The Nonlinearity of Brazilian Monetary Policy in the Inflation-Targeting Period: an Analysis based on an MS-VAR Model

Não Linearidade da Política Monetária Brasileira no Período de Metas de Inflação: uma Análise com Base em um Modelo MS-VAR

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Resumo: This article theoretically and empirically analyzes the hypothesis of the nonlinearity of Brazilian monetary policy following the implementation of inflation-targeting regime. At the theoretical level, it discusses growth and macroeconomic regimes and their effect over Brazilian economy according to the behavior of a number of variables. Empirically, it tests the hypothesis of the nonlinearity of monetary policy in Brazil, estimating a Markov-switching vector autoregressive (MS-VAR) model. The results identify two different monetary regimes: the first regime, which primarily occurred between 2000 and 2007, and the second regime, which primarily occurred between 2007 and 2013. In the case of the second regime, a contractionary monetary policy had more persistent effects on both the public debt and the exchange rate.

Palavras-chave: Nonlinearity. Inflation targeting. Brazilian economy.

Abstract: Este artigo analisa, teórica e empiricamente, a hipótese da não linearidade da política monetária brasileira após a implementação do regime de metas de inflação. No plano teórico, discute o crescimento e os regimes de macroeconômicos e o seu efeito sobre a economia brasileira de acordo com o comportamento de um número de variáveis. Empiricamente, ele testa a hipótese da não linearidade da política monetária no Brasil, estimando-se um vetor autorregressivo com o modelo de correntes markovianas (MS-VAR). Os resultados identificam dois regimes monetários diferentes: o primeiro regime, que ocorreu principalmente entre 2000 e 2007, e o segundo regime, que ocorreu principalmente entre 2007 e 2013. No caso do segundo regime, uma política monetária contracionista teve efeitos mais persistentes tanto sobre a dívida pública como sobre a taxa de câmbio.

Keywords: Não linearidade. Metas de Inflação. Economia Brasileira.

JEL Classification: C14; E12; E42.

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1 Introdução

In economic theory there is a convention to work with linear models because they imply the existence of a unique equilibrium that generates well defined results in terms of a cause-and-effect relationship. Models with multiple equilibria are an alternative to this trend because they are based on the existence of nonlinear functional relationships, enabling results that are not uniquely defined by a cause-and--effect relationship.

Several authors have performed empirical work with the hypothesis of nonlinearity in economic models, including Hamilton (1989), Krolzig (1996, 1997a, 1998, 2003a and 2003b), Sims and Zha (2004 and 2006), Kim and Nelson (1999) and Ehrmann, Ellison and Valla (2003). With respect to monetary policy nonlinearity in Brazil, Silva Filho (2006), Silva Filho, Costa Silva and Frascaroli (2006) and Tomazzia and Meurer (2010) have found evidence that the effects of Brazilian monetary policy on economic variables do not occur in a linear fashion.

The aim of this article is to identify the possibility of nonlinearity in Brazilian monetary policy following the implementation of Inflation Targeting (IT). This identification is important because it allows a broader notion of the effects of higher interest rates over different macroeconomic variables in Brazil, along with analyzing the characteristics and trends in recent monetary policy. Considering the studies that have already been conducted in Brazil, this work's contribution is to test the hypothesis of monetary policy nonlinearity in more recent times , mainly after the implementation of IT with the aim of defining whether monetary policy had non--linear effects over inflation, fiscal variables, exchange rates and real output from 1999 to 2013. The identification of non-linearity in monetary policy is important because it implies in the occurrence of a regime switching in Brazil during this period.

In order to do that, the article starts with a discussion about growth and monetary policy regimes with the aim to establish the existence of two different monetary regimes in Brazil under IT. Thereafter, data on selected macroeconomic variables are presented and their behavior within the monetary regimes studied. The hypothesis of the nonlinearity of Brazilian monetary policy is tested using Markov--switching vector autoregressive (MS-VAR) models. A brief summary of the main results obtained is presented as the conclusion.

2 Growth and Macroeconomic Policy Regimes

A *macroeconomic policy regime* is defined as a set of objectives, goals and instruments of macroeconomic policy along with the institutional framework in which these policies are implemented. A *growth regime* is defined as the relationship between growth, aggregate demand and income distribution with a focus on the

autonomous demand component that acts as the engine of long-term growth. The interaction between macroeconomic policy regime and growth regime is of fundamental importance for the long-term sustainability of the growth path for real output.

This approach is widely used by authors who consider aggregate demand expansion fundamental to economic growth, whether through consumption, investment or positive net export balance.

Studies by Bowles and Boyer (1995), Uemura (2000), Palley (2002), Stockhammer and Onaran (2004), Naastepad and Storm (2006), Hein and Vogel (2008) and Stockhammer, Onaran and Ederer (2009) conduct an empirical investigation of the relationship between aggregate demand, distribution and growth. In addition, they have confirmed the existence of two basic growth regimes: i) *wage-led*, which is the growth regime in which aggregate demand expansion is led by consumption and induced by an increase in wage-share; and ii) *profit-led,* which is the growth regime wherein aggregate demand expansion is led by investment and/or exports and induced by increased profit margins and/or the profit-share. In both cases, economic growth is eminently *demand-led*, i.e., economic growth is driven by aggregate demand expansion.

According to Oreiro (2012), for countries that do not have convertible currency, only a growth-led export regime will be sustainable in the long term. This is because on the one hand, investment is a variable that responds to changes in output level and/or growth rate and therefore cannot lead growth; on the other hand, expansion of government spending and/or of consumption generates an increase in the current account deficit and/or an increase in families´ level of indebtedness, which makes economic growth unsustainable over the long term. Moreover, a wage-led growth regime where consumption demand is stimulated by means of income distribution form profit earners to wage earners by means of a trend increase in wage share is unsustainable in the long-run since it results in a reduction of profit rate and over the incentives to investment. The long-term consequence of such growth regime is a profit squeeze and a capital accumulation crisis.

In this context, a long-term sustainable growth regime is not only *profit-led* but *export-led*, i.e., it is a regime in which growth is driven by exports, thereby allowing expansion of the actual output rate, which generates an increase in labor productivity. This macroeconomic accumulation regime originated with the work of Kaldor (1966, 1981 and 1988) and Thirlwall (1983 and 2002). To sum up, these studies show that economies with low economic dynamism in the external sector have low levels of economic growth, stagnant aggregate demand and deindustrialization[1], as Oreiro (2012) describes.

1 The "classic" concept of deindustrialization was coined by Rowthorn and Ramaswany (1999) and is characterized as a persistent reduction in the proportion of industrial employment in total em-

Araújo and Gala (2012) have conducted a study on the nature of the prevailing growth regime in Brazil that has resulted in evidence that the Brazilian growth pattern is of the *wage-led* type and therefore, aggregate demand responds positively to an increase in the proportion of wages to income. However, when those authors consider the external sector of the Brazilian economy, the accumulation pattern becomes profit-based, i.e., it is a profit-led system. These results are important because in light of this information, economic policies directed to either regime may be formulated to accelerate investment and increase the rate of economic growth. Oreiro, Abramo and Lima (2013) have estimated a post-Keynesian macro-dynamic accumulation model that aims to determine which accumulation regimes existed in Brazil between 1995 and 2008. They have found that in the periods 1995-1998 and 2007-2008 the accumulation regime was *wage-led* and that in the 1998-2007 period it was *profit-led*.

Oreiro (2011, 2015) also emphasizes, with respect to macroeconomic policy regimes, that between 2000 and 2006 a system called the *Flexible Tripod* prevailed in Brazil with the objectives, goals and instruments described in Table I below:

Table 1 - Description of the *flexible* tripod macroeconomic regime

Type of Policy	Objectives or Goals	Targets	Instruments
Monetary	Inflation rate stability both in the long and the short terms.	Constant inflation targets	Short-term interest rate (SELIC).
Exchange	Monetary policy autonomy. Stability of the real exchange rate.	None	Purchase of international reserves on a large scale.
Fiscal	Public debt as a low and stable proportion of GDP in the medium and long terms. Increased public investment.	Reduction in primary surplus target	Increased tax burden. Increase in primary expenditure as a proportion of GDP. Stability of the primary surplus as a proportion of GDP.

Source: Authors´ own elaboration based in Oreiro (2011).

In the post-2007 period, a change in macroeconomic policy regime can be observed. Oreiro (2011, 2015) named this regime as *Inconsistent Developmentalism* because its goals and objectives are not consistent in Tinbergen's sense of the term,

ployment in a country or even a region. However, Tregenna (2008) has redefined the term deindustrialization to add the term "classic," which incorporates a drop in the industry's added value as a proportion of GDP. For details, see Oreiro and Feijó (2010).

i.e., the goals and objectives cannot be obtained simultaneously. In Oreiro's view, this inconsistency was mainly due to the simultaneous adoption of a wage-led growth regime by Brazilian policy-makers, which turn growth pattern unsustainable in the long-term. . The characteristics of this macroeconomic policy regime are described in Table 2.

Table 2 - Description of an *inconsistent developmentalism* macroeconomic regime

Type of Policy	Objectives or Goals	Targets	Instruments
Monetary	Inflation rate stability in the long term. (Sustainable?) Robust growth (?) of actual output.	Constant inflation targets but with extensions of the convergence period.	Short-term interest rate (SELIC). Macroprudential measures.
Exchange	Monetary policy autonomy. Stability of the real exchange rate	None	Large scale accumulation of international reserves. Control of capital inflow.
Fiscal	Public debt as a stable proportion of GDP in the medium and long term. Increased public investment Increase in domestic aggregate demand.	Primary surplus target approximately 2.5% of GDP.	Increased tax burden. Increase in primary expenditure as a proportion of GDP. Reduction of primary surplus as a proportion of GDP.
Wage	Increase in wage share	Not defined	Minimum wage growth according to last year inflation and growth rate of real GDP at year t-2.

Source: Authors´ own elaboration based in Oreiro (2011, 2015).

The unsustainability of the growth pattern associated with *Inconsistent Developmentalism* is clear from the inspection of the most recent data, which cover the period 2007-2013. Indeed, strong growth in 2007, 2008 and 2010 is observed; however, from 2011 onwards, strong growth reduction signals are present, as seen in Table 3.

Table 3 - Evolution of the Brazilian economy during the inflation-targeting regime

Key Indicators	1999	2000	2001	2002	2003	2004	2005	2006
Selic (%)[1]	19	15.75	19.00	25.00	16.50	17.75	18.00	13.25
IPCA variation (%)	8.9	5.97	7.67	12.53	9.30	7.60	5.69	3.14
Real GDP variation (%)[2]	0.3	4.3	1.3	2.7	1.2	5.7	3.2	4.0
Primary surplus (% GDP)	3.2	3.6	3.7	4.1	4.3	4.6	4.8	4.3
Net public sector debt (DLSP) (% GDP)[1]	48.7	48.8	52.0	60.4	54.8	50.6	48.4	47.3
Nominal exchange rate (R$/US$)[1]	1.80	1.95	2.31	3.53	2.88	2.65	2.34	2.13
Trade balance (US$ billions)	-1.2	-0.7	2.7	13.1	24.8	33.6	44.7	46.5
Key Indicators		**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Selic (%)[1]		11.25	13.75	8.75	10.75	11.50	7.25	10.00
IPCA variation (%)		4.46	5.90	4.31	5.91	6.50	5.84	5.91
Real GDP variation (%)[2]		6.1	5.2	-0.3	7.5	2.7	0.9	2.4
Primary surplus (% GDP)		4.0	4.1	2.1	2.8	3.1	2.4	2.1[3]
DLSP (% GDP)[1]		45.5	38.5	42.1	39.2	36.4	35.2	33.9[3]
Nominal exchange rate (R$/US$)[1]		1.77	2.33	1.74	1.66	1.87	2.04	2.34
Trade balance (US$ billions)		40.0	24.8	25.3	20.1	29.8	19.4	25.6

Source: Authors´ own elaboration.
Notes: [1] Period end; [2] New series of quarterly national accounts, according to the methodology adopted in 2006 by the Brazilian Institute of Geography and Statistics (IBGE); [3] Up to November 2013; [4] Up to the third quarter of 2013. Source: IPEADATA (primary surplus, net public debt [DLSP], trade balance, nominal exchange rate, EMBI Brazil and Foreign Exchange Reserves); IBGE (GDP and broad consumer price index [IPCA]); Central Bank of Brazil (Selic); and IMF (International Monetary Fund) (current account).

The behavior of the Selic interest rate, which peaked in 2002 (25% per year), exhibited a downward trend between 2003 and 2013. The broad consumer price index (IPCA) showed stable behavior starting in 2005, always remaining within the targets set by the Monetary Policy Committee (COPOM). The exchange rate showed strong depreciation until 2002 and then appreciated until 2007 before returning to a depreciation trajectory following the global crisis of 2008.

Keeping in mind these considerations about Brazil's growth and macroeconomic regimes and our macroeconomic data analysis of the Brazilian economy, the next section assesses whether monetary policy in Brazil has nonlinear effects on some economic variables, particularly public debt, industrial production, inflation and the exchange rate. For this purpose, estimating vector autoregressive models with Markovian regime changes is useful.

3 An Empirical Analysis of Markov Switching Autoregressive Vectors

Internationally, the hypothesis of economic variable nonlinearity has been tested by several authors. Hamilton (1989) is a pioneer in analyzing business cycles in the United States. The work of Krolzig (1996, 1997a, 1997b, 1998, 2000 and 2003) has provided an impetus to spread these models among macroeconomic research and has served as a reference in many empirical studies. In addition, Sims and Zha (2004 and 2006), Kim and Nelson (1999) and Ehrmann, Ellison and Valla (2003) have used Markovian chains to analyze various macroeconomic aspects, mixing Markovian chains with vector autoregression (MS-VAR), as in this study.

With respect to Brazil and its monetary policy nonlinearity, Silva Filho (2006), Silva Filho, Costa Silva and Frascaroli (2006) and Tomazzia and Meurer (2010) have analyzed the nonlinear aspects of Brazilian monetary policy. Taking different approaches, these authors have found evidence that the effects of Brazilian monetary policy on economic variables are not linear and that the models estimated using MS-VAR better fit and are more coherent than those estimated in studies using only vector autoregressive (VAR) models.

The work of da Silva Filho, da Costa Silva and Frascaroli (2006), who have analyzed the period from 1980 to 2005, is marked by two distinct phases: the first phase is called pre-Real Plan and describes a period during which the interest rate had no effect on price levels; the second phase is called post-Real Plan and describes a period during which the government was able to use interest rates as a monetary policy instrument with an effect on price levels. Tomazzia and Meurer's (2010) work has presented three major structural changes: the first between 1995 and 1998; the second from 1999 to 2003; and the third from 2003 onwards. The effects of increased interest rates on output and price increased during the period of transitioning from one regime to another. This means that between 1995 and 1998, monetary policy (via interest rates) had little impact on output and inflation; however, because of the regime change, over time the interest rate began to impact these variables - particularly output - more markedly.

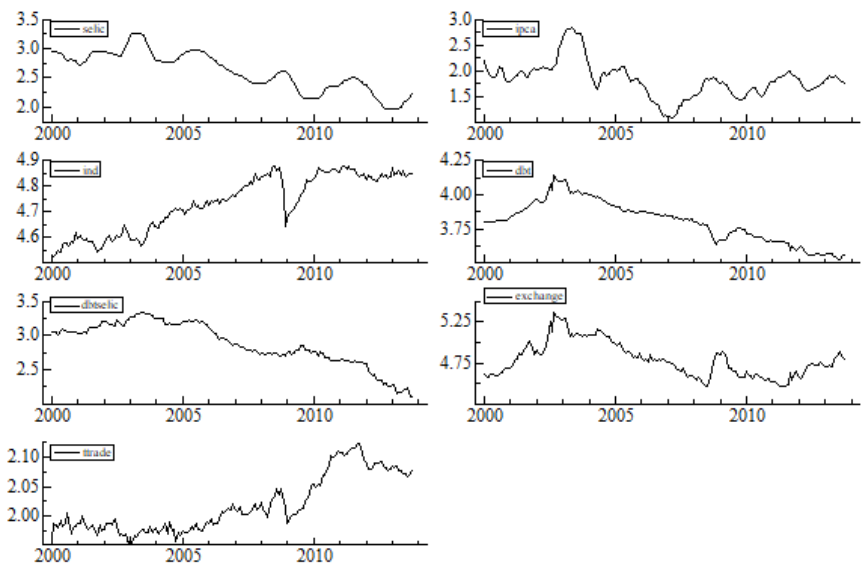
Keeping in mind the studies already conducted in Brazil, this work's contribution is to test the hypothesis of monetary policy nonlinearity for a more recent period, marked only by the inflation-targeting regime, with the aim of establishing

whether the effects of monetary policy had a different effect on inflation, fiscal variables, exchange rates and economic performance in terms of economic activity after the 1999 adoption of that regime.

To answer this question, the data used in our model consist of monthly time series for the Brazilian economy from January 2000 to October 2013, for 164 observations overall. Seven endogenous variables are used: the annualized Selic interest rate (selic); inflation (ipca), measured by the monthly broad consumer price index accumulated over twelve months (IPCA); the industrial production index (ind), monthly and seasonally adjusted; the percentage of net public sector debt in proportion to GDP (dbt); the percentage of debt indexed to Selic (dbtselic); the nominal R$/US$ exchange rate index (exchange); and an index that measures the trade terms of the Brazilian economy (ttrade). All of the variables are expressed in natural logarithm because they take the form of indices accumulated over 12 months.

The data were extracted from the online database of the Applied Economic Research Institute (IPEADATA), the Central Bank of Brazil time series database and the Brazilian Institute of Geography and Statistics (IBGE). Each variable's behavior can be observed in Figure 1.

Figure 1 - Behavior of the selected variables over time



Source: Authors´ own elaboration based in OxMetrics 7.2.

3.1 The MS-VAR Model

For the empirical analysis of monetary policy nonlinearity, an unrestricted MS-VAR model was estimated with intercept, variance and parameters varying according to the regime. Thus, using the nomenclature developed by Krolzig (1997a), an MSIAH(2)-VAR(2) was estimated wherein the number of possible regimes, m, was set as two (2) and the optimal lag p was chosen according to the estimated criteria of the VAR model, which is equal to 2 (two).

The explanation of why the number of regimes was fixed at 2 is that under the RMI, Brazil had only two types of monetary policy: one upward, represented by increases in interest rates; and the other downward, in the opposite direction.

With respect to the linearity test (LR test) in Table 4, it can be seen that the model in question is nonlinear with a significance level of 1% and that the parameters change significantly between regimes, thus justifying the use of MS-VAR.

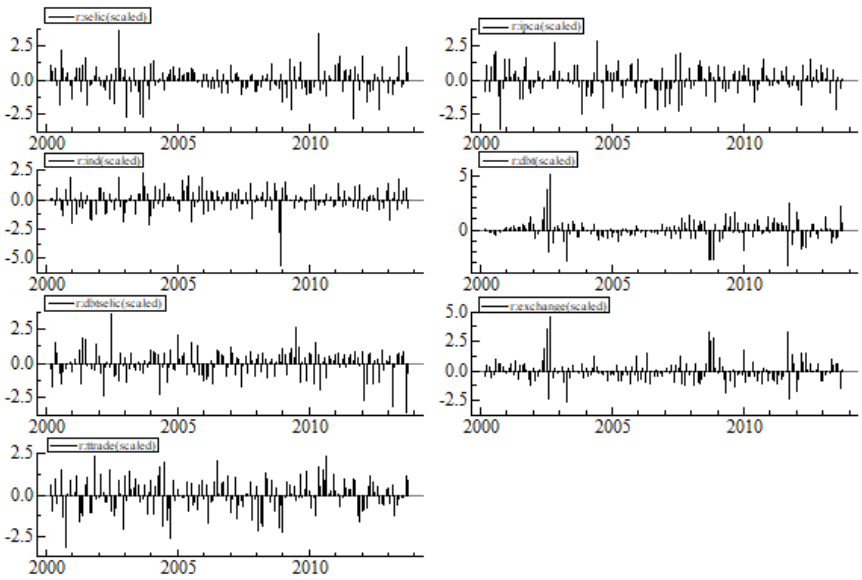
Table 4 - LR linearity test

H_0 - The model is linear		
LR linearity test	7,785.1	[0.0000]*

Source: Authors´ own elaboration.

The MS-VAR residuals are shown in Figure 2.

Figure 2 - MS-VAR residuals

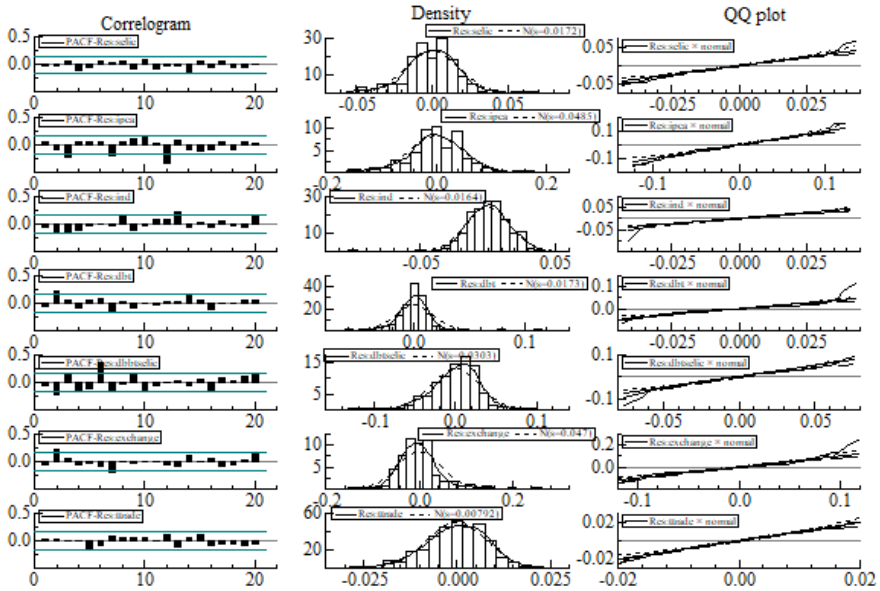


Source: Authors´ own elaboration based in OxMetrics 7.2..

It can be seen that the residuals behaved well and tended toward a normal distribution. The normality test of the residuals was significant at 1%.

To complete the analysis, the correlogram, density and QQ-Plot of the residuals were plotted and are shown in Figure 3.

Figure 3 - Correlogram, density and QQ-Plot of standard residuals in MS-VAR



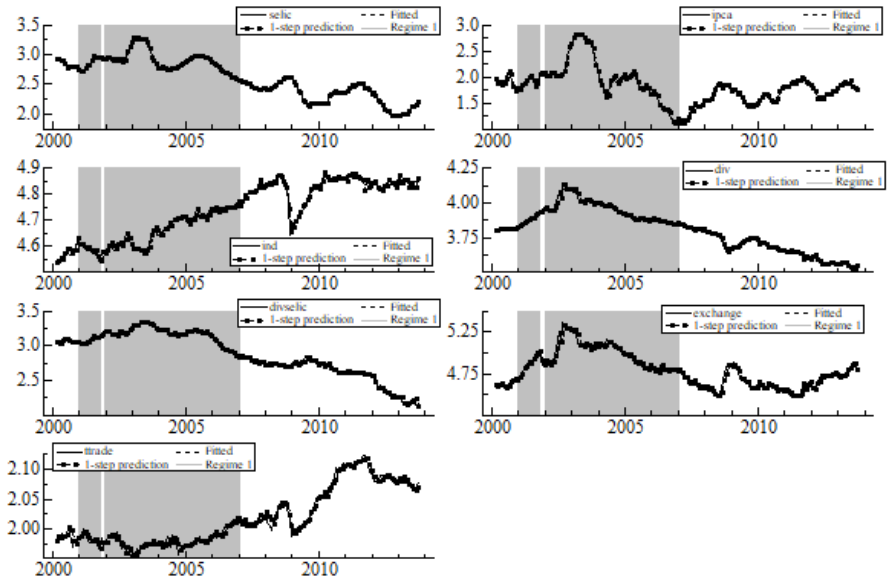
Source: Authors´ own elaboration based in OxMetrics 7.2.

The residuals are poorly correlated and their distribution tends to be normal, except for the ind variable, which has a residual distribution with an elongated tail to the left; however, that does not significantly compromise the estimated model. The QQ-Plot tool is relatively simple but very powerful when the objective is to analyze the distribution of residuals compared to a normal distribution (CLEVELAND, 1985).

It can therefore be assumed that the estimated model residuals have well-behaved distributions close to a normal distribution (on average), which leads to the conclusion that using non-stationary series as endogenous variables in the did not compromise the estimation of the results.

The convergence of the expectation-maximization (EM) algorithm occurred after 39 interactions, with a probability of change of 0.0001. Figure 4 shows the model fit in each estimated regime.

Figure 4 - Model fit for regimes



Source: Authors´ own elaboration based in OxMetrics 7.2.

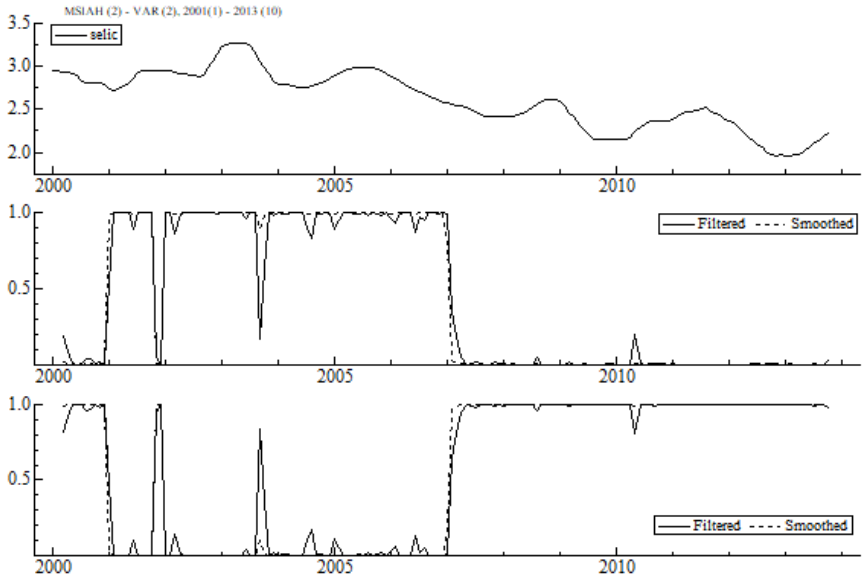
The MS(2)-VAR (2) estimated in this study for the period January 2000 to October 2013 displayed the following regime transition matrix:

$$\hat{T} = \begin{bmatrix} 0.96467 & 0.019852 \\ 0.035331 & 0.98015 \end{bmatrix} \quad (1)$$

It can be seen from matrix $\hat{T}$ that the regimes estimated in the model are persistent, that is, once monetary policy remains in one of the regimes, the probability of it continuing to remain in this same regime is high because according to matrix , when in the first regime, the probability of moving to the second regime is only 3.5%, whereas the probability of remaining in the same regime is 96.46%. The same phenomenon occurs in the second regime: when in that regime, the probability of change is only 1.98%, whereas the chance of remaining is 98%.

In this case, therefore, an impulse-response function that depends on the regime is a good analytical tool. Figure 5 illustrates the behavior of the Selic interest rate and the estimated probabilities of the two regimes.

Figure 5 - Selic interest rate (selic) and the filtered and smoothed probabilities



Source: Authors´ own elaboration based in OxMetrics 7.2.

Figure 5 shows that according to the estimated probabilities the two regimes can be classified in time, resulting in Table 5.

Table 5 - Estimated regime classification

Regime 1	**Regime 2**
01/2001 - 10/2001 (0.998) 01/2002 - 01/2007 (0.995)	03/2000 - 12/2000 (0.998) 11/2001 - 12/2001 (0.999) 02/2007 - 10/2013 (0.999)
Total: 71 months Represents 43.29% of the estimated period with a median duration of 35 months.	Total: 93 months Represents 56.71% of the estimated period with a median duration of 31 months.

Source: Authors´ own elaboration.
Note: Probability in parentheses.

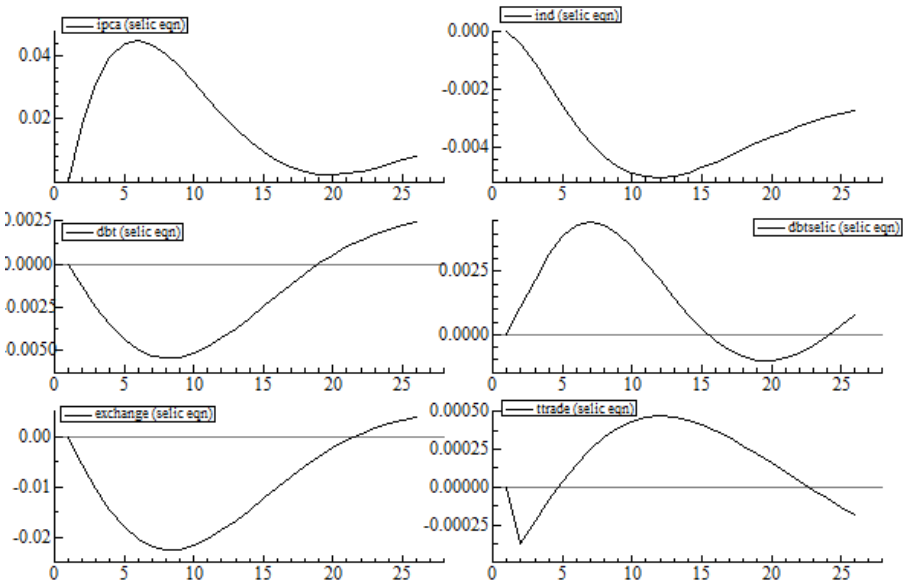
Regime 2 is more persistent but is not the predominant regime: it was in place for 93 months of the reporting period with a mean duration of 31 months. Regime 1 is less persistent, having been in place for 71 months of the reporting period with a mean duration of 35 months.

Thus, impulse response functions are typically constructed to analyze each of the differences between the estimated models in greater depth along with the regime difference within the MS-VAR model. This function is important in time--series analysis because it summarizes the estimated autoregressive parameter information and estimated variances and covariances, making the interpretation of changes between parameters more evident and easily observed. Impulse response functions will therefore be analyzed in more depth and their results discussed in the next subsection.

3.2 Results

Based on the results obtained, this part of the study will focus on analyzing impulse response functions (IRFs). The MS-VAR model has two distinct functions: the first IRF is the result of an estimate that depends on Regime 1, whereas the second IRF depends on Regime 2. These functions are represented by Figures 6 and 7, respectively.

Figure 6 - Impulse-response function dependent on Regime 1 (shock of one percentage point in the Selic)



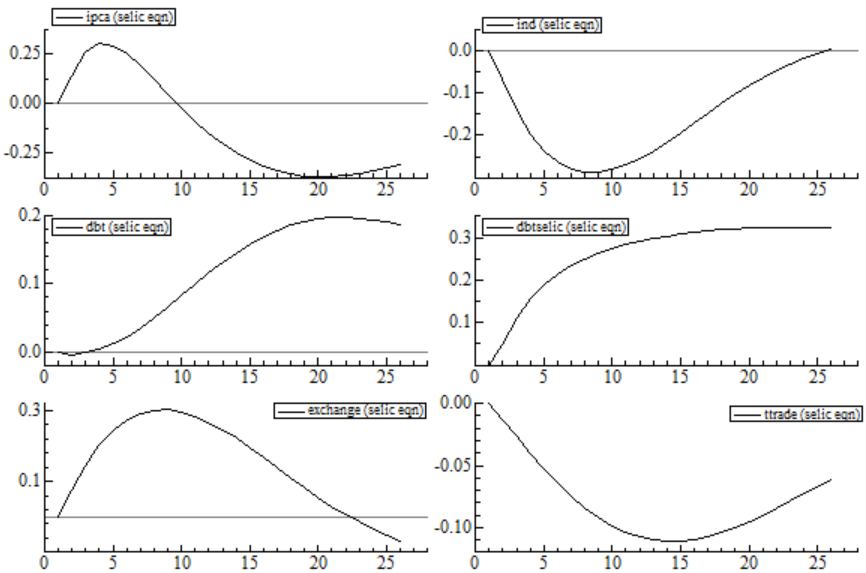
Source: Authors´ own elaboration based in OxMetrics 7.2.

In the IRF dependent on Regime 1, a shock in interest rates first has a positive impact on the IPCA and it is only after 12 periods that the interest rate begins to show the expected effects in terms of inflation reduction. It is evident that the

inflationary response to an increase in the Selic represents a typical price puzzle situation, as noted by Walsh (2003) and found by other studies on the Brazilian economy (for example, Modenesi and Araújo (2013)). A positive shock in the Selic causes a negative result in industrial production: a valley occurs over four periods, after which there is a recovery and return to the previous level within approximately 15 months. With respect to the effects on securities debt, this variable shows an initial stability as a function of an increase in interest rates; later, it increases after 10 periods. With respect to the securities debt indexed to Selic, it is observed that an increase in interest rate causes a greater increase in this part of the debt compared to total securities debt. This effect dissipates after 13 periods. With respect to the exchange rate and trade terms, the effects are of a currency appreciation and a reduction in trade terms, with the former variable more affected than the latter.

Figure 7 summarizes the effects of the IRF that depends on Regime 2.

Figure 7 - Impulse-response function dependent on Regime 2 (shock of one percentage point in the Selic)



Source: Authors´ own elaboration based in OxMetrics 7.2.

Analyzing the impact of interest rates on the other system variables, in Regime 2, we see that the impact of Selic on IPCA is very similar to the impact in Regime 1; however, it is initially dispersed with an increase in the first 10 months and only after this period does it negatively responds to higher interest rates. The shock on the proxy for economic activity has very similar behavior to that obtained in the previous model.

That notwithstanding, the results of an increase in the Selic interest rate on debt and the exchange rate are quite different. Debt initially suffers a small negative shock and then grows significantly, stabilizing at a high level, thus showing that the effect of an increase in interest rates results in persistent increases in public debt. The same applies to the debt indexed to the Selic: the effect of an increase in the Selic is even more persistent than in the previous case. The exchange rate undergoes a relatively large increase during the first periods and then tends to appreciation. This indicates that just as in the case of public debt, the effects do not dissipate after two periods and therefore an increase in interest rates has more lasting effects for public debt and the exchange rate. Trade terms are also more affected by an interest rate increase in Regime 2 than in Regime 1.

Some conclusions about the conduct of monetary policy can be drawn from these results, which reflect two distinct regimes: the first before 2007; and the second after 2007. In the case of Regime 2, a policy of increasing interest rates has more persistent effects on public debt and the exchange rate.

4 Final Considerations

This article investigates the existence of nonlinearity in Brazilian monetary policy in the post-RMI period using the MS-VAR model methodology.

Two monetary regimes were identified: the first regime, which primarily occurred between 2000 and 2007 with brief breaks for the second regime; and the second regime, which primarily occurred between 2007 and 2013. The first regime has characteristics similar to the *Flexible Tripod* discussed by Oreiro (2011, 2015), whereas the second has characteristics similar to *Inconsistent Developmentalism*. The identification of two different monetary regimes is important for the discussion of sustainability of growth regime. Indeed, the so-called *Inconsistent Developmentalism* is connected, according to Oreiro (2012, 2015), to a *wage-led growth regime*, which is not sustainable in the long run due to the effect of an increasing wage-share over profit rate and thus over incentives to investment. This means that a regime switching towards *Inconsistent Developmentalism* will sooner or later result in a profit squeeze, as it looks like to have occurred in Brazil after 2012 (ROCCA, 2015).

This regime switching shows strong evidence of a nonlinear monetary policy followed by a high persistence of the estimated regimes: that is, once one regime is established, the likelihood of change to another regime is very low. In both regimes, the response of inflation to an increase in interest rates is an increase in the initial periods followed by a reduction after 10 periods[2] although the magnitude of

2 Stylized fact, known as the price puzzle in economic literature. See Sims (1992).

the effect is significantly higher in Regime 1. In addition, economic activity (ind) shows a more persistent drop in Regime 2 than in Regime 1. In the first regime, both debt and the exchange rate respond negatively during the first periods and then converge to the origin of the shocks. In the second regime, the effect of the shocks on both debt and the exchange rate are positive and demonstrate some persistence.

Since its implementation, the characteristics of the IT have experienced numerous adjustments and monetary policy has experienced changes. Interest rates have impacted the economy in different ways during the period studied. In Regime 1, the initial effects had a smaller amplitude and duration. In Regime 2, the effects were longer and more persistent, indicating that monetary policy had a much more significant impact on this regime than on the first regime.

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