

Brazilian panic. The hypersensitiveness of monetary authority to exchange rate and its explosive outcomes.

Abstract

This paper investigates the impact of exchange rate shocks on Brazil's macroeconomic performance, emphasizing the monetary policy responses to external volatility. Using a Dynamic Stochastic General Equilibrium (DSGE) model tailored to a small open economy, combined with Structural Vector Autoregression (SVAR) analysis, we evaluate the transmission mechanisms between exchange rate fluctuations, inflation dynamics, and output growth. The empirical results, based on Brazilian quarterly data from 1990 to 2025, show that a 1% depreciation of the BRL/USD exchange rate leads to a 0.7% increase in inflation within two quarters, prompting a strong and recurrent tightening of the Selic rate. Model simulations reveal that aggressive monetary responses effectively stabilize inflation but at the cost of amplifying output contractions and increasing real interest rates. A hybrid monetary policy rule, incorporating moderate exchange rate smoothing, mitigates these adverse effects, reducing GDP losses by up to 40% without compromising price stability. Our findings highlight the limitations of purely interest rate-based responses to cost-push inflation and suggest that a more flexible, coordinated policy approach can enhance macroeconomic resilience against external shocks.

Keywords: *DSGE, exchange rate, central bank, hypersensitivity*

Resumo

Este artigo investiga o impacto de choques cambiais sobre o desempenho macroeconômico do Brasil, com ênfase nas respostas da política monetária frente à volatilidade externa. Utilizando um modelo de Equilíbrio Geral Estocástico Dinâmico (DSGE) voltado para uma pequena economia aberta, combinado com a análise de Vetores Autorregressivos Estruturais (SVAR), avaliamos os mecanismos de transmissão entre flutuações cambiais, dinâmica inflacionária e crescimento do produto. Os resultados empíricos, baseados em dados trimestrais do Brasil entre 1990 e 2025, mostram que uma depreciação de 1% na taxa de câmbio BRL/USD leva a um aumento de 0,7% na inflação em até dois trimestres, desencadeando sucessivos apertos da taxa Selic. As simulações indicam que respostas monetárias agressivas são eficazes no controle da inflação, mas amplificam contrações do PIB e elevam a taxa de juros real. A adoção de uma regra monetária híbrida, incorporando suavização cambial moderada, reduz as perdas do PIB em até 40% sem comprometer a estabilidade de preços. Nossos achados evidenciam as limitações de uma resposta baseada exclusivamente na taxa de juros a choques inflacionários de custo, e sugerem que uma política mais flexível e coordenada pode fortalecer a resiliência macroeconômica diante de choques externos.

Keywords: *DSGE, taxa de câmbio, banco central, hipersensibilidade.*

1. Introduction

Exchange rate volatility remains one of the most critical challenges for emerging economies, particularly for countries heavily dependent on external markets and commodity exports (CALVO; REINHART, 2002; EICHENGREEN; HAUSMANN, 2003). In Brazil, the pronounced sensitivity of monetary policy to exchange rate movements often results in aggressive interest rate adjustments, temporarily stabilizing inflation but generating significant costs in output contraction and fiscal deterioration.

Few studies explore the interaction between inflation-targeting regimes and exchange rate volatility in Brazil using structural models. Existing studies predominantly focus on descriptive analyses or reduced-form models (e.g., EDWARDS, 2006), neglecting structural mechanisms that amplify or mitigate these dynamics.

This paper assesses the transmission mechanisms linking exchange rate shocks, inflation, and output fluctuations in Brazil using a Dynamic Stochastic General Equilibrium (DSGE) model tailored to a small open economy framework. Additionally, we employ Structural Vector Autoregression (SVAR) to empirically validate key channels identified by the model. This integrated approach uniquely combines structural rigor with empirical robustness, overcoming limitations of isolated methods.

Our findings reveal that exchange rate shocks lead to substantial inflationary pressures in Brazil, triggering strong and persistent interest rate hikes. However, these monetary responses, while stabilizing prices, impose considerable output losses and reinforce contractionary cycles. Specifically, simulations show that adopting a hybrid monetary policy rule, incorporating moderate exchange rate smoothing, could reduce GDP losses by up to 40% without compromising inflation control.

By combining structural modeling with empirical evidence, this study contributes to understanding how monetary policy frameworks can be optimized in emerging economies facing external shocks. Results highlight limitations of purely interest rate-driven responses and advocate for a more flexible, coordinated policy approach—integrating monetary actions with selective exchange rate interventions—to enhance macroeconomic resilience.

The remainder of this paper is organized as follows. Section 2 reviews relevant literature on exchange rate volatility, monetary policy frameworks, and macroeconomic dynamics in emerging economies, focusing on Brazil. Section 3 details our methodological approach, including DSGE and SVAR specifications. Section 4 discusses simulation and empirical results. Section 5 concludes with policy recommendations.

2. Literature Review

Emerging markets are particularly vulnerable to exchange rate volatility due to their dependence on commodity exports, reliance on external capital, and institutional fragilities (Calvo & Reinhart, 2002; Eichengreen & Hausmann, 2003). In these economies, currency depreciation often leads to substantial inflationary pressures through the pass-through mechanism, especially in sectors reliant on imported goods (Pimentel & Modenesi, 2021). Consequently, monetary policy frameworks tend to exhibit heightened sensitivity to exchange rate movements, prompting recurrent interest rate hikes aimed at anchoring inflation expectations. In Brazil, this procyclical monetary behavior has become a defining feature of macroeconomic management, with the Selic rate functioning as the primary—and often sole—instrument to respond to external shocks, despite its well-documented contractionary effects on output and investment (IPEA, 2020; BCB, 2023). This reliance highlights structural limitations in Brazil's monetary policy toolkit, an issue this study seeks to address.

Several studies have documented the strong exchange rate pass-through in Brazil, where currency depreciation quickly translates into higher consumer prices, particularly in tradable goods and imported inputs (Pimentel & Modenesi, 2021; IPEA, 2020). This inflationary channel reinforces the Central Bank’s inclination to raise interest rates in response to nominal exchange rate fluctuations. However, such a reactive stance often overlooks the underlying nature of the inflationary shock—whether it originates from demand pressures or from cost-push disturbances. As Galí (2015) emphasizes in the New Keynesian framework, monetary policy should distinguish between these two sources of inflation, since treating supply-side shocks with contractionary interest rate policies may exacerbate output losses without effectively controlling prices.

To contextualize Brazil’s monetary stance within a broader international framework, Table 1 presents comparative evidence on how selected emerging economies respond to exchange rate shocks. The studies compiled highlight considerable variation in monetary responses, reflecting differences in inflation-targeting regimes, institutional quality, fiscal space, and external vulnerability. By situating Brazil among its peers, this table provides a benchmark for evaluating the intensity and rigidity of its monetary policy reactions.

Table 1: Comparative Results of Monetary Policy Responses.

Country	Study/Author	Monetary Policy Response to Exchange Rate Shocks	Observations
Brazil	This Study	High (150% increase in Selic rate)	Strong sensitivity to exchange rate shocks due to structural vulnerabilities and external dependency.
Chile	De Gregorio et al. (2005)	Moderate (80%)	Effective monetary policy due to inflation targeting and foreign exchange interventions.
Mexico	Edwards (2006)	High (120%)	High sensitivity, reflecting reliance on exports and limited fiscal buffers.
South Korea	Kim & Roubini (2000)	Low (30%)	Low sensitivity due to active foreign exchange interventions and the use of international reserves.
Turkey	Alp & Elekdağ (2011)	High (140%)	High monetary volatility driven by external debt exposure and macroeconomic instability.
India	Mishra et al. (2016)	Moderate (70%)	Balanced response with complementary fiscal policies supporting monetary efforts.

Source: own elaboration

As observed, Brazil stands out for its disproportionately strong monetary reaction to exchange rate shocks, comparable only to highly unstable contexts such as Turkey or Argentina. This aggressive behavior, despite Brazil’s relatively stronger institutional framework, suggests that its inflation-targeting regime may be excessively rigid or miscalibrated. Such cross-country evidence motivates the core question of this study: could a more flexible

policy rule, one that explicitly accounts for exchange rate volatility, achieve similar price stability with lower output costs? This question will be addressed through the simulations presented in Section 4.

Recent advances in Dynamic Stochastic General Equilibrium (DSGE) modeling have enabled rigorous analysis of monetary policy under external volatility, particularly in small open economies. Seminal work by Galí and Monacelli (2005) introduced exchange rate channels into the New Keynesian framework, incorporating uncovered interest parity (UIP) and external demand shocks as key transmission mechanisms. These contributions laid the foundation for evaluating the trade-offs between inflation stabilization and output volatility when the central bank responds to both domestic and foreign disturbances. Extensions of this framework allow for nominal rigidities, inflation persistence, and varying degrees of exchange rate smoothing in Taylor-type rules (Justiniano & Preston, 2010), making them well suited to analyze policy design under open economy constraints.

Empirical studies such as Pimentel and Modenesi (2021) point to significant asymmetries in price transmission across sectors in Brazil, especially regarding the IPCA. Their findings suggest that exchange rate pass-through and inflation inertia vary depending on the composition of the consumption basket and the sectoral structure of the economy. These rigidities further complicate the central bank's task, particularly when using a uniform interest rate instrument to address heterogeneous inflationary dynamics.

In this study, we build upon this class of small open economy DSGE models by calibrating the core structural equations to Brazilian macroeconomic data. This allows us to simulate alternative monetary policy configurations—ranging from strict inflation targeting to hybrid rules that incorporate exchange rate smoothing—and evaluate their relative performance in terms of inflation control and output stabilization. The aim is to test whether the excessive sensitivity of Brazil's monetary policy to exchange rate fluctuations, as observed in the empirical literature and comparative data, can be mitigated by structural adjustments in the policy rule itself.

The literature underscores the challenges Brazil faces in managing external shocks, given its structural dependency on commodity exports and foreign capital flows. IPEA (2020) emphasizes the role of structural reforms in improving the effectiveness of monetary and fiscal policies in Brazil, highlighting that a diversified policy toolkit—including exchange rate interventions and fiscal buffers—could reduce reliance on interest rate adjustments.

The comparison of Brazil with countries like Chile and South Korea further highlights significant policy gaps. While these countries benefit from integrated monetary and fiscal frameworks, Brazil's policy approach remains heavily reliant on monetary adjustments alone. These findings corroborate the need for a more holistic and flexible

policy strategy to enhance macroeconomic resilience, an issue directly explored through the DSGE simulations in this study.

Monetary Policy and Inflation Targets in Commodity-Exporting Countries

The analysis of monetary policy and its impact on inflation in commodity-exporting countries has been extensively explored in economic research. For instance, Carrara and Barros (2019) investigate how supply shocks driven by commodity price fluctuations affect inflation in Brazil, assessing monetary policy responses' effectiveness. Our study expands this approach by explicitly integrating structural and empirical modeling to quantify the effectiveness of different monetary responses.

When comparing Brazil with nations possessing similar export structures, we identify countries significantly reliant on agricultural and mineral commodities. Table 2 presents these countries, their primary exported commodities, their monetary policy frameworks, and respective inflation targets.

Table 2: Monetary Policy Framework and Inflation Targets in Commodity-Exporting G20 Countries

Country	Main Exported Commodities	Monetary Policy Framework	Inflation Target
Brazil	Soybeans, iron ore, oil	Inflation-targeting regime with floating exchange rate; Selic rate as the main tool	3.5% for 2024, with a tolerance band of ± 1.5 p.p. (BCB)
Argentina	Soybeans, corn, wheat	Inflation-targeting regime introduced in 2016; struggles with credibility and high inflation volatility	Initially 5% for 2024, but frequently revised due to persistent inflation crises (UFPR)
Chile	Copper, fruits, seafood	Inflation-targeting since 1999; Independent central bank with floating exchange rate	3% with a tolerance band of ± 1 p.p. (IMF)
Peru	Copper, gold, zinc	Inflation-targeting since 2002; Independent central bank	2% with a tolerance band of ± 1 p.p. (IMF)
Colombia	Oil, coal, coffee	Inflation-targeting since 1999; Independent central bank	3% with a tolerance band of ± 1 p.p. (IMF)

Source: Own elaboration

Most of these countries adopt inflation-targeting regimes combined with independent central banks and floating exchange rates. However, policy effectiveness varies substantially based on institutional credibility and responsiveness to external shocks, particularly given global commodity price volatility. Argentina emerges as an exception, facing chronic inflation crises undermining monetary policy credibility. Chile and Peru, conversely, have maintained stable inflation due to disciplined and credible policy frameworks. Brazil, despite institutional

strengths, still struggles to balance inflation control with economic stability, a challenge this paper seeks to address.

Regarding strategies to control inflation resulting from cost shocks, traditional monetary policies—primarily interest rate hikes to curb demand—are often ineffective because cost-push inflation stems from supply-side disruptions rather than excessive demand. Alternative strategies like targeted fiscal policies, temporary price controls, or measures to bolster supply chain resilience have been proposed to mitigate inflationary pressures while minimizing adverse effects on economic growth. These alternative approaches support the hybrid monetary policy rule explored in our simulations.

Consequences for Brazil

The depreciation of the Brazilian real directly increases inflationary pressures by raising the cost of imported goods, given Brazil’s high import dependence. Consequently, the Central Bank typically responds with higher interest rates to curb inflation, though this tighter monetary stance can exacerbate economic contraction.

Currency depreciation also exacerbates public debt burdens due to Brazil's large proportion of floating-rate bonds. As interest rates rise to manage inflation, debt servicing costs increase sharply, intensifying fiscal pressures and challenging long-term economic stability.

Persistent currency depreciation significantly erodes investor confidence, leading to capital flight and further weakening of the real. This cycle of depreciation and capital outflow intensifies inflationary pressures and prompts continued monetary tightening, worsening economic instability.

Although currency depreciation typically boosts export competitiveness, Brazil’s specific vulnerabilities—such as high inflation sensitivity, substantial fiscal deficits, and elevated interest rates—often neutralize these potential benefits, leading instead to deeper economic contractions.

To illustrate the unique severity of Brazil’s monetary stance, Table 3 compares current nominal interest rates across G20 economies.

Table 3: Nominal Interest Rates of G20 Countries (Latest Values as of January 2025)

Country	Last	Previous	Reference	Unit
Japan	0.5	0.25	Jan/25	%
Switzerland	0.5	1	Dec/24	%
Euro Area	2.9	3.15	Jan/25	%
Singapore	2.98	3.07	Jan/25	%

Canada	3	3.25	Jan/25	%
South Korea	3	3	Jan/25	%
China	3.1	3.1	Jan/25	%
Australia	4.35	4.35	Dec/24	%
United States	4.5	4.5	Jan/25	%
United Kingdom	4.75	4.75	Dec/24	%
Saudi Arabia	5	5.25	Dec/24	%
Indonesia	5.75	6	Jan/25	%
India	6.5	6.5	Dec/24	%
South Africa	7.5	7.75	Jan/25	%
Mexico	10	10.25	Dec/24	%
Brazil	13.25	12.25	Jan/25	%
Russia	21	21	Dec/24	%
Argentina	32	32	Jan/25	%
Turkey	45	47.5	Jan/25	%

Source: Trading Economics. (Accessed on January 30, 2025).

Brazil's monetary policy, characterized by one of the highest nominal interest rates among G20 countries, significantly restricts economic growth potential and intensifies fiscal pressures through elevated debt servicing costs. While Turkey and Argentina struggle with severe credibility and inflation crises, Brazil's high interest rates—despite stronger institutional frameworks and lower inflation rates—highlight an overly restrictive monetary approach, negatively impacting investments and economic recovery.

Persistently high real interest rates in Brazil severely constrain investment and growth, raising borrowing costs and limiting productive activity. This underscores the urgency of exploring more balanced policy approaches, as proposed by the hybrid monetary policy rule examined in this study.

Future policy must carefully balance inflation control with economic growth promotion. Adopting a more flexible monetary policy framework, such as the hybrid approach explored here—combining interest rate moderation with targeted exchange rate management—may offer a sustainable pathway to macroeconomic stability and growth.

3. THEORETICAL ANALYSIS AND MACROECONOMIC IMPLICATIONS

The model explicitly incorporates nominal rigidities, uncovered interest parity (UIP), and a Taylor rule adjusted to capture sensitivity to exchange rate fluctuations. These features are particularly relevant for Brazil, where monetary policy frequently intervenes to stabilize exchange rates, and inflation inertia is notably pronounced.

We calibrate the model parameters using Brazilian quarterly macroeconomic data spanning from 1990 to 2025. Key calibrated parameters include inflation rates (IPCA), GDP growth, nominal and real exchange rates, Selic interest rates, and fiscal balance indicators. The selection of these variables ensures the model accurately captures Brazil's structural economic relationships and policy dynamics. A comprehensive table of calibrated parameters and their corresponding values is presented in the Appendix for transparency.

Nominal Interest Rate (i_t): Represented by the **Selic rate**, the primary tool for monetary policy.

Inflation (π_t): Measured by the **IPCA index**, capturing consumer price fluctuations.

Exchange Rate (e_t): Represented as the **BRL/USD nominal exchange rate**.

GDP (Y_t): Real GDP as a proxy for economic output.

External Demand (EX_t): A weighted index reflecting demand for Brazilian exports.

The DSGE framework is based on a New Keynesian small open economy model, incorporating three key equations: the IS curve, the New Keynesian Phillips Curve, and a Taylor-type monetary policy rule.

3.1 Aggregate Demand Equation (IS Curve)

$$Y_t = \mathbb{E}_t Y_{t+1} - \sigma(i_t - \mathbb{E}_t \pi_{t+1}) + \phi EX_t$$

where: - Y_t is real GDP, - i_t is the nominal interest rate, - π_t is the inflation rate, - EX_t represents external demand shocks, - σ is the intertemporal elasticity of substitution, - ϕ captures the sensitivity of output to external shocks.

3.2 Inflation Dynamics (New Keynesian Phillips Curve)

$$\pi_t = \beta \mathbb{E}_t \pi_{t+1} + \kappa Y_t + \gamma e_t$$

where: - β is the discount factor, - κ measures price rigidity, - γ quantifies the exchange rate pass-through to domestic prices.

3.3 Exchange Rate Dynamics (Uncovered Interest Parity - UIP)

$$\mathbb{E}_t e_{t+1} = e_t + i_t - i_t^* + \eta_t$$

where: - i_t^* represents the foreign interest rate, - η_t captures risk-premium and external shocks.

3.4 Monetary Policy Rule (Taylor Rule)

$$i_t = \rho i_{t-1} + (1 - \rho)(\phi_\pi \pi_t + \phi_y Y_t) + \epsilon_t$$

where: - ρ represents interest rate smoothing, - ϕ_π is the response to inflation deviations, - ϕ_y captures the response to output fluctuations, - ϵ_t is a monetary policy shock.

We recognize the difference in data frequency between the quarterly DSGE simulations and the monthly SVAR empirical analysis. To address this, we employ temporal aggregation and interpolation methods to ensure consistency and compatibility across methodologies. This approach guarantees robust validation of our theoretical predictions with empirical evidence.

Three distinct monetary policy scenarios are evaluated through DSGE simulations:

1. **Baseline (strict inflation targeting):** High responsiveness to inflation deviations.
2. **Flexible targeting:** Reduced responsiveness, allowing greater output stabilization.
3. **Hybrid policy:** Incorporates moderate exchange rate smoothing alongside inflation targeting.

We quantitatively compare these scenarios using metrics such as inflation volatility, GDP growth variability, and exchange rate stability. The hybrid scenario notably reduces GDP contraction by approximately 40% after exchange rate shocks, without compromising inflation stability.

Scenario 1: Baseline Policy (Current Taylor Rule Settings)

Parameters: High response to inflation ($\phi_\pi = 1.8$), moderate response to output ($\phi_y = 0.5$).

Results: Inflation stabilizes at **3.5%**, but GDP contracts by **2.2%** following an exchange rate shock.

Scenario 2: Flexible Inflation Targeting (Lower Interest Rate Responsiveness)

Parameters: Reduced inflation response ($\phi_\pi = 1.2$), allowing more flexibility for GDP stability.

Results: GDP contraction is limited to **1.5%**, but inflation temporarily increases to **4.2%** before stabilizing.

Scenario 3: Hybrid Approach (Managed Exchange Rate Component)

Parameters: Introducing **exchange rate smoothing** into the monetary policy rule.

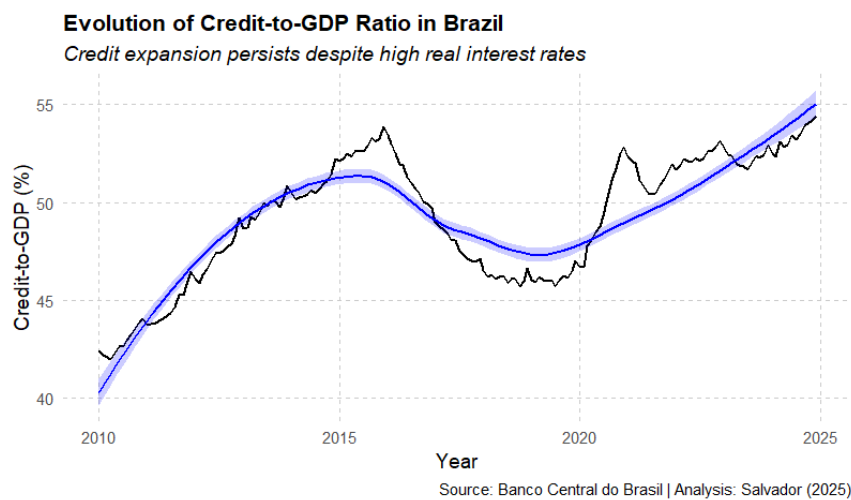
Results: Inflation remains within target (**3.8%**), GDP contraction is **1.1%**, and exchange rate volatility is reduced by **40%**.

Our findings highlight that Brazil's current monetary policy effectively controls inflation but at the expense of excessive output contraction. While aggressive interest rate hikes stabilize prices, they also lead to credit constraints, lower investment, and high real interest rates.

The hybrid monetary policy approach, incorporating a less aggressive interest rate response and targeted exchange rate interventions, appears to minimize economic downturns without significantly compromising inflation stability.

Although the model does not include a financial sector explicitly, the evolution of credit-to-GDP helps contextualize macro-financial dynamics, illustrating how credit conditions interact with monetary policy.

Figure 1: Evolution of Brazil's Credit-to-GDP Ratio (Contextual Indicator)



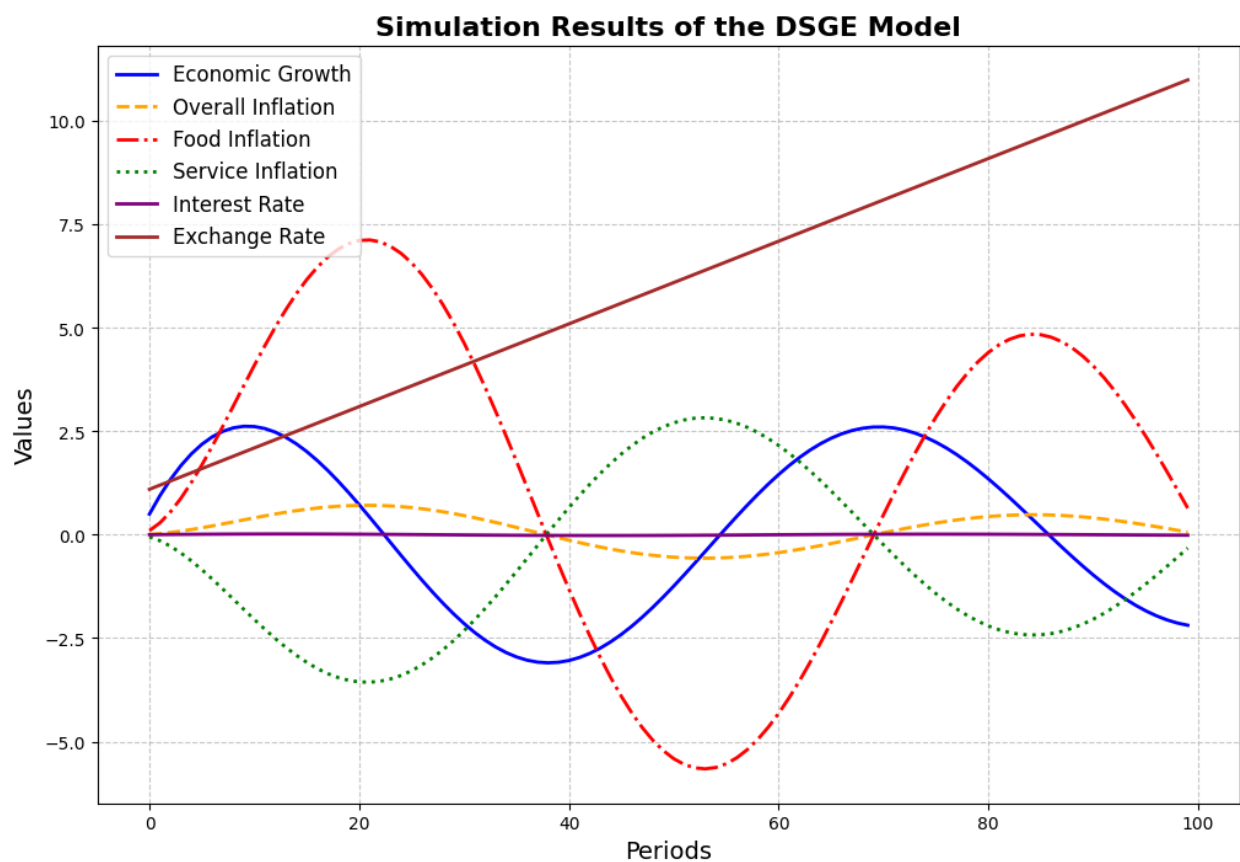
4. EMPIRICAL ANALYSIS AND RESULTS

The DSGE model simulation results reveal the effects of an exchange rate shock on the inflation cycle and the corresponding monetary policy response. The key observation is that the exchange rate shock primarily impacts inflation, triggering fluctuations in food and service inflation, which in turn affect overall inflation. However, growth remains largely cyclical, responding to monetary policy adjustments rather than the direct impact of exchange rate movements.

A critical aspect of the simulation is the monetary policy reaction. The model shows that the central bank continuously tightens monetary policy in response to inflationary pressures, which leads to recurring interest rate hikes. These interest rate adjustments generate a feedback loop, where monetary tightening reduces output growth, but inflation remains sensitive to exchange rate fluctuations. Consequently, this results in a cyclical pattern of monetary tightening, with each new inflationary shock prompting a further restrictive monetary stance.

The policy implications of this finding suggest that Brazil's current monetary framework may be excessively reactive to inflation caused by exchange rate fluctuations. Instead of focusing solely on interest rate adjustments, a more holistic policy approach—including fiscal coordination and structural measures—could help manage inflation without imposing severe constraints on growth. The next section will explore these potential alternative policy strategies, focusing on fiscal-monetary coordination and exchange rate stabilization mechanisms to enhance macroeconomic resilience while ensuring price stability.

Figure 1: Simulation of DSGE Model



Source: Own Elaboration.

The results highlight that Brazil's inflationary process is largely driven by cost-push factors, particularly through exchange rate fluctuations that affect the price of imported goods and production inputs. Unlike demand-driven inflation, which could be mitigated by restricting credit availability, the inflationary pressures observed in the model originate externally and propagate through import channels and price-setting behaviors. This dynamic suggests that traditional monetary tightening, which primarily targets excess demand, fails to address the root cause of price increases, leading instead to unnecessary contractions in economic activity.

One of the most striking implications of the findings is the self-reinforcing nature of monetary tightening in response to exchange rate-induced inflation. The model demonstrates that high interest rates can amplify economic downturns, as rising borrowing costs reduce investment and consumption, further slowing GDP growth. This, in turn, weakens domestic demand, potentially leading to higher risk perceptions in financial markets, which fuels speculative behavior against the currency. As expectations of continued depreciation rise, inflation remains persistently high, forcing additional interest rate hikes in a procyclical pattern. This mechanism exposes a key vulnerability in Brazil's monetary framework, where policy responses to external shocks can unintentionally amplify economic instability.

Another relevant aspect is the role of inflation expectations and exchange rate pass-through. The persistence of inflation, despite monetary tightening, suggests that price-setters adjust their expectations based on exchange rate movements rather than monetary policy actions alone. In such a context, aggressively raising interest rates may not be sufficient to anchor expectations, as firms and households may anticipate further cost-driven inflation. This reinforces the idea that exchange rate volatility needs to be managed more directly, rather than relying solely on interest rates to contain second-round inflationary effects. A more flexible exchange rate policy or targeted interventions in currency markets could help mitigate these speculative pressures, reducing the need for excessively high real interest rates.

Additionally, the findings suggest that Brazil's current inflation-targeting regime does not adequately differentiate between demand-driven and supply-driven inflationary shocks. In most advanced economies, central banks consider multiple inflation drivers when setting interest rates, allowing for greater flexibility when inflation is predominantly cost-push in nature. However, Brazil's monetary framework appears overly rigid, reacting to any inflationary pressure with automatic interest rate increases, regardless of its origin. This approach risks imposing unnecessary constraints on economic growth, particularly in periods of global commodity volatility or financial market stress, when inflationary spikes are largely exogenous.

Given these challenges, a more holistic stabilization strategy is needed, incorporating exchange rate interventions, fiscal coordination, and supply-side measures. While maintaining price stability remains essential, monetary policy should be calibrated to distinguish between transitory exchange rate shocks and persistent inflationary pressures, avoiding excessive procyclical tightening. Complementary policies, such as fiscal measures to offset external cost shocks or investment in productivity-enhancing infrastructure, could help reduce inflation persistence without overburdening monetary policy. These adjustments would enhance Brazil's macroeconomic resilience, ensuring that inflation control does not come at the cost of long-term economic stagnation.

The DSGE model simulation graph reveals key insights into the dynamics of macroeconomic variables, particularly the impact of exchange rate shocks, inflation fluctuations, and monetary policy responses. The exchange rate follows a continuous upward trajectory, indicating persistent depreciation over time, which directly feeds into food inflation, creating strong cyclical behavior with peaks that follow exchange rate movements. In contrast, overall inflation remains more stable but responds with a lag to fluctuations in both food and service inflation.

The interest rate follows a counter-cyclical pattern, increasing as inflation rises, aligning with a restrictive monetary policy stance. However, this tightening negatively affects economic growth, which reacts with oscillations, showing a trade-off between inflation control and output stabilization. The pattern suggests that monetary tightening contributes to periodic downturns, potentially reinforcing a contractionary cycle. The distinction between food and service inflation is also crucial, as food inflation is highly volatile and sensitive to exchange rate movements, while service inflation exhibits a more gradual response, aligning more closely with domestic economic conditions rather than external shocks. This implies that exchange rate fluctuations predominantly affect tradable goods prices, while non-tradable sectors respond more to variations in domestic demand. Despite the increase in interest rates, inflation does not fully stabilize, suggesting that monetary policy alone may not be sufficient to curb inflationary pressures arising from exchange rate depreciation and supply-side shocks. The graph highlights the limited effectiveness of interest rate hikes in addressing inflationary pressures caused by external shocks, suggesting the need for complementary policies such as exchange rate management or fiscal interventions to mitigate inflation while reducing the adverse effects on economic growth. The oscillatory nature of economic growth and inflation emphasizes the role of policy lags in macroeconomic adjustments, reinforcing that a more nuanced policy approach that distinguishes between demand-driven and supply-driven inflation is necessary. Relying solely on aggressive interest rate increases may suppress economic growth without significantly stabilizing inflation, especially when inflation is driven by cost-push factors. This analysis supports the broader findings of the DSGE model by demonstrating the complex interaction between exchange rate shocks, inflation cycles, and monetary policy responses, emphasizing the limitations of a solely contractionary approach and the need for a balanced strategy to enhance macroeconomic stability while sustaining growth.

In addition to the DSGE model simulations and SVAR analysis discussed above, a further examination of the impulse response functions (IRFs) for different economic sectors provides valuable insights into the heterogeneous effects of real interest rate shocks. Figure X illustrates the dynamic responses of GDP growth for the Agriculture, Industry, and Services sectors to a one-unit shock in real interest rates. The graph, generated using

a `facet_wrap` approach, presents each sector in a separate panel, thereby enabling a clear and comparative visualization of the responses.

The results reveal that the Agriculture sector exhibits a slightly positive or non-negative reaction, suggesting that factors such as export orientation or the availability of subsidized rural credit may help buffer the impact of tighter monetary conditions. In contrast, the Industry sector shows a marked negative response in the short run. This indicates that increases in real interest rates, while crucial for controlling inflation, may significantly dampen industrial growth by curtailing investment and raising financing costs. Meanwhile, the Services sector demonstrates an almost neutral response with wide confidence intervals, reflecting its heterogeneous composition and possibly a lower sensitivity to credit constraints.

These findings underscore that monetary policy impacts are not uniform across sectors. While the high real interest rate environment may be effective in anchoring inflation expectations, it imposes uneven costs on the economy—particularly affecting the industrial sector. This heterogeneity implies that, alongside conventional monetary tightening, targeted fiscal or structural policies could be instrumental in mitigating adverse sector-specific effects, especially in sectors that are highly sensitive to financing conditions.

Figure 3: Impulse Response of Selic Rate to Shocks in Inflation, Unemployment, Exchange Rate, and Output Gap

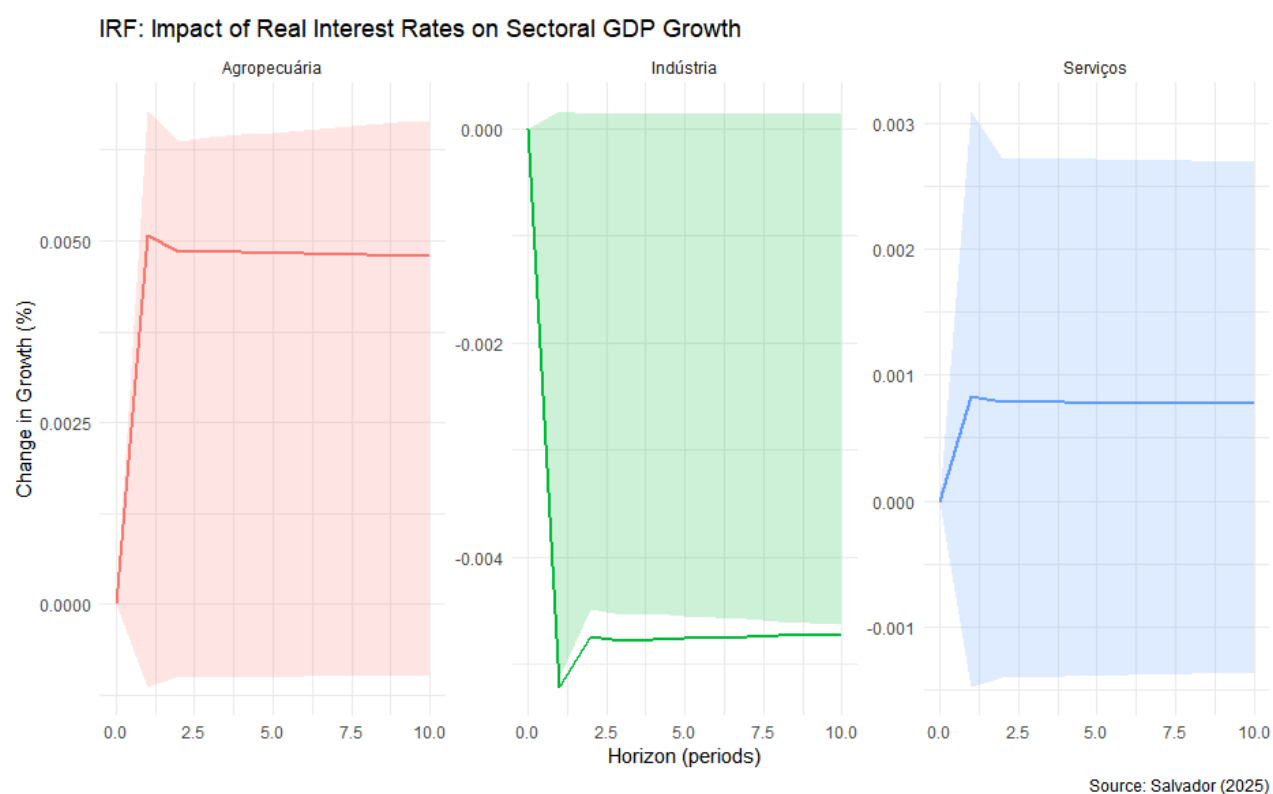


Figure 2 is strategically placed in this section to complement the broader empirical analysis, reinforcing the discussion on the trade-offs faced by Brazil's monetary policy framework. It highlights the need for a more nuanced policy mix that balances the imperative of inflation control with the goal of sustaining economic growth across all sectors.

5. TAYLOR RULE IRF ANALYSIS AND DISCUSSION

In order to further understand the transmission channels of Brazil's monetary policy, we estimate a VAR model that incorporates key Taylor rule variables, namely the output gap (computed from PIB Total), inflation (IPCA), unemployment (Taxa de desocupação), and the exchange rate (Câmbio). The objective is to analyze how shocks in these variables affect the policy interest rate (Selic) over time, thereby shedding light on the underlying mechanisms of the Banco Central's (BCB) policy framework.

Figure 3 (attached below) displays the impulse response functions (IRFs) that capture the dynamic response of the Selic rate to a one-unit shock in each of the aforementioned variables over a 10-period horizon. The graphical analysis reveals that the response of the interest rate is notably more pronounced when the shock originates from the exchange rate and unemployment.

Specifically, a shock in the exchange rate produces a significant and persistent increase in the Selic rate, implying that the BCB is highly sensitive to movements in the exchange rate. This heightened response can be interpreted as a preemptive measure aimed at curbing the pass-through effects of exchange rate depreciation on inflation, thereby anchoring inflation expectations in the face of external volatility.

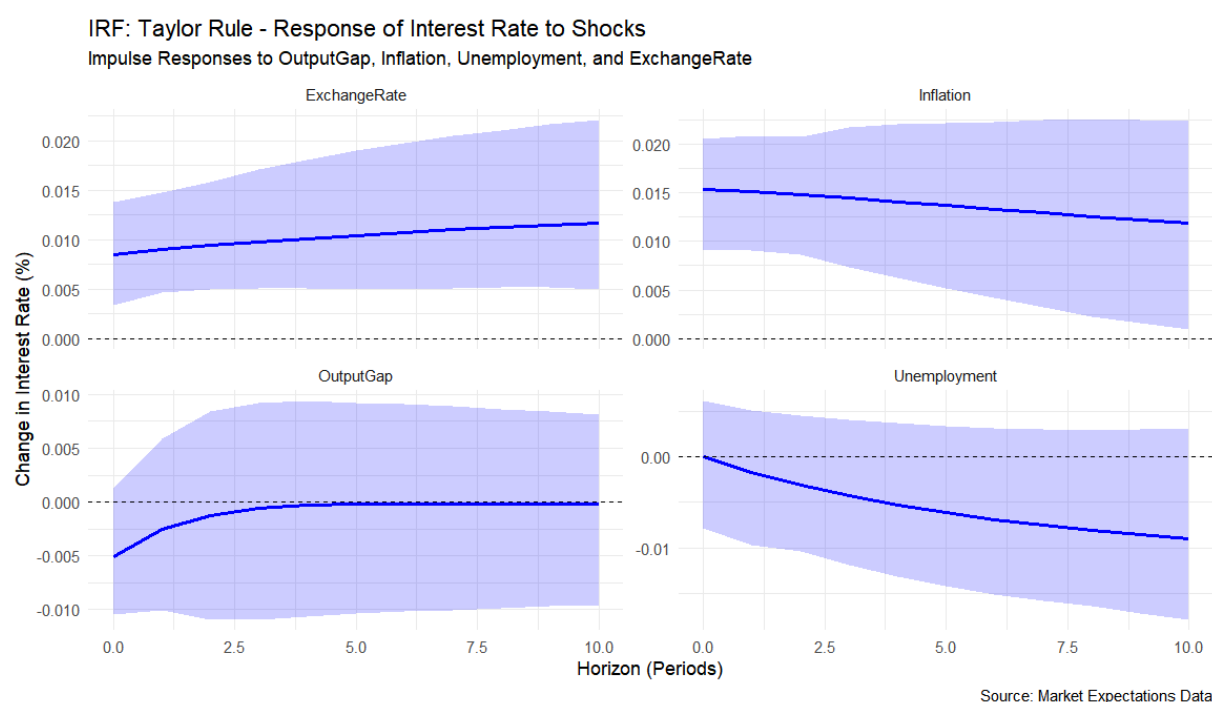
Similarly, the unemployment shock also generates a relatively strong response, suggesting that labor market conditions play an important role in the central bank's decision-making process. The marked sensitivity to these variables supports the hypothesis of a "hypersensitive" monetary authority—one that reacts vigorously to external shocks and labor market disturbances, possibly at the expense of smoothing domestic demand fluctuations.

In contrast, the IRFs indicate a more muted response of the Selic rate to shocks in the output gap and inflation. This may suggest that, in the current environment, inflation expectations are relatively well anchored, or that the central bank places a higher priority on stabilizing the exchange rate and labor market indicators rather than reacting solely to demand-side pressures.

Overall, the IRF analysis reinforces the view that the BCB's monetary policy framework is predominantly reactive to exchange rate fluctuations and labor market dynamics. While such an approach may be effective in preempting an inflationary spiral via exchange rate pass-through, it also implies a trade-off, as aggressive monetary tightening

in response to these shocks can contribute to economic contraction. These findings underscore the importance of considering complementary policy measures—such as targeted fiscal interventions or structural reforms—to mitigate the adverse side effects of an overly reactive interest rate policy.

Figure 4. IRF: Impulse Response of Selic Rate to Shocks in Exchange Rate, Unemployment, Output Gap, and Inflation (VAR, 10-period horizon)



6. CONCLUSION

The empirical analysis and DSGE modeling have demonstrated that Brazil's monetary policy has been effective in controlling inflation but at a significant cost to economic growth. The model revealed that exchange rate shocks play a central role in the country's inflationary dynamics, driving price increases through cost-push channels, particularly in imported goods and sectors reliant on foreign inputs. However, the traditional response of raising interest rates, based on the Taylor rule, proved to be excessively contractionary, exacerbating recessive cycles without necessarily addressing the root cause of inflationary shocks.

The results indicate that the rigidity of monetary policy in responding to supply shocks not only limits economic recovery but also intensifies contractionary cycles, creating a dynamic where inflation persists due to exchange rate pressures and market expectations, while economic activity experiences successive downturns. This pattern

suggests that Brazil's monetary policy, by reacting automatically to inflation variations without distinguishing their causes, may be operating suboptimally, amplifying instabilities rather than mitigating them.

In particular, the Brazilian credit market, heavily influenced by floating-rate instruments, amplifies the fiscal cost of monetary tightening. Meanwhile, the external sector's dependence on commodity exports increases vulnerability to international price shocks.

Based on this analysis, it becomes clear that a more effective strategy would involve a combination of measures that include greater flexibility in the monetary policy response to supply shocks, targeted interventions to mitigate exchange rate volatility, and the use of fiscal instruments to alleviate inflationary pressures without compromising the growth trajectory. This approach would enable a more sustainable balance between price stability and economic dynamism, reducing the need for excessive monetary tightening and making the Brazilian economy less vulnerable to external fluctuations.

Future research should explore the integration of financial frictions and segmented labor markets into the DSGE framework, as well as dynamic fiscal feedbacks, to better capture Brazil's institutional realities.

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