

## Inflation targeting regime and the global financial cycle: An assessment for the Brazilian economy

ELISANGELA LUZIA ARAÚJO, ELIANE CRISTINA DE ARAÚJO,  
MATEUS RAMALHO DA FONSECA and PEDRO PERFEITO DA SILVA

### Abstract:

In light of the global financial cycle (GFC), this paper investigates the effectiveness of monetary policy in Brazil since the adoption of the inflation targeting regime. The theoretical section analyses monetary policy from the New Macroeconomic Consensus perspective, emphasizing the implications of the GFC. It also contrasts central bank theory with the post-Keynesian critique. For the empirical investigation, a Markov-switching vector autoregressive model is estimated from January 2000 to December 2017, combining the common variables from the empirical literature with the proxy for the GFC. The main results suggest that greater financial instability has a direct effect on domestic inflation.

Araujo, Araújo, State University of Maringá,  
email: elisangela15.araujo@gmail.com,  
elianedearaujo@gmail.com;  
Ramalho: Faculty of Maringá,  
email: mateusramalho88@hotmail.com;  
Perfeito: Central European University,  
email: perfeito\_pedro@phd.ceu.edu

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The crisis of the Bretton Woods System (BWS) in the early 1970s led to substantial changes in the International Monetary and Financial System (IMFS). This had important implications for domestic macroeconomic policymaking, especially for developing countries. Externally, the new context recommended that countries pursue the liberalization of economic relations, both in trade and financial relations, taking advantage of capital inflows and government policies on international trade (Mishkin, 2005; Kose et al., 2009). Internally, the recommendation was to control inflation, which, driven by clear rules, would boost the confidence of the private sector – the real protagonist of the growth process (Fischer, 1998).

Due to those changes, and in the face of the collapse of the developmental state in the early 1980s, Brazil engaged in economic globalization according to a strategy of subordinate integration. Thus, in its relations with the rest of the world, a pragmatic but progressive



process of trade and financial liberalization was instituted, while, internally, the scope of state intervention was reduced in order to continue with a national development trajectory that prioritized price level stabilization. This growth strategy, through the enactment of the Real Plan in 1994, made it possible to overcome hyperinflation. But its focus on external savings, together with the semi-fixed exchange rate regime implemented between 1994 and 1998, created new forms of instability. To address this instability, which culminated in the financial crisis of 1999, macroeconomic policy was modified to institute the so-called macroeconomic “tripod”: a floating exchange rate, a primary surplus target, and inflation targeting – to be fulfilled by means of a principal instrument, the manipulation of the basic interest rate.<sup>1</sup>

Several studies, including Sicsú (2002), Mendonça (2004, 2005, 2007), Minella et al. (2003), Squeff (2009), Ferreira and Jayme Jr. (2005), Dezordi et al. (2009), Mendonça et al. (2009), and Fonseca et al. (2018a), have addressed the conduct of Brazilian monetary policy over the almost two decades of the inflation targeting regime (ITR), critically evaluating it and questioning the effectiveness of the interest rate for price stability. Despite their contributions, those studies did not investigate the influence of the global financial cycle on the consequences of monetary policy, a gap that this research aims to fill.

To achieve that aim, this paper evaluates the relationship between the basic interest rate and prices in Brazil from January 2000 to December 2017, using a Markov-switching vector autoregressive (MS-VAR) model. The potentially original contribution of this research lies in the incorporation of the global financial cycle as a conditioning factor of the domestic monetary policy. It assumes that the global financial cycle decisively interferes with the conduct of domestic monetary policy and that the effects of financial instability are further aggravated by the rigid, or non-discretionary, conduct of the ITR. Specifically, the global financial cycle affects the outcomes of the monetary policy regime through the channels of the exchange rate and the formation of private investors’ expectations. Our main results suggest that financial instability has a direct effect on the rise of domestic inflation. Therefore, a review of central bank practices is fundamental in this context.

## 1. The international and Brazilian experience regarding the ITR

According to the New Classical School, the fact that economic agents anticipate the decision of policymakers implies that it is not possible to conduct monetary policy in a discretionary manner. As a result, several models emerge in an attempt to outline the optimal conduct for central banks. Emphasis is put on the independent central bank and inflation targeting models, which are based on the credibility-reputation-delegation triad.<sup>2</sup>

The independence of a central bank consists in delegating the conduct of monetary policy to an independent agent to control inflation, thereby maintaining the credibility of the monetary policy and the reputation of the monetary authority. Inflation targeting can be defined as a strategy for monetary policy, based on the announcement of a medium-term inflation target. In other words, there is an anchoring via agents’ expectations about future inflation, so the transparency of monetary policy, which must communicate to the public its plans, objectives, and decisions, plays a fundamental role.

<sup>1</sup> Such an economic policy strategy is based on the so-called New Macroeconomic Consensus. For more information, see Arestis and Sawyer (2008).

<sup>2</sup> For the New Classical School, see Lucas (1972), Lucas and Sargent (1981), and Lucas (1983).

In addition, there is the institutional commitment from the monetary authority to price stability, a commitment to which other objectives are subordinated. This means that the independence of the central bank is a desirable aspect for the New Classical School of thought. The use of available information from many variables is the basis for adjusting the monetary policy instrument – the short-term interest rate – whose level allows inflation to be brought to the center of the target range: it is raised whenever inflation or the economy's potential GDP is close to the inflation target.

In practice, 27 countries have adopted the ITR. Table 1 summarizes the key features of the ITR in each of those countries, including the objective, the time horizon expected to return inflation to target, the inflation type and measure, and which authority sets the target.

The most prominent feature in table 1 is the considerable diversity in the central banks' legal mandates. Not all central banks adopting the ITR set price stability as the main objective of monetary policy. They also consider other goals, such as economic growth, welfare, low unemployment and financial stability.

Regarding central bank independence in terms of autonomy for setting the monetary policy objective, Hammond (2012) points out that, as the monetary policy objective of price stability is generally established by law, the independence of such objective, as suggested by Rogoff (1985), becomes a second order issue when defining ITRs.<sup>3</sup> However, it should be noted that the central banks of countries adopting the ITR have operational independence. That is, as monetary policy managers they are free to choose the instruments needed to reach the established inflation target. In theoretical terms, as Walsh (1995) suggests, the independence of the central bank can be understood in terms of the independence of its economic policy instruments.

Table 1 – Key features of an ITR

Country and date IT adopted	Legal mandate	Target horizon	CB operational independence	Target type and measure	Target set by
Armenia, Jan. 1996	Price stability	Medium term	Yes	P + T; HCPI	G and CB
Australia, June 1993	Currency stability, full employment, economic prosperity and welfare	Medium term	Yes	Range; HCPI	G and CB
Brazil, June 1999	Price stability	Yearly target	Yes	P + T; HCPI	G and CB
Canada, Feb. 1991	Economic and financial welfare	Renewed for 5 years until the end of 2021	Yes	P + T; HCPI	G and CB

(continues)

<sup>3</sup> Rogoff (1985) proposes the establishment of a central bank *independent* in both its *objectives* and *instruments*; that is, the central bank is free to set the final monetary policy targets and the instruments used to achieve them.

(continued)

Country and date IT adopted	Legal mandate	Target horizon	CB operational independence	Target type and measure	Target set by
Chile, Sep. 1999	Currency stability and normal functioning of domestic and foreign payments	Around two years	Yes	P + T; HCPI	CB
Colombia, Oct. 1999	Maintaining currency purchasing power	Medium term	Yes	Range; HCPI	CB
Czech Republic, Dec. 1997	Price stability and support of economic policies for sustainable economic growth	Medium term, 12-18 months	Yes	P + T; HCPI	CB
Ghana, informally 2002, formally May 2007	Price stability, economic growth, and effective operation of banking and credit systems	Medium term	Yes	P + T; HCPI	G and CB
Guatemala, 2005	Price stability	End of year	Yes	P + T; HCPI	CB
Hungary, June 2001	Price stability	Medium term	Yes	Point; HCPI	CB
Iceland, March 2001	Price stability and support of government's main economic policy	On average	Yes	Point; HCPI	G and CB
Indonesia, July 2005	Stability of the rupiah value	Medium term	Yes	P + T; HCPI	G and CB
Israel, informally 1992, formally 1997	Price stability and support of government's economic policy	Two years	Yes	Range; HCPI	G and CB
Mexico, 2001	The purchasing power of the Mexican currency	Medium term	Yes	P + T; HCPI	CB
New Zealand, Dec. 1989	Price stability	Medium term	Yes	Range; HCPI	G and CB
Norway, March 2001	Low and stable inflation, output and employment.	Medium term	Yes	Point; HCPI	G
Peru, Jan. 2002	Preserve monetary stability	At all times	Yes	P + T; HCPI	CB
Philippines, Jan. 2002	Price stability, balanced and sustainable growth	Medium term	Yes	P + T; HCPI	G and CB
Poland, 1998	Price stability and support of government economic policies	Medium term	Yes	P + T; HCPI	CB
Romania, Aug. 2005	Price stability and support of general economic policy	Medium term	Yes	P + T; HCPI	G and CB
Serbia, informally Sep. 2006, formally Jan. 2009	Price stability, financial stability and support of economic policy	Medium term	Yes	P + T; HCPI	G and CB

(continues)

(continued)

Country and date IT adopted	Legal mandate	Target horizon	CB operational independence	Target type and measure	Target set by
South Africa, Feb. 2000	Protection of the value of the currency and sustainable economic growth	On a continuous basis	Yes	Range; HCPI	G
South Korea, 1998	Price stability	Three years	Yes	P + T; HCPI	CB (with G)
Sweden, announced Jan. 1993, applied 1995	Price stability, economic growth and employment	Two years	Yes	Point; HCPI	CB
Thailand, May 2000	Promotion of monetary stability and formulation of monetary policies	Eight quarters	Yes	P + T; HCPI	G and CB
Turkey, Jan. 2006	Price stability	Multi years (3 years)	Yes	P + T; HCPI	G and CB
United Kingdom, Oct. 1992	Price stability, economic growth and employment	At all time	Yes	Point; HCPI	G

Source: based on Hammond (2012) and data from national central banks.

Concerning the time horizon to return inflation to the target, it is notable that most countries adopted a medium-term period of two to three years. These medium-term horizons give greater flexibility to the ITR by anchoring inflation expectations while allowing short-term divergence from the stipulated target. When choosing the time horizon, it is also important to take into account the transmission speed of the monetary policy mechanisms. If the process by which monetary policy decisions are transmitted to real output and inflation is slow, then the central bank is not able to influence inflation in the short run.

Another fundamental feature of the ITR is the establishment of a point target or a target range. The point target, while implying a stricter regime, may also be more difficult to achieve, while a target range gives the regime greater flexibility, making it easier to reach. Table 1 shows that countries generally choose both: a point target with lower and upper inflation tolerance limits.

The definition of the price index is also an important ITR issue, as it can be a full index or a core inflation measure. All 27 countries that adopted the ITR use the consumer price index as a measure of inflation, especially for their monthly periodicity. However, many central banks also analyse core inflation measures as an indicator of the inflationary pressures of the economy. Hammond remarks that Australia, Canada, the Czech Republic, Ghana, Hungary, Norway, Poland, Sweden, and Turkey publish core inflation forecasts in addition to global inflation. These core inflation measures are characterized by the exclusion of more sensitive components of the various types of shocks in the inflation computation. The use of the core inflation aims to reduce the volatility of the price index and thus avoid excessive use of monetary policy in the event of supply shocks.

Finally, in most of the countries that have adopted the ITR (15 countries), the inflation target is set jointly by the government and the central bank. In nine countries, the central bank alone

sets the target of these, only Sweden is considered a developed economy. In the three remaining countries (South Africa, Norway, and the United Kingdom), the inflation target is set by the government.

Specifically regarding the Brazilian case, which is empirically evaluated in section 5, it is worth highlighting the issues related to the monetary policy objective and the inflation target horizon. Looking first at the legal mandate, table 1 shows that the Central Bank of Brazil (BCB) is one of the few to carry the sole objective of price stability. This leaves monetary policy underutilized for broader economic objectives. Most other countries have multiple objectives, even being under the institutional framework of the ITR.

Regarding the inflation time horizon in Brazil, table 1 highlights that Brazil is also one of the few countries that presents an annual limit to return inflation to the established target. Therefore, when the economy suffers shocks, the BCB needs to respond quickly to such shocks to meet the inflation target within the set horizon.

## **2. The global financial cycle and price stability at the bottom of the global currency hierarchy**

According to Minsky's Financial Instability Hypothesis (FIH), productive units, linked by payment commitments, rely on different financial structures concerning the relationship between expected cash flows and contracted debt (Minsky, 1986). In this regard, over periods of prolonged prosperity, private agents tend to adopt riskier strategies, moving capitalist economies from a financial structure dominated by hedge finance to a structure that increasingly emphasizes speculative and Ponzi finance, forging the conditions that lead to financial crises (Minsky, 1991).

It is possible to extend this hypothesis to address the role of the external dimension and its implications for monetary policy and price stability. For instance, post-Keynesian economists like Kregel (2014), Orlik (2008), and Ülgen (2016) discuss how the external financial liberalization of emerging and developing economies, located at the bottom of the global currency hierarchy, leads to cycles that resemble the FIH. According to this view, external financial liberalization favours the increase of capital inflows under global economic expansion, allowing peripheral economies to finance speculative and Ponzi profiles in their balance of payments. Their balance of payments, thus, becomes characterized by recurrent current account deficits and the necessary capital account surpluses (Kregel, 2014). While the global bonanza lasts, capital inflows fuel currency overvaluation, safeguarding domestic consumption at the expense of external competitiveness (Orlik, 2008). When the foreign investors' appetite changes, due to either global or country-specific shocks, peripheral economies are faced with financial fragility, being beset with massive currency devaluation, financial crisis and growth stagnation (Ülgen, 2016).

Despite relying on mainstream theoretical foundations, the recent work from the Bank for International Settlements (BIS) acknowledges the influence of Minsky's FIH on the conceptualization of the global financial cycle. According to BIS (2014) and Borio (2012), the global financial cycle refers to reinforced interactions between perceptions of value and risk, attitudes towards risk, and financial constraints. Like the aforementioned post-Keynesian perspective, this approach also addresses the imbalances in the international financial and monetary system, connecting financial instability to the excessive elasticity of this system. This

connection becomes apparent in the fact that the initial stage of expansion leads to interactions between institutional regimes and agents, which mutually reinforce each other by deepening the expansive trajectory, amplifying vulnerabilities in the financial and real sectors of the economy (Borio and Disyatat, 2011).

In terms of measurement, the global financial cycle can be analyzed through several variables, such as: (i) the actual growth of credit; (ii) the ratio between credit and nominal production; and (iii) the actual growth in real estate prices. Additionally, a number of empirical studies, including Nier et al. (2014), Pasricha et al. (2015), and Rey (2013), use the financial market volatility index (VIX), calculated by the Chicago Board Options Exchange (CBOE). In this case, lower VIX levels characterize the boom phase of the global financial cycle. In line with this empirical literature, we will use the VIX as the proxy variable for the global financial cycle.

The connection between Minsky's FIH and the global financial cycle-based approach becomes evident from Borio's (2014) discussion about the main features of financial booms. These are:

- (i) the pro-cyclical and volatile nature of agents' perceptions of value and risk, such that a lower perception of risk validates asset valuation, further encouraging risk taking;
- (ii) inappropriate incentives for agents, reinforcing short-term focus and coordination;
- (iii) the mechanisms of mutual reinforcement, such as the interaction between the fall in perceived risk and the incentive to take on more risk, given that there is a concomitant increase in access to external sources of financing and asset liquidity; and
- (iv) the absence of institutional constraints on expansion, for example, the current economic policy regime that combines liberalized financial systems (in the external and internal dimensions) and monetary policies focused solely on controlling short-term inflation.

Another important element is the way in which domestic financial cycles relate to one another, forming a global financial cycle. BIS (2014) and Borio (2012) focus on two points: (i) the immediate reaction of advanced countries (mainly the US) to the 2007 global financial crisis, as well as the limits of the actions undertaken; and (ii) the impact of such measures on domestic financial cycles around the world and the possibility of new problems. Those two studies recognize the centrality of American decisions in shaping the global cycle and conditioning cycles around the world. However, the analyses have a more pragmatic focus, giving priority to the most appropriate policy mix for countries at different stages of the domestic financial cycle – the topic of interest in the next section. Rey (2013) emphasizes the existence of a global cycle that hierarchizes and connects the national ones, and he stresses the leading role US monetary policy plays in determining global cycles, by influencing the volume and direction of gross capital flows.

Despite the mainstream underpinnings of Rey's (2013) approach, her conclusion regarding the subordination of domestic dynamics to global financial cycles converges with post-Keynesian authors like Alves and Toporowski (2019) and Paula et al. (2017) on the consequences of a low position in the global currency hierarchy. Emerging and developing countries like Brazil tend to be more exposed to the movement of cross-border financial flows, facing pressures for exchange rate overvaluation during the expansionary stage of the cycle, along with disproportional tendencies towards currency and financial crises during the reversal of the cycle (Bonizzi, 2017).

As mentioned in the introduction, this paper seeks to incorporate the role of the external dimension into the analysis of the performance of the ITR. In this regard, there are two

potential channels through which the external dimension may shape price stability and consequently monetary policy. The first is through the relationship between the policy interest rate and the exchange rate. An increase in the interest rate may be effective in taming inflationary pressures since it helps keep a strong currency, but it comes at the expense of external competitiveness and deepens the financial fragility (Kregel, 2014; Alves and Toporowski, 2019; Paula et al., 2017; Bonizzi, 2017).

For the countries on the low end of the global currency hierarchy, this dynamic limits their degree of freedom to prevent an upswing in the domestic financial cycle (Rey, 2013). This is because maintaining a higher interest rate aimed at reducing a domestic credit supply expansion leads to exchange rate appreciation and excessive capital inflows (restoring credit growth via external financing). At the same time, a reduction in the interest rate in order to avoid such problems sanctions the expansion of domestic credit and supports the loss of monetary policy autonomy (Borio et al., 2014).

The second channel is through the progression of the global financial cycle, which relates to the formation of the expectations of private agents. In a monetary economy of production, an increase in the volatility of financial markets can erode the positive prospects away from potential investors (Orlik, 2008). This process, we argue, may impact price stability differently. On the one hand, the expected deflation of asset prices could put deflationary pressure on the real economy; on the other hand, private agents may opt for the higher profit rates in a reduced market as a means to safeguard their expected profit flows (Coelho and Caldentey, 2018). Where there is an unequal income distribution, like in Brazil, the latter alternative tends to be favored, creating inflationary pressure. It is important to note that such a speculative impact of the global financial cycle takes place alongside the aforementioned effect through the exchange rate channel.

Summing up, this section sheds light on two weaknesses of the ITR. First, the level of prices in the economy in question may respond to external factors. Second, the focus on inflation control as the main objective of economic policy masks other problems, such as currency overvaluation, current account imbalances and excessive short-term capital inflows, which deepen the financial fragility even in a low inflation context.

### **3. Post-Keynesian criticism on the theory and practice of central banks**

As mentioned in section 2, the theory and practice of central banks around the world reflect the idea that inflation should be the main objective pursued by macroeconomic policies – to which everything else is subordinated – and that monetary stability is the fundamental condition for long-term growth. The range of policies, methods and tools that central banks can use has also been narrowed, being represented normally by an inflation target which is pursued via an official interest rate. Important issues such as financial stability have been set aside and even excluded from central bank policies.

This conduct has suffered several criticisms, especially by post-Keynesians, whose core rejection of a monetary theory of inflation and, more generally, of a structure of simple target instruments, such as the current one, derives from the premise that currency is not neutral at different levels. These authors argue that central bank policies should reflect concern over income and wealth distribution and the institutions that support currency as a social



relationship. This is why the focus should be on both price stability and real activity, with special attention to financial stability (Arestis and Sawyer, 2006; Down, 2016).

Arestis and Sawyer (2006) highlight some of the constraints of Keynesian theory on the ITR framework under the guidance of independent central banks. Briefly they emphasize that:

- I. The adoption of a nominal anchor, such as an inflation target, leaves little room for manoeuvre to stabilize output;
- II. The separation between the real and monetary factors of the economy implies that the rise in interest rates would only change demand in the short term, not altering supply in the long term;
- III. Considering only demand inflation can be a mistake for at least two reasons: one, the effectiveness of monetary policy over the control of aggregate demand and, two, the important role played by costs, considered a major source of pressure on prices by the Keynesian approach;
- IV. There is a discordance in the assumption of a single interest rate balance, which balances savings and investment and that tends to be neutral in the sense that it is consistent with the level of full employment, and one that can be defined by system parameters, accordingly, with any specified employment level. From the Keynesian view, at each interest rate level there is a corresponding level of effective demand and, therefore, different levels of employment.

Down (2016) criticizes central banks that act contrary to the current world context, both in terms of theory and practical action, stating that this has negative consequences on the real economy, either in aggregate terms or in income distribution terms. The author first mentions how changes in the interest rate, which imply changes in the availability and price of credit between different agents (rentiers and investors in productive activity), cause distributional impacts and regional development. Secondly, she argues that, in a world where deregulation and financial innovation expand continuously, the current mode of action of central banks should be to control not only the price of the currency but also other financial assets like near money assets.

In this sense, the reductionist view of the role of central banks in recent decades does not address the complexity and uncertainty surrounding globalized finance development: a financial crisis can lead to the collapse in prices/liquidity of these financial assets, compromising the ability of the entire system to grant credit. The result is a disruption of fundamental social relations for macroeconomic stability.

Hartwell (2019) joins the critics of the ITR and the independence of central banks by posing two questions. First, he queries whether institutions can dispense with institutions, that is, whether the central bank, which executes monetary policy through a single tool – the interest rate – can dispense with the wider and more complex institutional system that supports monetary policy. The author provides several implications of such conduct. One, drawn from the fact that the weight of the financial sector tends to grow in countries that have an independent central bank, is the suggestion that central bank leaders face more pressure not from the politicians or the voters but from the banks themselves. Secondly, the author questions how independent the central banks actually are in the context of globalized finance. In this regard, he shows the correlation between the interest rates of the world's major central banks, indicating that there is a coordination or convergence of the monetary policy of those central banks that call themselves “independent”.

Bibow (2004) also questions the ITR and the central bank independence thesis, severely critiquing the time inconsistency problem – a theoretical justification for independence. According to the author, time inconsistency leads to a biased and dangerously unilateral view

of central bank independence and monetary policy: that “maximizing” independence is always best, even at the expense of output stabilization. The author plainly states that it is a fallacious assumption considering the reality of most economies in the world. He also points out the lack of reliable studies showing the performance of independent central banks and determines that what scant literature exists is flawed and confuses cause and effect between central bank independence and economic performance.

Bibow further criticizes the fact that time inconsistency distorts the rules versus discretion debate, moving away from the propositions of Keynes and even Friedman, who never conceived of an independent central banker, believing that the concentration of such vast powers in the hands of a “banker” free of any kind of direct and effective political control would be a risk. Thus, the short-sighted view of monetary policy translates into unjustified reductionism on the single focus of price stability, rather than addressing the important functions of a central bank, such as effective policy coordination and democratic accountability.

In short, the post-Keynesian debate affirms the centrality of overcoming the current way of conducting monetary policy by central banks. In other words, it asserts the need of switching the focus on “one goal, one instrument,” given by the ITR and independent central banks, to a more realistic institutional framework, one that is particularly aware of the context of globalized finance and its potentially unstable effects, notably in developing countries.

#### **4. Monetary policy and the global financial cycle: an empirical assessment for the Brazilian economy (2000-2017)**

In order to evaluate the conduct of monetary policy under the ITR, this empirical section estimates a Markov-switching vector autoregressive (MS-VAR) model, which allows the incorporation of nonlinear variables. The estimated model is based on Fonseca et al. (2018b) and Araújo et al. (2018). The potentially original contribution of our study lies in the incorporation of a proxy variable for the global financial cycle – the indicator of volatility in the global financial market (VIX), mentioned in section 2.

According to Krolzig (1996, 1997, 1998), the MS-VAR model emerged from two sources: the vector autoregressive models from Sims (1990) that are widely used to analyse macroeconomic variables; and Markov-switching models that focus on regime changes in those variables.<sup>4</sup> Krolzig (1997) created a simple notation that allows the identification of MS-VAR models according to the dependence or not of the parameters in face of the regimes.

In time series analysis, the choice of a Vector Autoregressive (VAR) model or Error Correction model (ECM) depends on the stationarity of the series and on the existence of cointegration among them. However, according to Sims (1990), given that the purpose of the estimation is to understand the interrelationships between the variables, the differentiation of the series in VAR models can lead to the loss of important information. Additionally, although Bernanke and Mihov (1998) state that the estimation of the VAR model with level variables produces statistically consistent estimators, regardless of the existence of cointegration vectors, if there are cointegration relationships, the specification of the series in difference is inconsistent and produces biased estimators.

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<sup>4</sup> Several authors have worked with nonlinearity in macroeconomic models. For more details, see Hamilton (1994); Krolzig (1997); and Ehrmann et al. (2003).

In view of these problems related to the integration order of the series, a model that follows the Bayesian procedure, that is, the MS-VAR adopted in this research, appears to be a good option, given that the unit root problem is not a critical point in Bayesian statistics, which is also more efficient in small samples. This is because the unit root tests of the traditional classical approach are of low power compared to other alternatives, they are more subject to the problem of discontinuity generated in asymptotic theory, and the critical values generated from small samples can differ substantially from the asymptotic critical values (Koop, 1992; Sims, 1988; Sims and Uhlig, 1991).

In this paper, the MS-VAR is estimated with all parameters dependent on the regime, giving an MSIAH ( $m$ )-VAR ( $p$ ) model. The estimation of this model is based on expectation-maximization (EM).<sup>5</sup> We chose to estimate a model in which the intercept, the parameters and the variance all varied. Without this flexibility, the model would become more restricted and difficult to estimate.

The variables presented structural breaks as well, especially in 2001, 2002, 2007 and 2008, which makes linear models problematic. With our model thus chosen, we estimate six variables, including a proxy variable for the global financial cycle,<sup>6</sup> applying a monotonic transformation to natural logarithm as described in table 2.

Table 2 – *Data specification*

Series	Name	Description
Global Financial Cycle	VIX	Volatility Index, calculated by CBOE, monthly average.
Activity Level	IND	Industrial production, general industry, quantum, seasonally adjusted index (2002 average = 100) Monthly Industrial Survey, Physical Production (IBGE/PIM-PF)
Exchange rate	CAMBIO	Free Exchange Rate, Monthly average. 3695, Exchange rate, Free, United States dollar (purchase), end of period
Public Sector Net Debt	DIV	Percentage of public sector net debt as a proportion of monthly GDP. 4513, Net public debt (% GDP), Total, Consolidated public sector
Interest rate	SELIC	Annualized benchmark interest rate. 4189, Interest rate, SELIC accumulated in the month in annual terms (basis 252)
Price Level	IPCA	Broad National Consumer Price Index (IPCA) (January 1995 =100). 13522, National consumer price index (IPCA), in 12 months.

*Sources:* VIX: Chicago Board Options Exchange (CBOE), available at <http://www.cboe.com/vix>; IND: Brazilian Institute of Geography and Statistics (IBGE), available at <https://www.ibge.gov.br/en/statistics/economic/industry-and-construction/16901-pim-pf-brazil-pimpf1.html?=&t=series-historicas>; CAMBIO: Central Bank of Brazil (BCB), available at <https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries>; DIV: Central Bank of Brazil (BCB), available at <https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries>; SELIC: Central Bank of Brazil (BCB), available at <https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries>; IPCA: Central Bank of Brazil (BCB), available at <https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries>

<sup>5</sup> For more details, see McLachlan and Krishnan (2007).

<sup>6</sup> According to Nier et al. (2014), the empirical literature on the global financial cycle uses VIX as a measure of risk aversion and uncertainty in the global financial market, since the index points to the expectation of volatility in the stock market for the next thirty 30 days. In the upswing of the global financial cycle, there is a low level of volatility, while in times of decline, the level of volatility is higher.

Because the formal implementation of the ITR in Brazil occurred at the end of 1999, the research covers data from January 2000 until December 2017.<sup>7</sup>

Before proceeding to the empirical analysis, however, it is important to make some comments on the behaviour of the Brazilian economy and the main variables used in the research. In general, an analysis of the Brazilian economy's performance reveals instability in GDP growth and in most of the economic indicators during the period 2000-2017, except for the years between 2004 and 2008, when the country experienced a brief cycle of growth and improvement in the main fundamentals of the economy. This can be observed in table 3.

For a better understanding of the trajectory of the main indicators of this phase, it is convenient to divide it into four subperiods: 2000 to 2003, a period of economic instability; 2004 to 2010, the growth phase, but also reflecting the effects of the 2008 crisis; 2011 to 2014, a decline in growth; and from 2015 onwards, a period with relative homogeneity in the behaviour of macroeconomic variables.

In the first subperiod, which runs from 2000 to 2003, there is instability, given the occurrence of some external crises as well as some internal ones, such as the 2001 energy crisis, and the tense 2002 elections. In this phase, GDP showed low and volatile growth rates, with the exception of the year 2000. With the exchange rate on a depreciation path and inflation above the target most of the time, the basic interest rate (the Selic rate) remained at high levels: between 15% and 25%, approximately. This rate remained high until around 2005, also due to the increase in the price of oil in 2004 and the higher growth of the Brazilian economy in that same year.

The second subperiod that covers the years 2004 to 2008 is a time when the country started to grow. The improvement in the external scenario caused by a boom in commodity prices and greater international liquidity, coupled with the expansion of employment and income in Brazil, stimulated by the policies that were adopted after 2003, led to an improvement in the fundamentals of the Brazilian economy. In the new scenario of more controlled inflation, a gradual fall in interest rates was possible. This had a positive impact on the trajectory of the domestic public debt, which fell by around 12 percentage points between 2005 and 2012. An appreciation of the exchange rate due to a strong inflow of foreign capital was also one of the main factors that helped to keep inflation within the target during the years 2004 to 2008.

With the outbreak of the subprime crisis in the US economy in the last quarter of 2008, inflationary pressures returned. At this point, inflation was close to the upper limit of the target, which led to the increase in the Selic rate and the gradual worsening of the Brazilian economy in subsequent years. Thus, 2011 marks the country's entry into the third phase, of low growth and accelerated inflation. President Dilma Roussef (2011-2014), in her first term, chose to adopt a policy to stimulate economic growth, which had been stagnant in the previous years. The stagnation promoted a wide change in the conduct of domestic policies, basically stimulating a reduction in interest rates and control over the sharp appreciation of the currency.

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<sup>7</sup> An important step in time series analysis is the delimitation of the period. We chose to define a sample that runs from January 2000 to December 2017 (17 years). It would be ideal to have more observations. However, because the ITR was adopted in mid-1999 and there was a lot of instability in that year, we decided to start the following year. Similarly, in 2018 the Brazilian economy was marked by several events (truckers' strike, elections) that led to data volatility, hindering modelling, even nonlinear models.

*Table 3 – Selected economic indicators, Brazil, 2000-2017*

Year	Exchange rate R\$/US\$ – end of period quotation	Effective headline inflation rates (IPCA)	Annual interest rate (Selic)	Net public debt (% of GDP)	Annual growth rate
2000	1.83	5.97	15.84	36.50	4.3
2001	2.35	7.67	19.05	44.37	1.3
2002	2.92	12.53	24.90	43.21	3.1
2003	3.07	9.30	16.33	42.36	1.3
2004	2.92	7.60	17.75	44.79	5.7
2005	2.43	5.69	18.05	47.64	3.1
2006	2.17	3.14	13.19	50.47	4.0
2007	1.94	4.46	11.18	46.27	6.0
2008	1.83	5.90	13.66	46.74	5.0
2009	1.99	4.31	8,65	42.94	-0.2
2010	1.76	5.91	10.67	42.53	7.6
2011	1.67	6.50	10.91	40.29	3.9
2012	1.95	5.84	7.29	38.12	1.8
2013	2.15	5.91	9.90	39.42	2.7
2014	2.35	6.41	11.65	47.01	0.1
2015	3.33	10.67	14.15	55.09	-3.8
2016	3.49	6.29	13.65	60.78	-3.3
2017	3.19	2.95	6.90	64.52	1.3

Source: elaboration based on Ipeadata (2019).

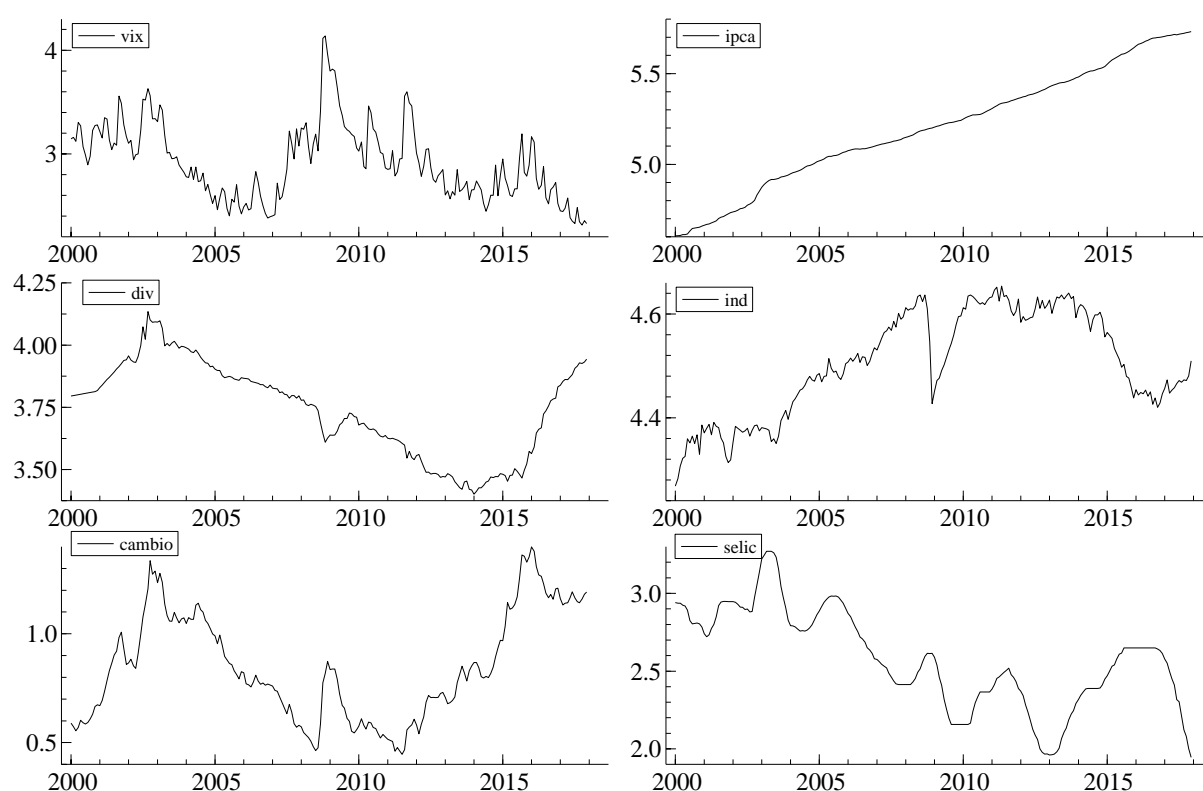
As a result of President Rousseff's policy, the basic interest rate dropped continuously after 2011 and reached its historical lower limit of 7.25% p.a. in March 2013. In addition, the domestic currency showed a considerable depreciation trajectory. Despite these and other granted incentives, the adopted policy failed completely and GDP grew very little in this phase. This happened on account of the reversal of the benign external scenario and the return of inflation in the country. Thus, after 2013, a new trajectory started to increase the basic interest rate, which had negative effects on income and, in particular, on the trajectory of public debt, which has been growing rapidly.

This brings us to the fourth and final phase. From 2015 forward, there has been a serious crisis that is not only economic but also political and institutional in nature. It has seen the removal, in 2016, of a president and the complete reversal of policies that were being adopted. Inflationary pressures, partly justified by the increase in administered prices, and expenses with the World Cup, among others, stimulated the continuation of increases in the Selic rate, which reached 14.25% in 2015, almost double the level recorded in the beginning of 2013.

Because the Selic interest rate is one of the main public debt indexes, its behaviour impacted the amount of public debt. Finally, it is worth noting the severe recession of 2015-2016, when GDP saw a historic fall (-7.1%). Faced with this situation, inflation eased and was even below the target set for 2017, despite the historic increase in domestic public debt, which exceeded 64% of GDP.

With these considerations in mind, we can now proceed to the empirical analysis. The choice of variables was based on the study by Fonseca et al. (2018b). Figure 1 presents the behaviour of these variables.

Figure 1 – Evolution of the variables



According to Wooldridge (2002), an estimate presents a sufficient degree of confidence when it meets two conditions: (i) more than 60 observations; and (ii) the number of parameters less than the total observations. In this study both conditions are met, since 164 parameters were estimated from 214 observations.

One potential caveat of our empirical strategies is the choice of industrial production as a proxy for aggregate demand. Because industrial production accounts for less than 20% of GDP, its use brings limitations that cannot be ignored. The ideal solution would be to adopt a broader

indicator of economic activity that, in addition to contemplating industrial production, would also incorporate the service sector, for example. However, in the absence of a monthly economic activity index, the option was to employ the industrial production index, already used in other empirical studies such as Fonseca et al. (2016), Fonseca et al. (2018b) and Araújo et al. (2018).

That said, before estimating the model, it is important to conduct several selection tests. First, we present the tests that indicate the correct number of lags to be used in the model, as shown in table 4.

Table 4 – Lag criteria tests

Lag (p)	LogL	LR	FPE	AIC	SC	HQ
0	477.779	NA	4.80E-10	-4.429853	-4.335168	-4.391588
1	3067.68	5009.58	1.85E-20	-28.41017	-27.74738	-28.14232
2	3227.48	300.0952	5.79E-21	-29.57262	<b>-28.34173*</b>	<b>-29.07518*</b>
3	3265.36	<b>68.99185*</b>	<b>5.70e-21*</b>	<b>-29.59022*</b>	-27.79122	-28.86319

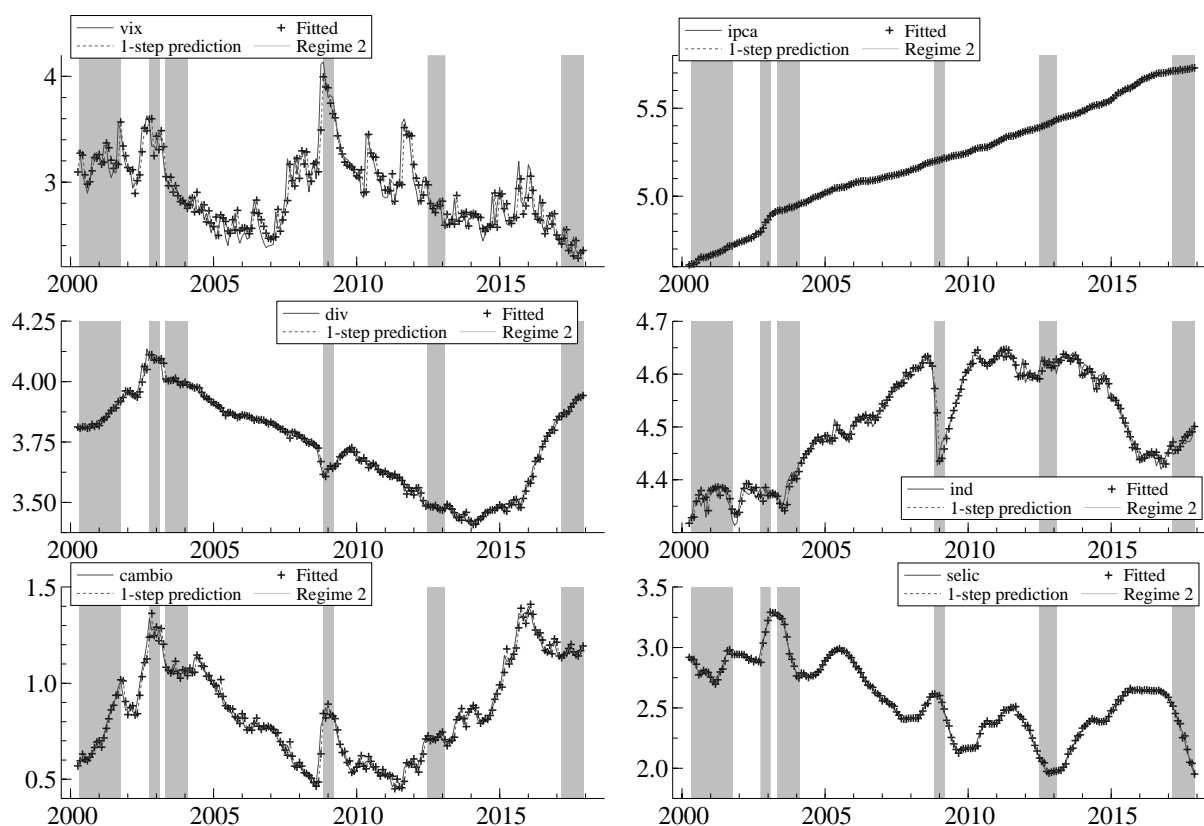
Notes: \* indicates the number of lags selected by each criterion for the VAR system. LR: LR statistic. PEF: final forecast error. AIC: Akaike information criterion. SC: Schwarz's information criterion. HQ: Hannan-Quinn's information criterion.

Based on table 3, we estimate the MS-VAR model, in which the number of possible regimes –  $m$  – is 2 and the number of lags –  $p$  – is equal to 3. The explanation for the number of regimes is based on the dynamics of the price level, which has one regime characterized by higher inflation rates and another one characterized by lower rates. Additionally, the number of parameters of an MS-VAR model with three regimes grows considerably, making the analysis unfeasible.

The decision of estimating MS-VAR is supported by the linearity test (LR). According to this test, the model is nonlinear at 0.01 significance, so that the parameters change significantly from one regime to another. Regarding the behaviour of the residuals, at 0.01 significance, the Portmanteau and ARCH tests pointed, respectively, to the absence of autocorrelation and heteroscedasticity. 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 analyse the distribution of residuals compared to a normal distribution (Cleveland, 1985). The tests performed on the MS-VAR model, including the residual tests, are detailed in the appendix to this paper.

The convergence of the EM algorithm occurred after two interactions, with a probability of change of 0.0001. Figure 2 shows the adjustment of the model in both estimated regimes.

Figure 2 – Model adjustment



The MS(2)-VAR(3) model estimated for the period January 2000 to December 2017 showed the following matrix of transition of the regimes:

$$\hat{T} = \begin{bmatrix} 0,95681 & 0,10800 \\ 0,043188 & 0,89200 \end{bmatrix} \quad (1)$$

Table 5 – Classification of estimated regimes

Regime 1	Regime 2
04/2000 – 04/2000 (0.528)	05/2000 – 10/2001 (0.970)
11/2001 – 09/2002 (0.992)	10/2002 – 02/2003 (0.999)
03/2003 – 04/2003 (0.998)	05/2003 – 02/2004 (0.884)
03/2004 – 10/2008 (0.989)	11/2008 – 03/2009 (0.972)
04/2009 – 06/2012 (0.990)	07/2012 – 02/2013 (0.900)
03/2008 – 02/2017 (0.975)	03/2017 – 12/2017 (0.993)
<i>Total: 157 months</i>	<i>Total: 56 months</i>
Representing 73.71% of the estimated period with an average duration of 26.17 months.	26.29% of the estimated period with an average duration of 9.33 months.

Notes: probabilities in parentheses.



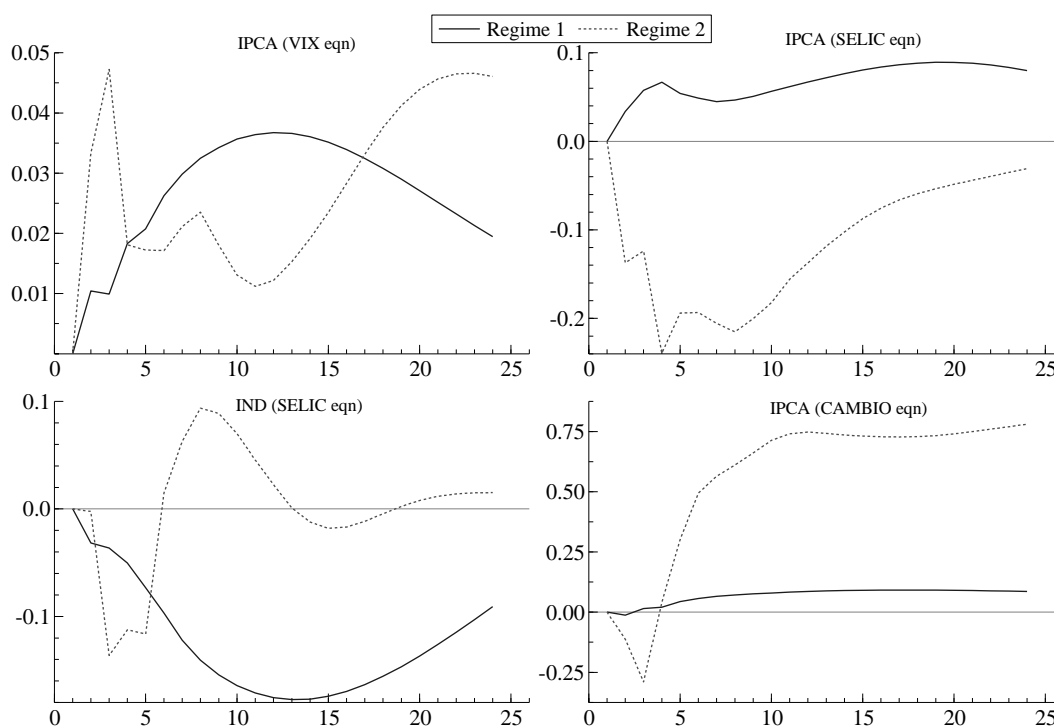
It can be seen, through the matrix  $\hat{T}$ , that the regimes are persistent. That is, if monetary policy is in one of the regimes, the probability of remaining in this same regime is high: being in the first regime, the probability of switching to the second regime is 0.043, whereas remaining in the same regime, the probability is 0.957. The same occurs in the second regime: once in it, the probability of changing is 0.108, while the probability of staying is 0.892. Table 5 presents the classification of the two regimes.

As table 5 demonstrates, Regime 1 (one) is more persistent and predominant, totalling 157 months and lasting 26.17 months on average. Regime 2 (two) has a lower persistence, totalling 56 months in the period analysed and having an average of 9.33 months duration.

Therefore, to analyse the results of the MS-VAR model, it is usual to build impulse-response functions. Such functions are important in the analysis of time series, since they summarize the information from the estimated autoregressive parameters, as well as variances and covariances, making it easier to observe and understand changes between the parameters.

The impulse-response functions of the estimated model are represented in figure 4, in accordance with the regime: the blue lines represent the estimation under Regime 1, and the red lines the estimation under Regime 2.

Figure 3 – Regime-based impulse-response functions



Based on figure 3, we can interpret the effectiveness of monetary policy under the hypothesis of the influence of the global financial cycle according to two main analytical axes: (i) the effectiveness of the ITR in achieving its objectives, and (ii) other aspects that interfere

with the results and, therefore, implicitly or explicitly are (or should be) part of the economic policy decisions.

Regarding the direct impact of monetary policy on the Brazilian macroeconomic performance, we can observe that the consequences of a contractionary monetary policy are a function of the price level regime. That is, in a regime characterized by a stagnant level of activity, an increase in interest rates may be associated with an initial inflationary effect, the so-called *price-puzzle* phenomenon. On the other hand, under the expansive regime, the contractionary monetary policy behaves as expected, helping to control inflation.

The response to the level of economic activity to monetary policy also follows a similar pattern: under the stagnant regime, a contractionary policy has a recessive effect, whereas in the expansive context, an increase in interest rates results in a larger fluctuation of output over time.

The second axis of analysis concerns the other aspects that shape the evolution of the price level, specifically, the exchange rate and the global financial cycle. Since the impulse-response function points to a direct relationship between the price level and the exchange rate in both regimes, we can conclude that exchange rate overvaluation contributes to inflation control, increasing the effectiveness of monetary policy in this context.

This finding suggests that at least part of the ITR effectiveness depends on an indirect monetary policy transmission channel – the exchange rate. However, despite facilitating the achievement of targets, the appreciation of the domestic currency can render negative consequences in the medium and long term, such as the deepening of the deindustrialization and the regressive specialization of the economy, a topic that has been recurrent among scholars of Brazilian development.<sup>8</sup>

Finally, regarding the global financial cycle, we can see that a shock in the variable chosen as a proxy to represent financial instability – VIX – is associated with a higher price level in both contractionary and expansionary regimes. Such a result is quite illustrative of the potentially destabilizing effects of globalized finance on a developing country like Brazil. One possible interpretation of this dual influence stems from the post-Keynesian approach, whereby private agents seek to defend their profit margins in periods characterized by deteriorating expectations and, even in times of recession, may wish to raise their prices.

In short, the destabilizing effects of the financial cycle, coupled with the non-discretionary conduct of domestic monetary policy, amplify the recessive impacts which further aggravate the situation in developing countries. It is important to stress, however, that the results obtained in the empirical part of the research must be analysed in the light of two dimensions: (i) the position of the Brazilian economy in the global monetary and financial system; and (ii) the consequences on the Brazilian macroeconomic performance over the last two decades.

In the first case, the response of price levels to the increase in global financial instability can be taken as an indicator of Brazil's peripheral position in the international currency hierarchy, as the global financial cycle is fundamentally influenced by the monetary policy of developed countries, in particular the United States. In addition, in line with the discussion in the previous section, it is noted that the performance of the ITR is a function of the stage of the global financial cycle. This conclusion is significant because the adoption of the regime around the world took place amid a period of cyclical expansion, characterized by increased global economic integration and reduced risk aversion by investors. In other words, the effectiveness

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<sup>8</sup> See Lamonica and Feijó (2011), Marconi and Rocha (2012), Mattei and Scaramuzzi (2016), and Araújo and Peres (2018).

of the ITR tends to be put in check in periods of greater instability, which have been recurrent after the global financial crisis.

Regarding the second aspect, that is, the consequences for the Brazilian macroeconomic performance, the results obtained by the present research also indicate that the economy tends to face inflationary pressures during the reversal of the global financial cycle. According to the ITR assumptions, such a situation requires the adoption of a contractionary monetary policy, which further accentuates the recessionary trend, reinforced by the rules of the Brazilian ITR.

It is also worth noting that our results are corroborated by the recent evolution of the Brazilian economy, as periods of growth slowdown coincide with higher inflation, especially at the beginning of the economic downturn. Moreover, since currency overvaluation seems to be the most effective channel to contain inflation, there is also a strong exposure of short-term macroeconomic performance to external fluctuations.

Finally, this empirical exercise has important limitations, since the behaviour of impulse-response functions does not imply a causal relationship. On the other hand, the combination of these results with the literature on the subject suggests the importance of the global financial cycle movement, pointing to the need for discussing the recent performance of the central banks, especially the ones that adopt the ITR like the BCB in Brazil.

## 5. Final remarks

This paper evaluated the conduct of monetary policy in Brazil under the ITR in the face of the global financial cycle. Our theoretical framework came from Central Bank theory and practice, whose recent performance is based on the ITR and, in some cases, on central bank independence, positioning the discussion on the destabilizing role of globalized finance. After that, we presented the Post-Keynesian critique with particular attention to the issue of financial instability. Finally, in the empirical section, we estimated a Markov-switching vector autoregressive model (MS-VAR) for the period January 2000 to December 2017, incorporating a proxy variable for the global financial cycle, which is the main contribution of the present study.

This empirical exercise has generated results in line with the post-Keynesian critique of the ITR around the world. First, we observed that the impact of a rise in the basic interest rate on inflation is a function of the regime in which the price levels are located: under a low inflation regime, a contractionary monetary policy seems to have an initial inflationary effect due to the *price-puzzle* phenomenon. On the other hand, under a higher inflation regime, an increase in interest rates contributes to inflation control. As expected, the price level also responds to other constraints, such as the exchange rate and, in particular, the global financial cycle.

In this regard, the occurrence of a shock that leads to currency devaluation has a negative impact on the price level. The increase in global financial instability is associated with an increase in the price level, regardless of the monetary policy regime, expansionist or restrictive, indicating that actors may be trying to protect their profit margins by raising prices, even in a context of economic stagnation.

The recent evolution of the Brazilian economy reinforces our results by showing that the growth slowdowns coincide with higher inflation, especially at the beginning of the economic downturn. This tendency is deepened by the rigidity of the Brazilian regime of inflation targets

as well as by the *price-puzzle* phenomenon. Finally, we emphasize that such results are intended not to exhaust the discussion on the topic but rather to establish a research agenda for future studies.

## Appendix

Table A1 – LR linearity test

H <sub>0</sub> – The model is linear		
LR linearity test	Chi <sup>2</sup> (29) = 9510.1	[0.0000]**

Table A2 – Residuals test

Vector portmanteau statistic for squared scaled residuals	Chi <sup>2</sup> (1296) = 1454.5	[0.0013]**
Vector normality test	Chi <sup>2</sup> (12) = 136.55	[0.0000]**

Figure A1 – MS-VAR residuals

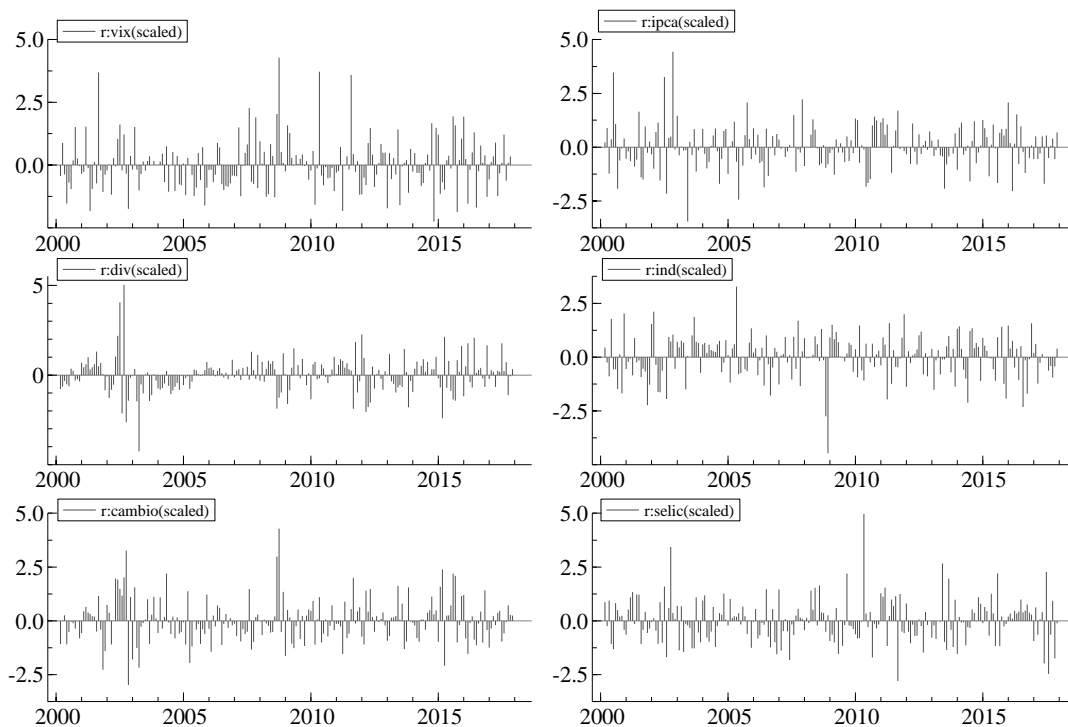
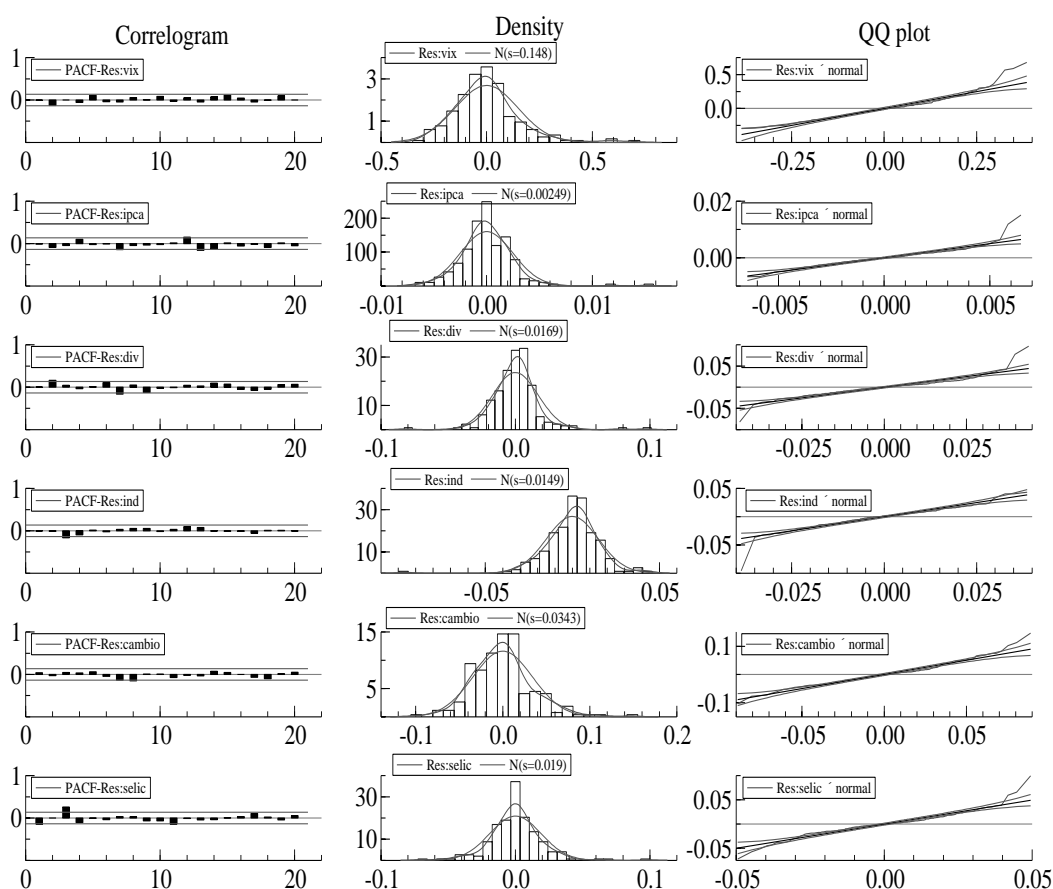


Figure A2 – Correlogram, density and QQ-plot of standard residuals in MS-VAR



## References

- Alves C., Toporowski J. (2019), "Growth of international finance and emerging economies: Elements for an alternative approach", *PSL Quarterly Review*, 72 (288), pp. 3-27.
- Araujo E.L., Araújo E.C. and Ferrari-Filho F. (2018), "Macroeconomic Performance in Brazil after Inflation Targeting Regime", *Investigación Económica*, 77 (304), pp. 72-101.
- Araújo E.C. and Peres S.C. (2018), "Política Cambial, Estrutura Produtiva e Crescimento Econômico: Fundamentos Teóricos e Evidências Empíricas para o Brasil no período 1996-2012", *Análise Econômica*, 36 (69), pp. 67-107.
- Arestis P. and Sawyer M. (2006), "Inflation Targeting and Central Bank Independence: We Are All Keynesians Now! Or Are We?", *Journal of Post Keynesian Economics*, 28 (4), pp. 639-652.
- Arestis P. and Sawyer M. (2008), "A Critical Reconsideration of the Foundations of Monetary Policy in the New Consensus Macroeconomics Framework", *Cambridge Journal of Economics*, 32 (5), pp. 761-779.
- Bernanke B.S. and Mihov I. (1998), "Measuring Monetary Policy", *The Quarterly Journal of Economics*, 113 (3), pp. 869-902.
- Bibow J. (2004), "Reflections on the Current Fashion for Central Bank Independence", *Cambridge Journal of Economics*, 28 (4), pp. 549-576.
- BIS (2014), *84th Annual Report*, Basel: Bank for International Settlements.
- Bonizzi B. (2017), "An Alternative Post-Keynesian Framework for Understanding Capital Flows to Emerging Markets", *Journal of Economic Issues*, 51 (1), pp. 137-162.
- Borio C. (2012), "The Financial Cycle and Macroeconomics: What Have We Learnt?", *BIS Working Paper*, n. 395, Basel: Bank of International Settlements.
- Borio C. (2014), "The International Monetary and Financial System: Its Achilles Heel and What To Do About It", *BIS Working Papers*, n. 456, Basel: Bank of International Settlements.

- Borio C., James H. and Shin H. (2014), "The International Monetary and Financial System: A Capital Account Historical Perspective", *BIS Working Papers*, n. 457, Basel: Bank of International Settlements.
- Borio C., Disyatat P. (2011), "Global imbalances and the financial crisis: Link or no link?", *BIS Working Papers*, n. 346, Basel: Bank of International Settlements.
- Cleveland W.S. (1985), *The Elements of Graphing Data*, Monterey (CA): Wadsworth.
- Dezordi L.L., D'Agostini L.L.M., Bittencourt M.V.L. and Curado M.L. (2009), "Regime de Metas de Inflação para a Condução da Política Monetária Brasileira: uma aplicação do modelo VAR", in Oreiro J.L., de Paula L.F. and Sobreira R. (eds.), *Política Monetária, Bancos Centrais e Metas de Inflação: teoria e experiência brasileira* (pp. 121-147), Rio de Janeiro: Editora FGV.
- Coelho D., Caldentey E. (2018), "Neo-Kaleckian models with financial cycles: A center-periphery framework", *PSL Quarterly Review*, 71 (286), pp. 309-326.
- Down S. (2016), "Central Banking in the Twenty-First Century", *Cambridge Journal of Economics*, 41, pp. 1539-1557.
- Ehrmann M., Ellison M. and Valla N. (2003), "Regime-Dependent Impulse Response Functions in a Markov-Switching Vector Autoregression Model", *Economics Letters*, 78 (3), pp. 295-299.
- Ferreira A.B., Jayme Jr. F.G. (2005), "Metas de inflação e vulnerabilidade externa no Brasil", paper presented at the 33<sup>rd</sup> Encontro Nacional de Economia da ANPEC (Brazilian Association of Graduate Programs in Economics), Natal, available at: <http://www.anpec.org.br/encontro2005/artigos/A05A035.pdf>.
- Fischer S. (1998), "Capital-Account Liberalization and the Role of IMF", in *Should the IMF Pursue Capital-Account Convertibility?* (pp. 1-11), *Essays in International Finance*, n. 207, Princeton: Princeton University, Department of Economics, International Financial Section.
- Fonseca M.R.R., Peres S.C. and Araújo E.C. (2016), "Regime de metas de inflação: análise comparativa e evidências empíricas para países emergentes selecionados", *Revista de Economia Contemporânea*, 20 (1), pp. 113-143.
- Fonseca M.R.R., Oreiro J.L.C. and Araújo E.C. (2018a), "The Nonlinearity of Brazilian Monetary Policy in the Inflation-Targeting Period: an analysis based on an MS-VAR model", *Análise Econômica*, 36 (70), pp. 63-81.
- Fonseca M.R.R., Silva P.P. and Araújo E.C. (2018b), "Política monetária e ciclo financeiro global: uma análise sobre o caso brasileiro durante o regime de metas de inflação", *Brazilian Keynesian Review*, 3 (2), pp. 82-106.
- Hamilton J.D. (1994), *Time Series Analysis*, Princeton: Princeton University Press.
- Hammond G. (2012), *State of the Art of Inflation Targeting*, London: Centre for Central Banking Studies, Bank of England.
- Hartwell C.A. (2019), "On the impossibility of central bank independence: four decades of time- (and intellectual) inconsistency", *Cambridge Journal of Economics*, 43 (1), pp. 61-84.
- Koop G. (1992), "'Objective' bayesian unit root tests", *Journal of Applied Econometrics*, 7 (1), pp. 65-82.
- Kregel J. (2014), "Minsky and dynamic macroprudential regulation", *PSL Quarterly Review*, 67 (269), pp. 217-238.
- Krolzig H. (1996), "Statistical Analysis of Cointegrated VAR Processes with Markovian Regime Shifts", *SFB 373 Discussion Paper*, n. 25, Berlin: Humboldt University of Berlin, Interdisciplinary Research Project 373.
- Krolzig H. (1997), *Markov-Switching Vector Autoregressions: Modelling, Statistical Inference, and Application to Business Cycle Analysis*, Berlin: Springer.
- Krolzig H. (1998), "Econometric Modelling of Markov-Switching Vector Autoregressions Using MSVAR for Ox", *mimeo*, Department of Economics, University of Oxford, available at: <http://fmwww.bc.edu/ec-p/software/ox/Msvardoc.pdf>.
- Kose M., Prasad E., Rogoff K. and Wei S.-J. (2009), "Financial Globalization: A Reappraisal", *IMF Staff Papers*, 56 (1), Washington (DC): International Monetary Fund.
- Lamonica M.T. and Feijó C.A. (2011), "Crescimento e industrialização no Brasil: uma interpretação à luz das propostas de Kaldor", *Revista de Economia Política*, 31 (1), pp. 118-138.
- Lucas R.E. (1972), "Expectations and the Neutrality of Money", *Journal of Economic Theory*, 4, pp. 103-124.
- Lucas R.E. (1983), "Understanding Business Cycles", in *Studies in Business-Cycle Theory* (pp. 215-239), Cambridge: MIT Press.
- Lucas R.E. and Sargent T.J. (1981), *Rational Expectations and Econometric Practice*, Minneapolis: The University of Minnesota Press.
- Marconi N. and Rocha M. (2012), "Taxa de câmbio, comércio exterior e desindustrialização precoce – o caso brasileiro", *Economia e Sociedade*, 21, pp. 853-888.
- Mattei L. and Scaramuzzi T. (2016), "A taxa de câmbio como instrumento do desenvolvimento econômico", *Revista de Economia Política*, 36 (4), pp. 726-747.
- Mclachlan G. and Krishnan T. (2007), *The EM Algorithm and Extensions*, Hoboken (NJ): John Wiley & Sons.
- Mendonça H.F. (2004), "Mensurando a credibilidade do regime de metas inflacionárias no Brasil", *Revista de Economia política*, 24 (3), pp. 344-350.
- Mendonça H.F. (2005), "Metas para inflação e variáveis macroeconômicas: uma avaliação empírica", paper presented at the 33<sup>rd</sup> Encontro Nacional de Economia da ANPEC (Brazilian Association of Graduate Programs in Economics), Natal, available at: <http://www.anpec.org.br/encontro2005/artigos/A05A040.pdf>.
- Mendonça H.F. (2007), "Metas de inflação e taxa de juros no Brasil: uma análise do efeito dos preços livres e administrados", *Revista de Economia Política*, 27 (3), pp. 431-451.

- Mendonça H.F., Dezordi L.L. and Curado M.L. (2009), "A Determinação da Taxa de Juros em uma Economia sob Metas de Inflação: o caso brasileiro", in Oreiro J.L., de Paula L.F. and Sobreira R. (eds.), *Política Monetária, Bancos Centrais e Metas de Inflação: teoria e experiência brasileira* (pp. 165-186), Rio de Janeiro: Editora FGV.
- Minella A., Freitas P.S., Goldfajn I. and Muinhos M.K. (2003), "Inflation Targeting in Brazil: Constructing Credibility under Exchange Rate Volatility", *Journal of International Money and Finance*, 22 (7), pp. 1015-1040.
- Minsky H.P. (1986), *Stabilizing an Unstable Economy*, New Haven: Yale University Press.
- Minsky H.P. (1991), "The Financial Instability Hypothesis: a Clarification", in Feldstein M. (ed.), *The Risk of Economic Crisis* (pp. 158-166), Chicago: The University of Chicago Press.
- Mishkin F. (2005), "Is Financial Globalization Beneficial?", *NBER Working Paper*, n. 11891, Cambridge (MA): National Bureau of Economic Research.
- Nier E., Sedik T.S. and Mondino T. (2014), *Gross Private Capital Flows to Emerging Markets: Can the Global Financial Cycle Be Tamed?*, *IMF Working Paper*, n. 14/196, Washington (DC): International Monetary Fund.
- Orlik N. (2008), "The effects of external capital flows on developing countries", *International Journal of Political Economy*, 37 (4), pp. 90-102.
- Pasricha G., Falagiarda M., Bijsterbosch and Aizenmann J. (2015), "Domestic and Multilateral Effects of Capital Controls in Emerging Markets", *NBER Working Paper*, n. 20822, Cambridge (MA): National Bureau of Economic Research.
- Paula F., Fritz B., Prates D. (2017), "Keynes at the periphery: Currency hierarchy and challenges for economic policy in emerging economies", *Journal of Post Keynesian Economics*, 40 (2), pp. 183-202.
- Rey H. (2013), "Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence", paper presented at the Economic Policy Symposium, 21-23 August, Jackson Hole, in *Global Dimensions of Unconventional Monetary Policy* (pp. 285-333), Economic Policy Symposium Proceedings, Kansas City: Federal Reserve Bank of Kansas City, available at: <https://www.kansascityfed.org/publicat/sympos/2013/2013Rey.pdf>.
- Rogoff K. (1985), "The Optimal Degree of Commitment to an Intermediate", *Quarterly Journal of Economics*, 100 (4), pp. 1169-1189.
- Sicsú J. (2002), "Expectativas inflacionárias no regime de metas de inflação: uma análise preliminar do caso brasileiro", *Economia aplicada*, 6 (4), pp. 703-711.
- Sims C.A. (1990), *Macroeconomics and Reality. Modelling Economic Series*, Oxford: Clarendon Press.
- Sims C.A. (1988), "Bayesian Skepticism on Unit Root Econometrics", *Journal of Economic dynamics and Control*, 12 (2), pp. 463-474.
- Sims C.A. and Uhlig H. (1991), "Understanding Unit Rooters: A Helicopter Tour", *Econometrica*, 59 (6), pp. 1591-1599.
- Squeff G.C. (2009), "Repasse cambial 'reverso': uma avaliação sobre a relação entre a taxa de câmbio e IPCA no Brasil (1999-2007)", *Master's Degree Dissertation*, Universidade Estadual do Rio de Janeiro.
- Ülgen F. (2016), "Financial Liberalization as a Process of Flawed Institutional Change", *Journal of Economic Issues*, 50 (2), pp. 485-493.
- Walsh C.E. (1995), "Optimal Contracts for Central Bankers", *American Economic Review*, 85 (1), pp. 150-167.
- Wooldridge J.M. (2002), *Econometrics Analysis of Cross Section and Panel Data*, Cambridge (MA): MIT Press.