the Brazilian economy underwent a series of structural reforms, such as the labor reform, the spending cap, and the pension reform, aimed at controlling public accounts, which had to be reversed after the COVID-19 pandemic. This period comprises the Temer and Bolsonaro governments. However, this scenario of reforms and pandemic revealed, on average, low economic growth, a devalued exchange rate, high interest rates, an increase in the debt/GDP ratio, and country risk, according to

[3] Budget operations carried out by the National Treasury not provided for in the legislation, which consist of delaying the transfer of funds to private and public banks in order to alleviate the government's fiscal situation in a given month or year, revealing an improvement in economic indicators to the financial market and to specialists in public accounts.

data from IPEA (2022) and Investing.com (2022). This recent macroeconomic situation raises indications of fiscal dominance.

Thus, the hypothesis of this study is that there was a regime of fiscal dominance during the Temer government and part of the Bolsonaro government. The general objective of this study is to use bivariate and multivariate causality analyses to identify which dominance regime prevailed in the Brazilian economy between September 2016 and December 2021, based on the methodology of Gadelha and Divino (2008). According to these authors, the analysis of causality is adequate because it allows testing the definition of Sargent and Wallace (1981), where the existence of unidirectional causality of the primary surplus for the public debt is consistent with a regime of monetary dominance, while the unidirectional causality of the public debt for the primary surplus determines a regime of fiscal dominance. In addition, Gadelha and Divino (2008) point out that the causality test allows verifying the transmission between fiscal and monetary variables, as determined by Blanchard (2004), to explain that the Brazilian economy was under a regime of fiscal dominance in the mid-2000s.

Specific objectives include:

- To describe the macroeconomic scenario after the impeachment of President Dilma Rousseff, from September 2016 to December 2021, analyzing the behavior of GDP, debt/GDP ratio, interest rate, exchange rate, inflation rate, and country risk index.
- To detail which dominance regime prevailed in the post-impeachment period, from September 2016 to December 2021, covering the Temer government and the first three years of the Bolsonaro government, based on bivariate and multivariate causality analyses, based on the study by Gadelha and Divino (2008).
- Identify whether the hypothesis of the study was rejected or not, discussing the perspectives of the macroeconomic scenario for the coming years.

This study is relevant because it reinforces and expands the literature and empirical evidence on the subject, provides a detailed analysis of the efficiency of fiscal and monetary authorities, and serves as a reference to assist policymakers in their macroeconomic decisions.

The project is structured as follows, in addition to this introduction and the bibliography: section 2, which discusses the regimes of monetary and fiscal dominance; section 3, which gathers empirical evidence; section 4, which addresses the methodology and presents two subsections comprising the database and the description of the

econometric method used, which is divided into the unit root test, multivariate causality and bivariate causality; section 5, which sets out the expected results; section 6, which deals with the provisional summary of the monograph; and section 7, which brings the schedule.

2 A BRIEF DISCUSSION ON THE REGIMES OF MONETARY AND FISCAL DOMINANCE

The theme of fiscal dominance permeates the academic debates more strongly after the seminal article on the coordination of fiscal and monetary policies. Sargent and Wallace (1981) analyzed a possible perverse effect on the relationship between fiscal and monetary policy. According to the authors, the interaction between the fiscal and monetary authority of an economy can be established in two ways: monetary dominance or fiscal dominance.

In the first case, in relation to monetary dominance, monetary policy dominates fiscal policy. It is a situation in which the monetary authority will determine the amount of revenue that will offer the fiscal authority via expansion of the monetary base. That is, the fiscal authority will have to finance its possible deficits through a combination of seigniorage (predetermined by the monetary authority) and bonds offered to the public (which face a constraint derived from the demand function for bonds). Under this coordination, the monetary authority has control of inflation, according to the authors.

In the second case, by setting its objectives without taking into account the objectives of monetary policy, the fiscal authority will independently establish its current and future budgets. By "cutting" the need for a primary surplus to finance fiscal budgets, the revenue needed to finance the fiscal budget should come from the sale of government bonds or via seigniorage. For the first possibility, even if the fiscal authority manages in the short term to avoid the need to expand the monetary base with the issuance of bonds, the increase in the principal and the impact of interest on the debt can generate inflation in the long run, because the financing of the deficit by the sale of bonds has a long-term inflationary potential. Financing with government bonds can be more inflationary than the expansion of the monetary base today. For the second possibility, expanding the monetary base will imply inflation. In this case, the fiscal authority will not restrict the surplus to a situation in which control of the public sector's net debt as a proportion of GDP is maintained. Sargent and Wallace (1981) call this scenario "Nasty Monetarist Arithmetic".

If the fiscal authority does not run primary surpluses to help finance the budget, especially at times when the monetary authority aims to contain inflation, a low monetary expansion will be necessary, causing the stock of bonds to increase. However, there is a limit to the demand for bonds relative to the size of the economy, which prevents financing via the issuance of bonds *ad infinitum*. Upon reaching this limit, the Central Bank is obliged to expand the monetary base to finance the fiscal authority, promoting an increase in the price level. Therefore, when the economy is in fiscal dominance, there tends to be inflation today or future inflation.

3 EMPIRICAL EVIDENCE

Blanchard (2004) investigated whether the Brazilian economy, during the years 2002 and 2003, experienced a scenario of fiscal dominance. A model was used that examines the interaction between the interest rate, the exchange rate and the probability of default in an economy with high indebtedness and high risk, such as the Brazilian one in this period. The analysis concluded that, in 2002, the level and composition of Brazil's public debt, together with the degree of risk aversion in the financial market, resulted in a negative effect of the interest rate on the exchange rate and inflation.

Aguiar (2007) sought to test the hypothesis of fiscal dominance and estimate a fiscal reaction rule for Brazil in two phases. Initially, the author investigated the presence of fiscal dominance in Brazil from 1999 onwards, a period in which primary surplus targets were established, using the Econometric Technique of Autoregressive Vectors (VAR). Subsequently, it analyzed whether the Brazilian fiscal policy responded to variations in the debt by adjusting the primary result, aiming at the sustainability of the debt/GDP ratio and allowing the effectiveness of the monetary policy, using linear regression. The results indicated the absence of empirical evidence of fiscal dominance in Brazil between 1999 and 2006; The country adjusts the primary result in response to changes in public indebtedness and economic activity, revealing a reactive and cyclical character of fiscal policy.

Gadelha and Divino (2008) examined the existence of fiscal or monetary dominance in the Brazilian economy after the Real Plan, using the long-run equilibrium relationship and the bivariate and multivariate Granger causality between the variables nominal interest rate, debt/GDP ratio, primary surplus/GDP ratio, real exchange rate and risk premium. The results showed that the Brazilian economy operated under a regime of

monetary dominance, according to the concepts of Sargent and Wallace (1981), and that the model proposed by Blanchard (2004) did not find empirical support.

Nobrega (2016) investigated whether there was a regime of fiscal or monetary dominance in the Brazilian economy between 2003 and 2015. Using the Autoregressive Vectors (VAR) model, the results indicated the existence of a monetary dominance relationship over the period, according to the definitions of Sargent and Wallace (1981) and Blanchard (2004). However, in 2011, a structural change was identified in the relationship between the variables. From multiple regressions with the inclusion of dummies variables, it was observed that the money supply began to present a negative relationship with the debt, suggesting that the expansion of the monetary base was used to contain the public debt. This result indicates a regime of fiscal dominance from this period, confirmed by the Autoregressive Vectors with Markovian Change (MS-VAR) method, which identified two distinct regimes in the analyzed period.

Marques Júnior (2020) sought to empirically identify whether the Brazilian economy presented a scenario of fiscal dominance after six years of Lula's government, using the same method adopted by Blanchard (2004). The study concluded that the Brazilian economy suffered from a process of fiscal dominance, although less markedly than in the previous period.

Oliveira (2020) conducted a historical analysis, exposing the main theoretical models on the relationship between fiscal sustainability and fiscal dominance. The study begins by detailing the Ricardian Equivalence Theorem of Barro (1974), followed by the model of Sargent and Wallace (1975) and the first theoretical elaboration of the concept of "Fiscal Dominance" in Sargent et al. (1981). The author deconstructs the premises and weaknesses of the public debt trajectory models via future surpluses to explain the empirical unsustainability of these models. The results indicate that conducting sustainability tests and observing the trajectory of public debt are not sufficient to draw conclusions on fiscal sustainability.

4 METHODOLOGY

This section gathers the database used in the model and describes the econometric method used.

4.1 DATABASE

According to the models discussed by Blanchard (2004), Sargent and Wallace (1981), and Gadelha and Divino (2008), the variables considered in the causality analysis include the interest rate, the public debt, the primary surplus, the real exchange rate and the country risk. The analysis will be conducted for the period following the impeachment of President Dilma Rousseff, covering from September 2016 to December 2021, a period that encompasses the Temer government and the first three years of the Bolsonaro government.

The nominal interest rate, i_t, will be represented by the Selic rate, which is the main monetary policy instrument of the Central Bank of Brazil. The debt-to-GDP ratio, indicates the net debt of the public sector, including the federal government, the Central Bank of Brazil, state and municipal governments, and state-owned enterprises (federal, state, and municipal), as a percentage of Gross Domestic Product (GDP). The primary surplus/GDP ratio, , reflects the central government's public sector borrowing needs, as a percentage of GDP, considering the exchange rate devaluation on the stock of domestic securities debt.$d_t sp_t$

$$z_t z_t = e_t \left(P^*/P_t\right) z_t$$

Comentado [IC1]: Não coloquei (1) nesse porque o autor não colocou, dessa forma se eu adicionar vai alterar a ordem das outras e consequentemente o texto

The real exchange rate, represents the price in reais of a monetary unit of the dollar, adjusted for the price differential. This is expressed by, where is the real exchange rate, is the nominal exchange rate (R$/US$), is the consumer price index of the United States, and is the Brazilian consumer price index (IPCA). In relation to the risk premium, the country risk, represented by the spread of the Emerging Markets Bond Index (), will be used as a proxy. $e_t P^* P_t$ The $embi_t embi_t$measures the difference between the yield of a dollar-denominated bond issued by the Brazilian government and a similar bond issued by the U.S. Treasury. Finally, all variables will be logarithmized.

Regarding the source of the data, all variables will be extracted from the database of the Institute of Economic and Applied Research (IPEA).

4.2 DESCRIPTION OF THE ECONOMETIC METHOD

This section details the econometric method that will be adopted in the study and is divided into a subsection that deals with the unit root test, multivariate and bivariate causality.

4.2.1 Unit Root Testing

The unit root test aims to identify whether the series presents stationary behavior or not. Among the traditional tests that identify this type of behavior, we can mention the Dickey-Fuller test (1979, 1981), Said and Dickey (1984) and the Phillips-Perron test (1988). We can also mention the modified Dickey-Fuller ($MADF^{GLS}$) and Phillips-Perron (, elaborated by Elliot, Rottemberg and Stock (1996), and Ng and Perron (2001) tests, which are more efficient in performing the stationarity test of the series because they overcome the problems of low statistical power and size distortions of traditional tests.MPP^{GLS})

The modified Dickey-Fuller ($MADF^{GLS}$) and Phillips-Perron (tests consist of dealing with two central points of traditional tests: the inefficiency of removing the trend in time series using MPP^{GLS})*Ordinary Least Squares (OLS*); the appropriate selection for the lag order of the increased term, in order to acquire a better approximation to the true data-generating process.

On the first point, authors Elliot, Rothenberg, and Stock (1996) suggest employing Generalized *Least Squares (GLS*) to remove the stochastic bias from the series. For this, a standard method is adopted to estimate the statistic that represents the t-statisticADF^{GLS} to test the null hypothesis, which indicates that the series has a unit root, of this regression estimated by ordinary least squares:H_0: $\beta_0 = 0$

$$\Delta\tilde{y}_t = \tilde{\beta}_0\tilde{y}_{t-1} + \Sigma_{j=1}^{k}\beta_j\Delta\tilde{y}_{t-j} + e_{tk} \qquad (1)$$

$\tilde{y}_t$With the alternative hypothesis that there is no unit root in the series, that is, that the series is stationary. In equation 1 above, it is the series with the trend removed by generalized least squares, indicates the operator of first differences, expresses the residue that carries autocorrelation and homoscedasticity.Δe_{tk}

Regarding the second point, Ng and Perron (2001) reveal that the information criteria of Akaike (AIC) and Schwarz (SIC) present a selection bias of low values for the lag *k*, when there is a large negative root, close to -1, for example, in the polynomial of moving averages of the series, leading the unit root tests to strong distortions. This characteristic identified by the authors stimulated the elaboration of a modified Akaike information criterion (MAIC) aimed at selecting the autoregressive lag, in order to reduce the changes generated by the inappropriate selection of lag in equation (1) above.

MPP^{GLS}Also according to the authors, they suggest that these modifications are also implemented in the Phillips and Perron (1988) test, giving rise to the . Using simulations, Ng and Perron (2001) point out that the adoption of the generalized least squares method for the extraction of the deterministic tendency and the MAIC lag selection criterion generate tests with greater power and lower distortions of statistical magnitude when compared to the traditional ADF and PP tests.

However, the modified tests present low efficacy in the presence of structural breaks, revealing a bias of non-rejection of the null hypothesis of the presence of a unit root when in fact the series is stationary. Perron (1989) presents solutions to this type of problem. The date of occurrence of the structural break is known and it is treated as an exogenous event. Thus, it indicates the period before the structural break, where the null hypothesis is that the series exhibits a unitary root behavior with structural break in the period , and the alternative hypothesis is that the series is a stationary series. The generalist model, expressed as model (C), considers the breakout of the intercept and the trend and is formalized as:$\tau y_t t = \tau + 1 y_t$

$$y_t = a_0 + a_1 y_{t-1} + a_2 t + \mu_1 D_L + \mu_2 D_P + \mu_3 D_T + \Sigma_{i=1}^{k} \beta_i \Delta y_{t-1} + \epsilon_t \quad (2)$$

$D_P = 1t = \tau + 1 D_L = 1t > \tau D_T = t - \tau$Such that if and zero opposite case, if and zero opposite case, if and zero opposite case, $t > \tau\ \epsilon_t$ indicates the non-autocorrelated and homocedastic residue.

Thus, the residuals generated by equation 2 are used to estimate the following equation by ordinary least squares:

$$\hat{\varepsilon}_t = a_1 \hat{\varepsilon}_{t-1} + v_t \quad (3)$$

a_1In a unit-root null hypothesis scenario, the theoretical value of is unitary. Considering that the residues are independent and identically distributed, the distribution of will be linked to the breakage fraction, represented by, in which T expresses the number of total observations. In case there is a correlation between the residuals, equation (4), next, must take the form of the ADF test, properly selecting the lags to correct the autocorrelation. And the t-statistic, estimated for the null hypothesis, can be equated with the critical values tabulated by Perron (1989). $a_1 \lambda = {}^{\tau}/_{T}\, a_1 = 1$

4.2.2 Multivariate Causality

The causality analysis is given from the use of the autoregressive vector model (VAR) relating to the variables mentioned above at the beginning of the section. VAR models are characterized by being systems of simultaneous equations that capture the presence of interdependence relationships between variables, and that make it possible to analyze the stochastic shocks in each variable of the system (HILL ET AL., 1999; GUJARATI AND PORTER, 2011).

The concept of causality explains a relationship between variables where a certain variable impacts the behavior of another. The denomination of causality in Granger's sense, on the other hand, is related to the fact that a certain variable carries information from the past that helps in the process of predicting another variable. In this way, if y_t you carry past information that helps to predict, then you have that Granger-causa (GRANGER, 1969). It is possible to write the VAR in its reduced form, with size p, as follows:$z_t y_t z_t$

$$X_t = A_0 + A_1 X_{t-1} + A_2 X_{t-2} + \ldots + A_p X_{t-p} + \zeta_t \qquad (4)$$

Being X_ta vector of stationary variables, p corresponds to the number of lags, represents the vector of intercepts, indicates the matrices of coefficients and expresses a vector of non-autocorrelated and homoscedastic residuals. Thus, the vector carries the series of interest rate, real exchange rate, risk premium, debt/GDP ratio and surplus/GDP ratio. The lag order (p) is identified based on the Akaike and Scharwz criterion. And knowing that causality analysis does not require the estimation of structural parameters, it is not necessary to adopt an identification strategy in equation (4).$A_0 A_i \zeta_t X_t$

Thus, to test Granger's causality from the variable j to the variable h, we test the null hypothesis that the coefficients of the variable j in all its lags are, at the same time, statistically equal to zero in the equation where h is the dependent variable. Thus, if the null hypothesis is rejected, the variable j is Granger-causa h.

Since the variables are not stationary, it is necessary to test for cointegration. In the presence of cointegration between the variables, the cocomponent vector is used to generate stationary linear combinations between the variables and an autoregressive vector model of error correction, called VEC, is estimated. The statistical significance of the correction of the error term should also be considered in the causality test. X_t

Johansen and Juselius (1990) and Johansen (1991) developed a test where it is possible to test cointegration, this test models time series as a reduced rank regression where the maximum likelihood estimates of the co-integrating vector are calculated in the multivariate error correction model with Gaussian errors. This procedure requires estimating the error-correcting representation represented by:

$$\Delta X_t = \mu + \pi X_{t-1} + \Sigma_{i=1}^{p-1} \pi_i \Delta X_{t-i} + \varepsilon_t \qquad (5)$$

The variable X_t represents a column vector (5 x 1) of variables, expresses a vector (5x1) of constant terms, and $\mu\pi\pi_i$ indicates matrices of coefficients, p represents the order of lags and indicates the residue with homoscedastic characteristics and not self-correlated. It is called the coefficient matrix, and is characterized by encompassing information that is related to the long-term equilibrium between the variables. The number of co-integrating vectors in the system is given by the number of eigenvalues that are statistically different from zero, which corresponds to the position of The author Johansen presents a method of $\varepsilon_t\pi\pi\pi$.*trace* statistics and *maximum eigenvalue* that seeks to test the number of co-integrating vectors existing in equation 5. Such statistics are:

$$\lambda_{traço}(r) = -T \sum_{i=r+1}^{n} ln(1 - \hat{\lambda}_i) \qquad (6)$$

$$\lambda_{max}(r, r+1) = -Tln\left(1 - \hat{\lambda}_{r+1}\right) \qquad (7)$$

In which $\hat{\lambda}_i$ represents the estimated values of the eigenvalues acquired from the matrix and T indicates the number of observations. This test adopts a recursive procedure, so that the null hypothesis is that there are at most r co-integrating vectors. The critical values were tabulated by Johansen and Juselius (1990) and Johansen (1991). π

4.2.3 Bivariate causality

The bivariate causality analysis from Granger's perspective is related to the estimation of autoregressive models of distributed lags (ADL) for pairs of variables. The ADL model is broad and makes it possible to capture the dynamics of the system, to avoid bias of omission of relevant lags. Thus, this model does not require that all equations present the same number of lags in the variables, as is required in the VAR model.

However, bivariate causality may suffer due to the omission of a variable in the system. This problem was corrected by Granger's multivariate causality test – discussed in the previous subsection.

Granger's correlation model explains that if, for example, the series and are cointegrated, then the regression between them can be expressed from an error correction model (EAGLE AND GRANGER, 1987). Thus, if the variables are cointegrated, Granger's causality should be analyzed by inserting the lagged residue of a period of the cointegrative regression, called error correction mechanism, in the autoregressive model and in the distributed lag model (ADL) in first differences. That is:$y_t z_t$

$$\Delta y_t = \alpha_1 + \alpha_y \hat{e}_{yz,t-1} + \sum_{i=1}^{p} \alpha_{11}(i)\Delta y_{t-1} + \sum_{i=1}^{q} \alpha_{12}(i)\Delta z_{t-1} + \varepsilon_{yt} \quad (8)$$

$$\Delta z_t = \alpha_2 + \alpha_z \hat{e}_{zy,t-1} + \sum_{i=1}^{l} \alpha_{21}(i)\Delta y_{t-1} + \sum_{i=1}^{m} \alpha_{22}(i)\Delta z_{t-1} + \varepsilon_{zt} \quad (9)$$

in which and are the residues of non-autocorrelated characteristics, and correspond to the error correction mechanisms (ECM).$\varepsilon_{yt}\varepsilon_{zt}\hat{e}_{yz,t-1} = (y_{t-1} - \beta z_{t-1})\, \hat{e}_{zy,t-1} = (z_{t-1} - \varphi y_{t-1})$

For equations 8 and 9, detailed above, we have that:

- The null hypothesis indicates that it does not Granger-cause, while the alternative hypothesis expresses that Granger-cause.H_0: $\alpha_{12}(i) = 0\alpha_y = 0\Delta z_t\Delta y_t H_a$: $\alpha_{12}(i) \neq 0\alpha_y \neq 0\Delta z_t\Delta y_t$
- The null hypothesis indicates that it does not Granger-cause, while the alternative hypothesis expresses that Granger-cause.H_0: $\alpha_{21}(i) = 0\alpha_z = 0\Delta y_t\Delta z_t H_a$: $\alpha_{21}(i) \neq 0\alpha_z \neq 0\Delta y_t\Delta z_t$

Thus, from such hypotheses, 4 outcomes are possible for pairs of variables.

Knowing that Granger's causality test is elastic to the number of lags inserted in the ADL models, as it influences the direction of causality, rigid lag criteria should be employed, based on the criteria of AIC and SIC and on the "general to the specific" method, suggested by Campbell and Perron (1991).[4]

[4] In this method, a maximum number of lags () is chosen by deduction, which are eliminated one by one, if the coefficient of the last lag is not significant. The optimal lag will be obtained when the coefficient test was greater than 1.68, in absolute terms, at a significance level of 10%, where .$p_{máximo} tp = p_{ótimo}$

5 RESULTS

In order to test the null hypothesis that there is a regime of fiscal dominance in Brazil, the Eagle-Granger causality test was performed in the VAR model to identify the following relationships: net public debt as a proportion of GDP and the primary surplus as a proportion of GDP; the Selic rate and net public debt as a proportion of GDP; the Selic rate and the EMBI spread; and the EMBI spread and the net public debt as a proportion of GDP.

First, it was necessary to perform the unit root, Augmented Dickey-Fuller (ADF) and Phillips-Perron tests, to identify whether any of the variables are not stationary. The following table 1 demonstrates the ADF and Phillips-Perron test:

Table 1

Dickey-Fuller and Phillips-Perron Unit Root Test

Variable	Dickey-Fuller Test	Phillips-Perron Test
(DT)	Presence of a single root	Presence of a single root
(ST)	Presence of a single root	Presence of a single root
(SPT)	Absence of unit root	Absence of unit root
(embit)	Presence of a single root	Absence of unit root

Source: Prepared by the authors based on information extracted from the *Stata 16.0 software.*

The Dickey-Fuller test points to the presence of unit root in the variables net public debt as a proportion of GDP, Selic rate and country risk. The Phillips-Perron test, however, points to the presence of a unit root only in the variables public debt as a proportion of GDP and the Selic rate. The series that have a single root are differentiated once and the Dickey-Fuller and Phillips-Perron tests are performed again to identify whether the presence of a unit root persists. The results in table 2 indicate that the differentiated series no longer have a unit root.

Table 2

Unit Root Test (Dickey-Fuller and Phillips-Perron)

Variable	Dickey-Fuller Test	Phillips-Perron Test
(dif_dt)	Absence of unit root	Absence of unit root
(dif_st)	Absence of unit root	Absence of unit root
(dif_embit)	Absence of unit root	Absence of unit root

Source: Prepared by the authors based on information extracted from the *Stata 16.0 software.*

The optimal number of lags was given by the AIC, HQIC and SBIC selection criteria. The Laganger multiplication test, which identifies the absence of autocorrelation given the number of lags, indicated that all the lags chosen do not present autocorrelation. All 4 VAR models satisfy the stability condition and the errors have a distribution close to zero and low standard deviation, which rules out the presence of heteroscedasticity.

Thus, table 3 presents the Eagle-Granger causality tests for each of the relationships mentioned to identify the non-rejection or rejection of the hypothesis of the presence of fiscal dominance.

Table 3

Eagle-Granger Causality Test

Null hypothesis	P-Value	Cause	Lags
dif_dt not Granger-Causa dif_st	0.419	No	(1,1)
dif_st not Granger-Causa dif_dt	0.002***	Yes	
dif_dt not Granger-Causa spt	0.410	No	(1,1)
spt not Granger-Cause dif_dt	0.004***	Yes	
dif_dt not Granger-Causa dif_embit	0.006***	Yes	(2,2)
dif_embit not Granger-Causa dif_dt	0.001***	Yes	
dif_st not Granger-Causa dif_embit	0.615	No	(3,3)
dif_embit not Granger-Causa dif_st	0.419	No	

Source: Prepared by the authors, based on data extracted from the Stata 16 software. Observations: *** indicates statistical significance at 1%, ** indicates statistical significance at 5%, * indicates statistical significance at 10%.

First, it is possible to identify that the primary surplus/GDP ratio Granger-causes the net public debt/GDP ratio to be unidirectionally at the significance level of 1%. This result reveals that the debt/GDP ratio is affected by variations in the generation of primary surpluses, i.e., improvements in the stabilization of the debt/GDP ratio can be obtained through the generation of primary surpluses. Thus, in addition to promoting gains in the credibility of fiscal policy, this result characterizes a country under a regime of monetary dominance, according to the definition of Sargent and Wallace (1981), since fiscal policy guarantees the sustainability of the public debt.

Second, the Selic Granger interest rate unidirectionally causes the debt-to-GDP ratio to be at the significance level of 1%. This relationship suggests the presence of an autonomous monetary authority, with the capacity to set the Selic rate at the level it desires, thus indicating gains in the credibility of monetary policy. Therefore, monetary

policy is not affected by the dynamics of public debt, which characterizes a regime of monetary dominance.

Third, the absence of statistical significance in the relationship between the Selic rate and the EMBI spread reveals that variations in the Selic rate do not temporally precede variations in *the* EMBI spread and variations in the EMBI spread do not temporally precede variations in the Selic rate. Thus, it is not possible to say that improvements in the external assessment of the Brazilian economy are obtained by monetary policy or that the Selic interest rate is high because the country is risky or because it has not yet reached the credibility of monetary policy.

Finally, there is a two-causal relationship between the EMBI spread and the net public debt/GDP ratio, at a statistical significance level of 1%. The one-way Granger's causal relationship between the EMBI spread and the debt/GDP ratio indicates that country risk is important to understand the variations in the degree of public indebtedness because that this variable has on the external evaluation of the Brazilian economy and on the availability of resources to be allocated to the purchase of domestic and foreign government bonds. Thus, positive external evaluations of the country can contribute to the stabilization of the debt-to-GDP ratio because there is a high probability that the history of the EMBI spread will affect the trajectory of the debt-to-GDP ratio. This result is related to the study by Reinhart and Rogoff (2004) who, when analyzing historical data on the incidence of *default* on external public debt for countries in Europe and Latin America, including Brazil, found that the main explanation for Lucas' paradox (1990) lies in the fact that countries that have not paid their debts have relative temporal difficulty in obtaining loans from the rest of the world. The default history reflected in the EMBI Granger-causes the debt-to-GDP ratio.

However, the one-way Granger's causal relationship between the debt/GDP ratio and the EMBI spread shows that the degree of public indebtedness affects the external assessment of the Brazilian economy.

Thus, according to Granger's causality tests treated, there are no elements that demonstrate the presence of fiscal dominance in Brazil in the period in question. There are, however, elements that point to the presence of a regime of monetary dominance, according to the definition proposed by Sargent and Wallace (1981).

REFERENCES

Aguiar, M. (2007). Dominância fiscal e a regra de reação fiscal, uma análise empírica para o Brasil [Unpublished master's thesis]. Universidade de São Paulo.

Blanchard, O. (2004). Fiscal dominance and inflation targeting: Lesson from Brazil (NBER Working Paper No. 10389). National Bureau of Economic Research. https://www.nber.org/papers/w10389

Campbell, J. Y., & Perron, P. (1991). Pitfalls and opportunities: What macroeconomists should know about unit roots. In O. J. Blanchard & S. Fischer (Eds.), NBER macroeconomics annual 1991 (Vol. 6, pp. 141–201). MIT Press.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. Journal of the American Statistical Association, 74(366), 427–431. https://doi.org/10.1080/01621459.1979.10482531

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for Ascorbic acid autoregressive time series with a unit root. Econometrica, 49(4), 1057–1070. https://doi.org/10.2307/eb007042

Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. Econometrica, 55(2), 251–276. https://doi.org/10.2307/1913236

Elliott, G., Rothenberg, T. J., & Stock, J. H. (1996). Efficient tests for an autoregressive unit root. Econometrica, 64(4), 813–836. https://doi.org/10.2307/2171846

Gadelha, S., & Divino, J. (2008). Dominância fiscal ou dominância monetária no Brasil? Uma análise de causalidade. Economia Aplicada, 12(4), 659–675. https://doi.org/10.1590/S1413-80502008000400006

Granger, C. W. J. (1969). Investigating causal relations by econometric models and cross-spectral methods. Econometrica, 37(3), 424–438. https://doi.org/10.2307/1912791

Gujarati, D. N., & Porter, D. (2011). Econometria básica (5th ed.). McGraw Hill Brasil.

Hill, R. C., Griffiths, W. E., & Judge, G. G. (1999). Econometria. Saraiva.

Investing. (2022). Indicadores econômicos e de mercado. https://br.investing.com/

Ipeadata. (2022). Dados macroeconômicos. http://www.ipeadata.gov.br/Default.aspx

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. Econometrica, 59(6), 1551–1580. https://doi.org/10.2307/2938278

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with applications to the demand for money. Oxford Bulletin of Economics and Statistics, 52(2), 169–210. https://doi hearing: System: * Today's date and time is 09:15 PM -03 on Wednesday, July 16, 2025.