Default Risk Information and the Exchange Rate Puzzle in Brazil

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Abstract

This paper investigates the role of default risk information in explaining the exchange rate puzzle: depreciation of the nominal exchange rate following a monetary policy interest rate hike. Using financial market data and the IV-BVAR methodology, the findings reveal that when default risk information is excluded from interest rates, a contractionary monetary policy shock instead results in a nominal exchange rate appreciation.

Keywords— IV-BVAR, Monetary Policy, Default Risk, Exchange Rate Puzzle.

1 Introduction

In recent decades, many emerging economies have officially adopted inflation-targeting frameworks. Despite this shift, the literature on monetary policy transmission and its impact on macroeconomic variables has predominantly focused on advanced economies. Recently, however, researchers have been growing interest in examining these dynamics within emerging markets. The structural and institutional complexities of emerging economies often undermine the effectiveness of the interest rate as a standalone monetary policy instrument (Cordella & Gupta, 2015; Frankel, 2010; Vegh et al., 2017). One notable challenge is the behavior of exchange rates in response to unexpected changes in monetary policy interest rates. Unlike in advanced economies, where higher short-term interest rates generally lead to currency appreciation, emerging markets often exhibit the opposite reaction, with currencies tending to depreciate following such policy adjustments (Kim & Lim, 2022).

Using data from Brazil, this paper shows that interest rate increases partially transmit information about rising default risk and it is this information channel that causes the depreciation after an increase in the interest rate. In contrast, surprising increases

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in the interest rate not related to default risk, lead to an appreciation of the currency. That is, the Central Bank's decision to raise interest rates is partly driven by inflationary pressures linked to default risk, which may arise from factors such as fiscal policy dynamics or unexpected risk perceptions. Importantly, data suggests that the central bank has more information on default risk and this information becomes public through the central bank's official announcement, released alongside the monetary policy interest rate decision. As a result, the study highlights that exchange rate fluctuations are influenced not only by monetary policy stance but also by evolving perceptions of risk.

As an illustrative example of the mechanism, consider the following paragraph that appears for the first time in the minutes of the Copom[1] meeting on October of 2015:

"...However, the Committee notes that the lack of definition, the significant changes in the trajectory of primary surpluses, as well as in its composition, impact the working hypotheses considered for inflation projections and contribute to create a negative perception regarding of the macroeconomic environment. Regarding inflation control, the Committee highlights that the literature and the best international practices recommend a consistent and sustainable fiscal policy framework, in order to allow monetary policy actions to be fully transmitted to prices. ...".

After this meeting, the 5-year credit default swap of Brazilian government bonds (which is a measure of default risk) increased 18,4 basic points in one day.

This study employs a high-frequency identification approach to differentiate conventional monetary policy shocks from those driven by shifts in default risk. This method uses financial market data around monetary policy meetings, focusing on fluctuations in the risk premium of 10-year zero-coupon government bonds and credit default swaps. By examining the relationship between unexpected changes in the monetary policy interest rate and concurrent variations in these risk indicators, the analysis identifies unanticipated changes in the interest rates influenced by default risk information. A monetary policy contraction influenced by default risk is an increase in the monetary policy interest rate that coincides with an increase in the risk variable around the policy meeting.

The results show that the nominal exchange rate typically depreciates following an increase in the interest rate linked to default risk information. In contrast, when the effects of the information channel are excluded from the unanticipated increase in the interest rate, the domestic currency appreciates in response to the shock. Notably, a comparable pattern is observed in other Latin American economies, including Chile and Colombia.

The exchange rate puzzle was first examined in the seminal work of Grilli and Roubini (1995), which documented that nominal exchange rates in non-US G7 countries tend to depreciate against the US dollar following an interest rate hike. More recent studies have extended this investigation to emerging markets, finding similar patterns. For example, Hnatkovska et al. (2016), using short-run restrictions in a VAR framework, demonstrate that unexpected interest rate increases lead to currency depreciation in emerging

[1]Monetary Policy Committee of the Central Bank of Brazil.

economies, contrasting with the appreciation observed in advanced economies. Similarly, Kim and Lim (2022) employ sign restrictions to identify monetary policy shocks and confirm the depreciation of domestic currencies in seven emerging markets following such shocks. High-frequency identification methods have also been applied in related studies. For instance, Kohlscheen (2014) analyzes inter-day interest rate changes in Brazil and uncovers several unexpected monetary policy responses, including the exchange rate puzzle.

Explanations for this behavior in emerging markets have been mainly focused on theoretical models. Hnatkovska et al. (2016) develop a theoretical model attributing these differences to variations in liquidity demand. Alberola et al. (2021) propose a framework emphasizing the role of fiscal regimes in shaping the transmission of monetary policy to exchange rates. Their analysis reveals that when government debt lacks credible future fiscal surpluses, contractionary monetary policy shocks can lead to currency depreciation, driven by heightened concerns over debt sustainability. These findings highlight the intricate interplay between monetary and fiscal policies and their joint effects on exchange rate dynamics in emerging markets. Finally, Arellano et al. (2020) introduce a sovereign default model with monetary policy calibrated to the Brazilian economy, offering a theoretical explanation for the exchange rate depreciation. Building on this line of research, the present paper emphasizes the critical role of default risk information in understanding currency depreciation after increases in monetary policy. However, unlike the theoretical research, this work adopts an empirical approach, leveraging financial market data to demonstrate the significance of default risk in shaping exchange rate dynamics.

To the best of my knowledge, this paper is the first to empirically examine the exchange rate puzzle in emerging economies through the lens of a default risk information channel. Two closely related studies are Pirozhkova et al. (2024) and Checo et al. (2024). The former emphasizes country risk shocks as a key mechanism through which monetary policy affects the broader macroeconomy in South Africa, showing that these shocks lead to a depreciation of the South African rand against the US dollar and the Euro. By employing principal component analysis (PCA), the authors decompose various components of monetary policy shocks and identify country risk as a critical transmission channel for monetary policy in emerging markets. The latter study adopts an approach that orthogonalizes unanticipated monetary policy changes using lags of a broader set of macroeconomic variables, drawing on insights from Cieslak (2018), Miranda-Agrippino and Ricco (2021), and Bauer and Swanson (2023). Their findings suggest that, when orthogonalized monetary policy shocks are used, the exchange rate puzzle disappears in emerging economies. In contrast, this paper takes a different approach: rather than employing PCA or orthogonalizing shocks with lagged macroeconomic variables, it leverages high-frequency changes in financial markets to isolate default risk information-driven monetary policy shocks. This perspective interprets the default risk information channel as reflecting private information held by central banks prior to its disclosure, offering new insights into how informational asymmetries influence exchange rate dynamics.

The paper is organized as follows: Section 2 outlines the empirical methodology used to disentangle the effect of information in monetary policy shocks and their transmission to macroeconomic variables. Section 3 presents and discusses the data and key results, while Section 4 provides robustness checks. Section 5 interprets the findings within the framework of a medium-scale small-open economy, and Section 6 offers concluding remarks.

2 Empirical Strategy

In this study, I use an Instrumental Variable Bayesian Vector Autoregression model (IV-BVAR) to identify and quantify the impact of macroeconomic variables in response to unanticipated increases in interest rate, both with and without default risk information. This section provides a comprehensive explanation of the methodology used to construct proxy variables for these two distinct types of shocks, based on data from the survey of professional forecasters and financial markets.

The first step involves constructing variables of unanticipated interest rate changes, both with and without the default risk component. To do this, I rely on information drawn from the survey of professional forecasters and financial market data. The next focus of this section is to explain how these proxy variables are employed as instrumental variables within the IV-BVAR framework. These instruments facilitate the identification of Impulse Response Functions (IRFs), which are then used to analyze the responses of various macroeconomic variables to the specified shocks.

2.1 Information in Monetary Policy Interest rate

The construction of instruments follows a conceptual framework similar to the approaches of Cieslak and Schrimpf (2019), Kerssenfischer (2019), and Jarociński and Karadi (2020). These studies highlight the importance of considering the reaction of financial markets after monetary policy meetings as a key source of the information channel for monetary policy shocks. The identification process relies on two essential components:

1. **Unanticipated Changes in Interest Rate:** This variable captures the unexpected adjustments in interest rates that occur in the aftermath of monetary policy announcements.

2. **Information on Financial Assets Reflecting Risk Perception Differences:** This variable uses financial asset data to capture risk perception shifts immediately following monetary policy announcements. It enables the differentiation between monetary policy shocks that include default risk information and those that do not, allowing for a clearer understanding of how risk perceptions influence monetary policy transmission.

The methodology generates two orthogonal shocks using both components: one linked to monetary policy changes that incorporate default risk information, and the other associated with monetary policy shocks that exclude such information. This analytical framework facilitates a clear distinction between the effects of these two types of shocks, enhancing the understanding of how macroeconomic variables and exchange rates respond to both monetary policy and default risk.

In the initial step of the analysis, I use the "Survey of Informed Expectations" for the most recent 30 days to construct a time series for the unanticipated change in the policy rate. This survey, conducted by the Central Bank of Brazil, serves as a key tool for monitoring and assessing the expectations of professional forecasters about the Selic rate, which is the policy interest rate to be set at the upcoming monetary policy meeting.[2] To calculate the unanticipated change in the interest rate, denoted as S_t, I compute the difference between the actual Selic rate announced after each monetary policy meeting and the anticipated value of the rate. The anticipated rate is derived as the average of the professional forecasters' responses recorded on the day before the meeting.

In the second step, I compute the changes in risk premia surrounding the monetary policy meetings. De Leo et al. (2022) highlight that market interest rates, particularly those associated with government bonds, provide critical information about default risk in emerging markets. To measure changes in risk perception, I use the yields of the Brazilian government's 10-year zero-coupon bonds following each monetary policy meeting. This approach aligns with the strategy employed by Cieslak and Schrimpf (2019) in their research on advanced economies. The use of long-term interest rates allows for a more comprehensive evaluation of shifts in risk perception, ensuring that the analysis captures the full range of information embedded in these financial assets.

I assume that financial markets incorporate all available information into asset prices. As a result, the risk premium immediately following the monetary policy meeting is calculated as the difference between the yield on zero-coupon bonds and the Selic rate, which represents the short-term, risk-free interest rate in the economy. The risk premium just before the meeting is determined by the difference between the yield on zero-coupon bonds and the anticipated value of the Selic rate. This approach is grounded in the efficient markets hypothesis, which asserts that financial markets reflect all available information in asset prices at any given time.

Let v_t represent the change in the risk premium around a central bank announcement, rp_{t+1} denote the risk premium, i_t^T be the yield on zero-coupon bonds, and i_t^p the monetary policy interest rate.

$$v_t = rp_{t+1} - rp_{t-1} = (i_{t+1}^T - i_{t+1}^p) - (i_{t-1}^T - E_{t-1}[i_t^p]) = (i_{t+1}^T - i_{t-1}^T) - S_t \qquad (1)$$

This is the difference between the 10-year zero-coupon yield of Brazilian government bonds one day after the meeting and its value one day before, adjusted for the unexpected policy interest rate increase.[3]

Figure 1 presents a scatter plot comparing the variables S_t and v_t, highlighting the relationship between unanticipated increases in the policy interest rate (S_t) and shifts in

[2]The survey is conducted daily and is available up until the day before the meeting.

[3]Most studies that use high-frequency strategies to identify shocks typically rely on a narrower window around the announcement (Cesa-Bianchi et al., 2020; Gertler & Karadi, 2015; Miranda-Agrippino & Ricco, 2021). However, this approach is not feasible in Latin American economies, as financial markets are often closed at the time of the announcement. For further details, see Kohlscheen (2014).

risk perception (v_t). Notably, the plot exhibits a negative slope. This suggests that, in the absence of an overreaction in long-term government yields to positive values of S_t, there should be a negative relationship between the two variables.

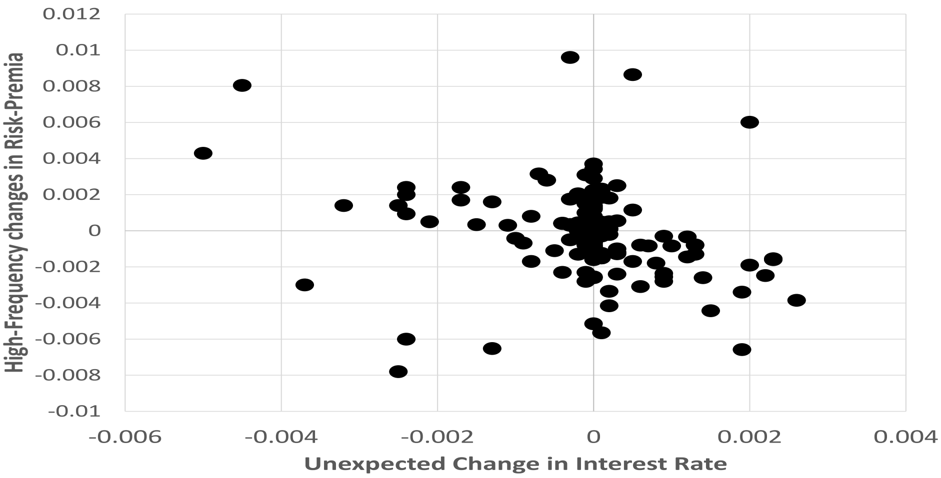

Figure 1: Scatter plot of S_t and v_t around monetary policy announcements.

To isolate the portion of the unanticipated interest rate increases attributed to default risk information (i.e., the part of the central bank's rate hike linked to default risk), I employ the procedure proposed by Jarociński and Karadi (2020). This procedure posits that the unanticipated interest rate increase can be decomposed into two orthogonal shocks: one associated with risk information (u_t^r) and the other containing unexpected innovations unrelated to risk information (u_t^M). The identification of these shocks relies on the information embedded in v_t and adheres to the sign restrictions outlined in Table 1. Specifically, u_t^r is expected to exhibit positive correlations with both v_t and S_t, while u_t^M should display a negative correlation with v_t and a positive correlation with S_t.

Figure 2 presents the series for S_t, u_t^r, and u_t^M. These variables are then used in the subsequent IV-BVAR analysis to identify the response of macroeconomic variables to MPS_t.

Variable	u_t^M	u_t^r
S_t	+	+
v_t	-	+

Table 1: Sign restrictions to identify unexpected innovations that are related to default risk information (u_t^r) and unexpected innovations not related to default risk information u_t^M.

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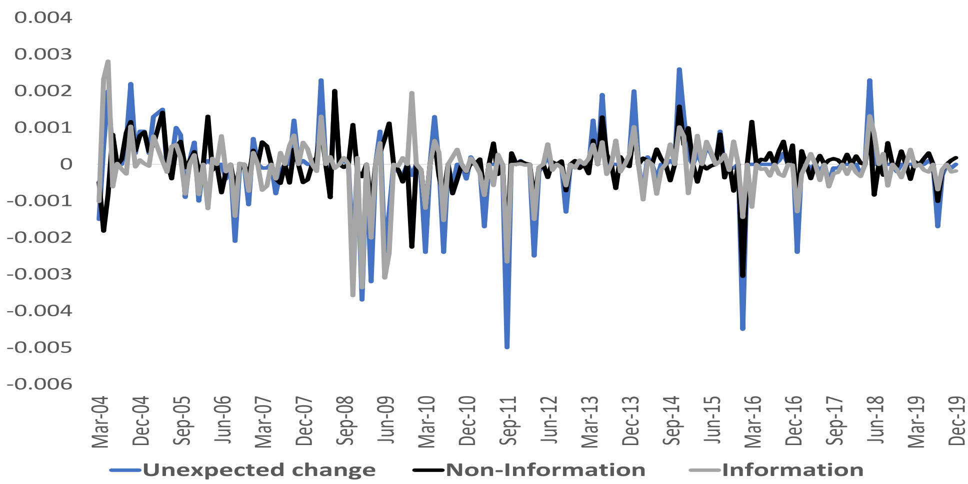

Figure 2: Unexpected increases in the interest rate S_t, The part that is not related to default risk information u_t^M and the part of the unexpected increase that is related to information u_t^r

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2.2 Transmission of Monetary Policy

I assess the transmission of monetary policy surprises using an Instrumental Variable Bayesian VAR (IV-BVAR) approach. This methodological choice leverages the strengths of Bayesian VARs, which have become a widely recognized tool for estimating and understanding the responses of macroeconomic variables to exogenous shocks. A key advantage of Bayesian VARs is their ability to address the curse of dimensionality, which often arises in large VAR models, as noted in the works of Miranda-Agrippino and Ricco (2019) and Kuschnig and Vashold (2021). For estimation, I adopt the standard Normal Inverted-Wishart (NIW) prior. This prior provides a solid framework for estimating the model's parameters, incorporating both prior beliefs and data to generate posterior estimates.

Additionally, I incorporate instrumental variables, drawing on the seminal contributions of Stock and Watson (2012) and Mertens and Ravn (2013). This approach has significantly advanced our understanding of the impact of monetary policy, as demonstrated in studies such as Gertler and Karadi (2015), Caldara and Herbst (2019), and Cesa-Bianchi et al. (2020). The use of instruments is particularly valuable for obtaining consistent estimators of the impulse response functions, enabling a robust analysis of how various macroeconomic variables respond to both monetary policy shocks that incorporate default risk information and those that do not.

Consider the following VAR process without deterministic components and exogenous variables for simplicity:

$$Y_t = \beta(L)Y_t + u_t \tag{2}$$

Where Y_t is an $(n \times 1)$ vector of macroeconomic variables at time t. $\beta(L) = B_1(L) +$

$B_2(L^2) + ... + B_P(L^P)$ is a lag polynomial, where P denotes the maximum number of lags in the model. u_t is a $(n \times 1)$ vector of reduced-form innovations, which are assumed to be a linear combination of structural shocks (ε_t):

$$u_t = A\varepsilon_t \tag{3}$$

where the matrix of variance and covariances of the innovations is:

$$\Sigma_u = E[u_t u_t'] = E[A\varepsilon_t \varepsilon_t' A'] = AA' \tag{4}$$

Knowing the values of A, and using the estimations of the parameters with the Bayesian techniques ($\hat{\beta}(L)$) I can estimate the values of the IRFs by computing:

$$IRF = (I - \hat{\beta}(L))^{-1}A \tag{5}$$

It is well known that the structural matrix A cannot be uniquely identified in this context. The inclusion of an exogenous variable (i.e., the instrument) becomes especially important when the goal is to identify the responses of the variables within the system to unanticipated innovations associated with a specific variable. In this study, the focus is on examining the responses of macroeconomic variables to unanticipated increases in the monetary policy instrument, namely, the policy interest rate. The use of instruments allows for the isolation of the exogenous component of the monetary policy shock, thereby facilitating a clearer understanding of how these variables react to changes in the policy interest rate that are not confounded by other endogenous factors.

The primary goal of this analysis is to determine whether unanticipated innovations that include default risk information have different effects compared to those without such risk-related information. The instrumental variable plays a crucial role in disentangling and isolating these distinct responses. To assess the influence of default risk information on the effects of MPS, I use the instrumental variable u_t^r. In contrast, when examining the responses to MPS that are free from default risk information, I employ u_t^M as the instrumental variable.

Following Stock and Watson (2018), let the instrument ($Z_t \in \{u_t^r, u_t^M\}$) satisfy the usual relevance ($E[\varepsilon_{n,t}Z_t] = \alpha$) and exogeneity ($E[\varepsilon_{1:n-1,t}Z_t] = 0$) conditions. Consider the covariance between the reduced form innovations and the instrument variable:

$$E[u_t Z_t] = E[A\varepsilon_t Z_t] = AE\begin{bmatrix}\varepsilon_{1:n-1,t}Z_t \\ \varepsilon_{n,t}Z_t\end{bmatrix} = A\begin{bmatrix}\alpha \\ 0\end{bmatrix} = \begin{bmatrix}A_{1:n-1,n}\alpha \\ A_{n,n}\alpha\end{bmatrix} \tag{6}$$

I assume $A_{n,n} = 1$ which is the unit effect normalization commonly used in Stock and Watson (2018). Therefore, the relationship between the instrumental variable and the reduced-form residuals can be expressed as:

$$\frac{E[u_{i,t}Z_t]}{E[u_{n,t}Z_t]} = A_{i,n} \tag{7}$$

The IRF to the unanticipated increases in the interest rate is then:

$$IRF = (I - \hat{\beta}(L))^{-1} A_{1:n,n} \tag{8}$$

Equation 7 allows me to obtain the values of the last column of the matrix A by performing an IV-regression of the reduced-form residuals of all the variables in the system on the reduced-form residuals of the monetary policy variable. Moreover, this strategy has the advantage of using a smaller sample of data for the instrument Z_t. This is particularly desirable because the data for the instrument may not be available for the entire period under consideration, which could otherwise pose challenges to the analysis. By using the reduced-form residuals from the available data, I can still perform the necessary identification without requiring a complete set of instrument data over the entire sample.

3 Data and Results

I estimate all VAR models in levels, following Sims et al. (1990), using two lags for each variable. The IRFs are computed with a forecast horizon of 24 months, and the results are accompanied by a 90.0% confidence interval.[4] I use monthly data from January 2004 to December 2019 to avoid potential complications arising from the COVID-19 pandemic and its impact on the transmission mechanism. For time series with significant seasonal variation, I apply the filtering method outlined in Sax and Eddelbuettel (2018) to ensure the removal of any seasonal effects.

I include the following variables in the analysis: the Federal Funds interest rate (FED) to control for international liquidity stance that will help me to estimate the response of the exchange rate and GDP free of interest rate differentials; monthly estimate of Gross Domestic Product (GDP); the Consumer Price Index (CPI); the Housing Price Index (REP), which is also used in the literature to deal with potential price puzzle (Bernanke & Mihov, 1998), real total credit outstandings (DEBT), the nominal exchange rate (EXC), net capital flows as a percentage of GDP (CF), narrow money (M1), and the interbank interest rate as a proxy for the central bank's policy interest rate (INT).[5] All variables are expressed in logarithms, except for FED, CF and INT, which are presented in percentage terms. The sources and computational details for these variables are provided in Appendix A.1.

3.1 Responses of Macroeconomic Variables to monetary policy

Figure 3 displays the impulse responses to an unexpected increase in the interest rate without decomposing them into components related to default risk and non-default risk, i.e. I use as the instrument the variable S_t. The IRFs illustrate the reaction of macroeconomic variables to a 1.0% unanticipated increase in the interest rate, which follows the

[4]I utilize the Matlab codes from Miranda-Agrippino and Ricco (2021), which are available on their personal websites.

[5]The correlation coefficient between INT and the central bank's policy interest rate series is 99.0%.

standard approach in monetary policy transmission studies (Gertler & Karadi, 2015). Notably, after the interest rate hike, there is a decline in GDP, real DEBT, M1, and the Housing Price Index (REP), which is consistent with the predictions of prevailing theoretical models on the impact of monetary tightening.

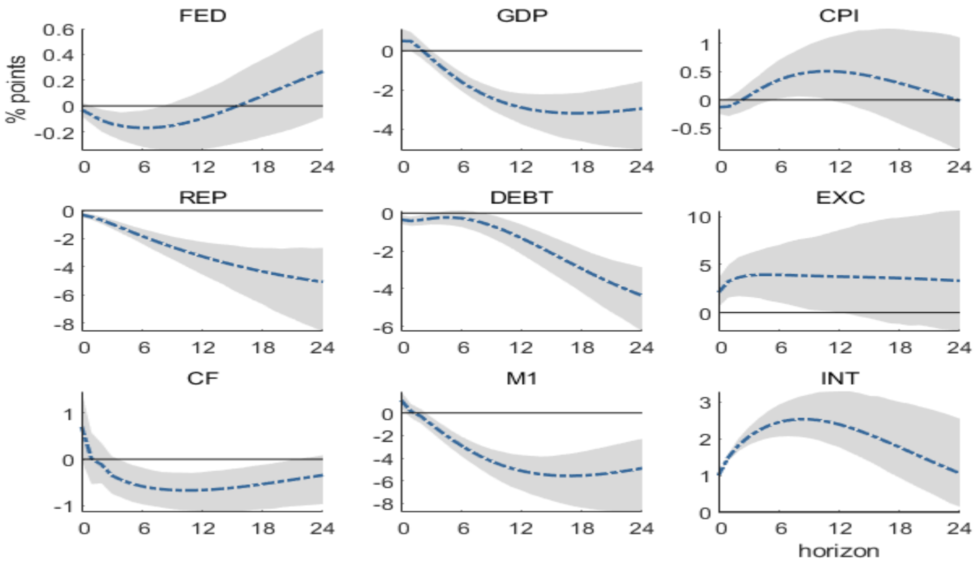

Figure 3: IRF of macroeconomic variables to MPS instrumented wit unexpected increase in monetary policy interest rate, S_t. Confidence intervals at 90,0%.

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Simultaneously, there is a noticeable outflow of capital, depreciation of the nominal exchange rate, and an increase in the aggregate price level. These phenomena are often referred to in the literature as the "exchange rate puzzle" and the "price puzzle," particularly in the context of emerging economies (Hnatkovska et al., 2016; Kim & Lim, 2022; Kohlscheen, 2014). Specifically, a 1.0% increase in the interest rate leads to a 0.5 percentage point decrease in the capital flow ratio and a 4.0% depreciation of the nominal exchange rate within the first year following the shock. Additionally, the CPI rises by 0.5% during the same period.

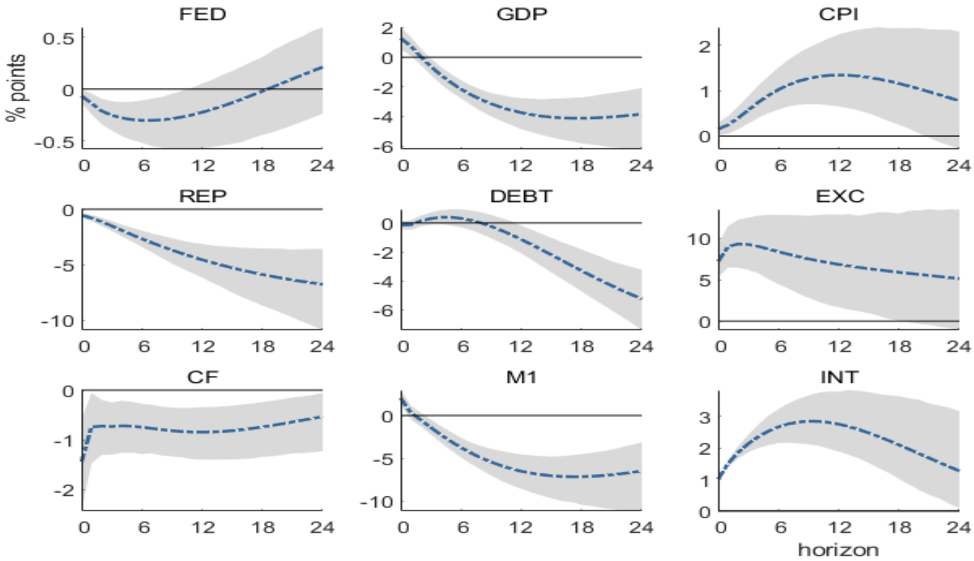

Figure 4: IRF of macroeconomic variables to MPS instrumented with the u_t^r that represents the default risk information of the monetary policy shock. Confidence intervals at 90,0%.

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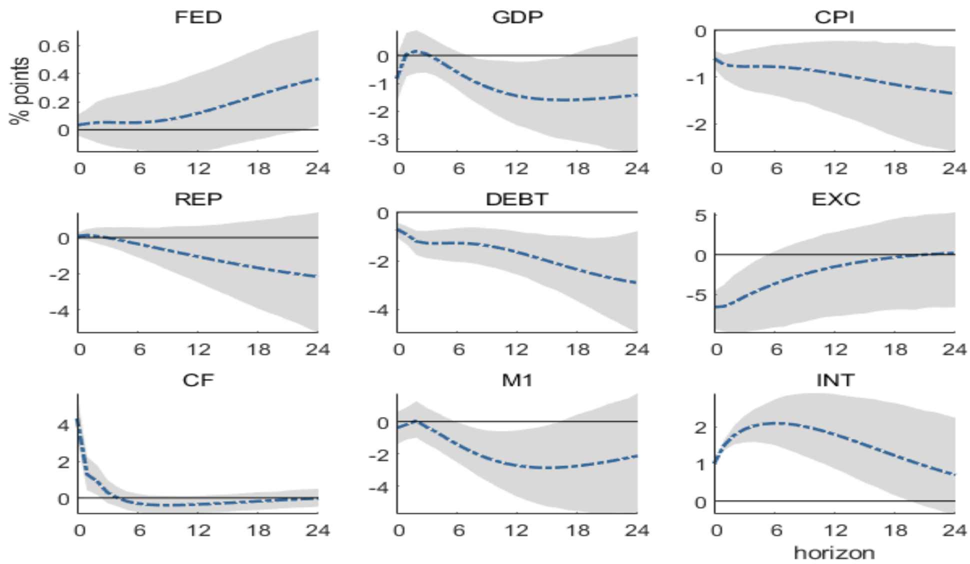

Figure 5: IRF of macroeconomic variables to MPS instrumented with the u_t^M that represents the monetary policy shock free of default risk information. Confidence intervals at 90,0%.

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Understanding the role of default risk information in unanticipated increases in interest rates helps to understand the exchange rate puzzle. Figure 4 presents the IRFs changes in interest rates, instrumented with the variable u_t^r. This graph illustrates the dynamic response of macroeconomic variables to unexpected increases in the interest rate while accounting for information related to default risk. Notably, the responses observed in this figure resemble those in Figure 3, but with a more pronounced impact on capital flows, the nominal exchange rate, and the CPI. Specifically, following a 1.0% increase in the interest rate, the outcomes are as follows: a 1.5 percentage point decrease in the capital flow ratio at the time of the shock, a 9.0% depreciation of the nominal exchange rate within the first year, and a 1.3% increase in the CPI.

Finally, I examine the response of macroeconomic variables to changes in the interest rate that are not associated with default risk information. Figure 5 presents the IRFs using u_t^M as the instrument, isolating the impact of default risk information. It is important to note that the responses of domestic variables in this context align with conventional macroeconomic theoretical models. After an unanticipated increase in the interest rate, GDP, aggregate credit, and prices show a decline. Capital flows, on the other hand, increase, and the domestic currency appreciates. Although the response of the housing price index (REP) does not reach statistical significance at the 90.0% confidence level, a noticeable median decrease is observed.

The preceding findings show that the exchange rate puzzle, as explored in the literature on emerging markets, may be explained by the influence of default risk information in the estimation of monetary policy surprises. By removing this information channel, the impact of monetary policy on the economy appears to align more closely with the economic intuition derived from conventional macroeconomic models. This highlights the importance of considering default risk when analyzing the transmission of monetary policy in emerging economies, as it significantly shapes the response of key macroeconomic variables, particularly the exchange rate.

4 Robustness analysis

In this section, I conduct robustness checks on the previously presented results by modifying the identification strategy. First, I utilize CDS as a financial market instrument to capture changes in default risk perception following the monetary policy meeting. CDS spreads provide an alternative measure of perceived credit risk, offering a different perspective on how markets react to shifts in default risk. Second, I apply a "poor man's" strategy to derive the instruments u_t^r and u_t^M, which offers a simpler approach to isolating the default risk-related shocks and those unrelated to risk information. This alternative approach provides further insight into the robustness of the initial findings across different methodologies.

Furthermore, I extend the analysis to examine the presence of the identified transmission mechanism in other Latin American markets, with a particular focus on Chile and Colombia. The choice of these countries is based on four key considerations:

i) Both operate with a floating exchange rate regime, allowing for the analysis of exchange rate dynamics in response to monetary policy shocks.

ii) They implement inflation-targeting frameworks for their monetary policy, which provides a consistent policy approach conducive to studying the effects of monetary policy changes.

iii) Both countries have access to international financial markets, ensuring that they face similar external economic pressures that could influence the transmission mechanism.

iv) Comparable high-frequency variables, such as those derived from professional forecaster surveys and financial market data, can be constructed for both Chile and Colombia, facilitating the use of the same empirical methodology applied to Brazil.

4.1 Credit Default Swaps

CDS are derivative instruments widely used to hedge against the risk of default on specific securities. In the case of Brazilian government bonds, the five-year CDS reflects the market's assessment of the likelihood of default on the Brazilian government's debt over a five-year horizon. The buyer of the CDS makes periodic payments in exchange for protection against the possibility of default. Consequently, changes in the price of the CDS offer valuable information about how financial markets perceive the risk associated with the country's government debt.

In the context of this study, fluctuations in the five-year CDS surrounding monetary policy announcements are particularly informative. These changes capture shifts in market sentiment regarding the Brazilian government's default risk in response to monetary policy decisions. If a monetary policy announcement, such as an interest rate hike, leads to an increase in the CDS premium, this suggests that the market perceives higher default risk, potentially due to concerns about the impact of tighter monetary policy on the country's fiscal position or economic stability. Conversely, if the CDS premium falls, it could indicate a decrease in default risk perception. Thus, examining the movement in CDS spreads around monetary policy events helps to disentangle the role of default risk information in shaping the overall response of macroeconomic variables to monetary policy shocks.

In this analysis, I follow the methodology outlined by Jarociński and Karadi (2020) to derive the two types of monetary policy shocks: u_t^r and u_t^M. However, unlike the original method, which uses changes in market variables such as the risk premium (v_t) as a proxy for risk perception, I opt to use the difference in the values of the 5-year CDS of Brazilian government bonds as the instrument. Specifically, I calculate the change in the CDS spread between one day after the monetary policy meeting and one day before, denoted as ΔCDS_t. This adjustment allows me to focus directly on the market's perception of default risk as it responds to changes in monetary policy.

In the identification of these shocks (u_t^r and u_t^M), I impose sign restrictions as detailed in Table 2. These restrictions help ensure that the identified shocks are consistent with the expected behavior of the variables in the system. For example, a shock linked to an increase in default risk (i.e., an increase in CDS spreads) should lead to an appreciation of default risk, a tightening in credit conditions, and potentially a depreciation of the exchange rate, all of which are consistent with conventional economic theory. By applying these sign restrictions, I enhance the reliability of the results, ensuring that the shocks identified in the model are appropriately linked to the economic variables of interest.

Figures A1 and A2 in Appendix B display the responses of macroeconomic variables to unexpected increases in interest rate instrumented with u_t^r and u_t^M, respectively. The results align closely with the baseline specification. In the case where the interest rate incorporates default risk information (u_t^r), a significant decline in the capital flow ratio is observed, accompanied by currency depreciation and an increase in the CPI. In contrast, when the innovation excludes default risk information (u_t^M), currency appreciation and a reduction in the CPI are observed, while the capital flow response is statistically insignificant.

Variable	u_t^M	u_t^r
S_t	+	+
ΔCDS_t	-	+

Table 2: Sign restrictions to identify unexpected innovations that are related to default risk information (u_t^r) and unexpected innovations not related to default risk information u_t^M using CDS as the financial market variable.

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4.2 Poor man's identification

Instead of using the sign restriction methodology to decompose the unanticipated change in the monetary policy interest rate associated with default risk information, I adopt a simplified identification strategy. I classify the unexpected changes into two groups: when the unanticipated change in the policy rate (S_t) has the same sign as v_t, I set $u_t^r = S_t$; otherwise, when the signs differ, I set $u_t^M = S_t$. If $S_t = 0$, both u_t^r and u_t^M are assigned a value of zero. This simplified approach provides a clear way to distinguish between the effects of monetary policy shocks related to default risk, enhancing the interpretability of the results.

Figures A3 and A4 in Appendix B display the results of this robustness check. Consistent with the previous analysis, the findings remain stable despite the methodological modification. The inclusion of default risk information continues to clarify the responses of CF, CPI, and the EXC following a monetary policy rate change. This reinforces the robustness of the identified transmission mechanisms and highlights the significant role of default risk information in explaining these economic responses.

4.3 Latin American Economies

Chile and Colombia also provide daily data on financial instruments that can be used to construct the shocks. However, there are some important differences regarding the survey of economic expectations. Unlike Brazil, which has a daily survey, the surveys in both Chile and Colombia are less frequent. In Chile, there is an average lag of 4.5 days between the survey and the monetary policy meeting, while in Colombia, this lag is longer at 13.5 days. Furthermore, the time of the data series is shorter: in Chile, it starts in November 2007, and in Colombia, the first available observation is from August 2014.

Despite these differences, the IRF identification using the IV-BVAR framework still enables the computation of responses, even with the shorter survey periods. However, it is important to note that these discrepancies could impact the efficiency of the estimation process. To address potential issues arising from the variations in the computation of v_t, I present the results in this subsection using the sign restrictions outlined in Table 2 (i.e., using CDS to construct the risk premium around monetary policy meetings). This approach ensures a consistent analysis across the countries, enhancing the clarity of the transmission mechanisms being examined.

The results for Colombia are shown in Figures A5 and A6 in Appendix B.[6] The responses are strikingly similar to those observed for Brazil. Specifically, when using u_t^r to instrument the unanticipated increase in interest rate, currency depreciation and an increase in the aggregate price level follow the monetary policy contraction. The other macroeconomic variables respond following conventional macroeconomic models: a decline in GDP, a reduction in real estate prices, and a decrease in aggregate debt. When instrumenting the interest rate innovation with u_t^M, economic activity, real estate prices, and credit still decline after the interest rate hike, but the exchange rate appreciates following the contraction. In this case, the CPI exhibits non-significant responses.

Figure A7 in Appendix B illustrates the response of macroeconomic variables to interest rate changes instrumented with u_t^r in Chile. The observed reactions are puzzling, particularly regarding the exchange rate, prices, and economic and credit activities. Following a contractionary monetary policy shock that includes default risk information, there is an increase in these variables, with the exchange rate depreciating. In contrast, Figure A8 in Appendix B presents the responses to monetary policy surprises without default risk information. Here, the exchange rate appreciates following the monetary policy contraction. Although this reduces the puzzling responses of GDP and DEBT, the CPI rises. Interestingly, in both cases, capital flows show no significant reaction.

5 Explaining the Mechanism: A Small-open Economy

To better understand the mechanism, this section interprets the results through the lens of a small-open economy model, specifically using the benchmark model proposed by Gouvea et al. (2008).[7]

[6]Due to the lack of access to monthly capital flow data, as in Koepke and Paetzold (2024), I estimate the VAR without this variable.

[7]Gouvea et al. (2008) introduces the SAMBA model, a DSGE model used by the Central Bank of Brazil for policy analysis and medium-term forecasts. Although newer versions of the model exist, I use this version for two key reasons: *i).* it is a straightforward

In this model, there are two key authorities: the fiscal authority, which uses government expenditure as its instrument, follows a fiscal rule to maintain a long-term primary surplus and stabilize the internal debt-to-GDP ratio. Meanwhile, the monetary policy authority, which uses the short-run interest rate as its instrument, follows a Taylor rule to stabilize prices and reduce the GDP gap relative to its long-term trend.

The model also includes an exogenous process for the international interest rate spread, which captures the cost faced by the domestic economy when borrowing in international financial markets. This spread is determined by several factors: the level of government debt as a percentage of GDP, the exogenous fiscal expenditure set by the fiscal authority, and an exogenous component that reflects the risk perception of the domestic country by international investors. When this risk perception increases—indicating a higher risk premium—the international interest rate spread widens. This, in turn, makes it more expensive for the domestic economy to issue foreign debt, as investors demand a higher return to compensate for the perceived risk.

Assuming the simultaneous occurrence of monetary policy shocks, fiscal shocks, and shifts in foreign risk perception, I demonstrate that an unanticipated increase in the short-run interest rate, associated with a rise in the risk premium, is linked to nominal exchange rate depreciation and a reduction in foreign debt (i.e., capital outflows). This outcome aligns with empirical observations. The following subsections explore the model's key components, highlighting the equations that elucidate the underlying mechanisms. For a more detailed discussion on model estimation and construction, please refer to Gouvea et al. (2008).

5.1 The set-up

The small-open economy model simulates the dynamics of the Brazilian economy, with both the domestic and foreign economies assumed to follow similar structural frameworks. Notably, both countries (domestic and foreign) treat imports as inputs in their domestic production processes. Furthermore, exports from the domestic country are considered imports for foreign firms, establishing a reciprocal relationship between the economies. This assumption underscores the interconnectedness of trade and production in the global context.

The representative household in this model engages in consumption with habit formation, supplies labor, and provides utilization-adjusted capital to productive firms. Households are also subject to taxes and can save by purchasing one-period domestic bonds (denominated in domestic currency) issued by the fiscal authority. Additionally, they can invest in internationally traded one-period bonds denominated in foreign currency. The interest rate on domestic bonds is determined by the monetary policy authority, as outlined in the model. On the other hand, the interest rate on foreign bonds is influenced by an exogenous global interest rate and a risk premium. This risk premium depends

small-open economy model with a New Keynesian block to introduce monetary policy, and *ii)*. it treats the international interest rate as an exogenous process, facilitating the modeling of capital flows.

on the foreign debt-to-GDP ratio and the exogenous perception of the country's risk by foreign investors, which is treated as given within the model.

The economy comprises three distinct sectors:

1. **Importers:** These entities acquire foreign differentiated products, which are used as inputs in the production of a homogeneous good. This good is then sold in a competitive market to domestic producers.

2. **Domestic Producers:** These firms purchase labor and rent utilization-adjusted capital, combining them with imported goods as inputs. Operating under monopolistic competition, they face sticky prices according to the framework developed by Calvo (1983).

3. **Final Good Assemblers:** This sector combines differentiated domestic goods as inputs to produce a homogeneous final good. The final good is then sold in a competitive market, where it can be allocated for consumption, investment (capital), or export.

The economy is governed by two distinct authorities: the fiscal and monetary authorities. The fiscal authority uses government expenditure as its primary instrument, guided by a fiscal rule aimed at achieving a long-term primary surplus target and stabilizing the debt-to-GDP ratio. To meet the government budget constraint, the fiscal authority issues short-term debt. Meanwhile, the monetary authority utilizes the short-run interest rate as its instrument, following a Taylor rule. The primary goals of the monetary authority are to ensure price stability and reduce the GDP gap relative to its long-term trend.

5.2 Fiscal authority

The instrument of the fiscal authority is government expenditure, which is set to satisfy a fiscal rule aimed at stabilizing both the government debt-to-GDP ratio and the fiscal surplus as a percentage of value added. Additionally, the government deficit is financed exclusively with domestic debt. The fiscal rule, in log-linear terms, is expressed as follows:

$$g_t^y = \gamma_g g_{t-1}^y + (1-\gamma_g)(\gamma_s s_{t-1}^y - \gamma_b b_t^y) + z_t^g \tag{9}$$

Where g_t^y is the ratio between government expenditure and GDP, s_t^y is the ratio between fiscal surplus (taxes minus government expenditure) and GDP, and b_t^y is the government debt as a percentage of GDP. Finally, z_t^g is the exogenous government expenditure shock. The latter is assumed to follow an AR(1) process:

$$z_t^g = \rho^g z_{t-1}^g + \varepsilon_t^g$$

Where ε_t^g is i.i.d normally distributed with mean zero and variance σ_g^2. A shock in the government expenditure creates inflation pressures as it pushes the internal good demand, hence the monetary policy authority increases the interest rate. Nonetheless, given that international investors perceive more risk with the increase of government expenditure, there is an instantaneous reduction in foreign debt. The theoretical IRFs are shown in Figure A9 in Appendix B.

5.3 Monetary Authority

The monetary authority follows a Taylor rule to set the short-run interest rate as follows:

$$R_t = (R_{t-1})^{\gamma_r} \Big(E_t \Big[\frac{\Pi_{t+1}}{\bar{\Pi}}\Big]^{\gamma_\pi} \bar{\Pi}\bar{R}^{real} \Big[\frac{Y_t^{VA}}{\bar{Y}^{VA}}\Big]^{\gamma_y} \Big)^{1-\gamma_r} e^{z_t^r}$$

The rule can be re-expressed in log deviation terms as follows:

$$r_t = \gamma_r r_{t-1} + (1-\gamma_r)[\gamma_\pi E_t[\pi_{t+1}] + \gamma_y y_t^{VA}] + z_t^r \tag{10}$$

Where all the variables are expressed in log-deviation from its long-term trend. r_t is the short-run interest rate, π_t is the inflation rate and y^{VA} is the value added in the economy.[8] z_t^r is the exogenous component of the monetary policy. The latter is assumed to follow an AR(1) process:

$$z_t^r = \rho^r z_{t-1}^r + \varepsilon_t^r$$

where ε_t^r is the monetary policy shock and is i.i.d normally distributed with mean zero and variance σ_r^2. The effects of these shocks are the same as in traditional NK models: monetary policy shock reduces consumption because of the optimality conditions of households. Such reduction leads to a fall in GDP and (because of optimal price setting of monopolistic competitors) a reduction in prices. The higher interest rate in domestic bonds also implies a decrease in international bonds held by households (i.e. capital inflows) and hence an appreciation of domestic currency. The theoretical IRFs of some variables to this shock is in Figure A10 in Appendix B.

5.4 Foreign investors risk premium

Let the interest rate for international foreign bonds be R_t^f. The model assumes it satisfies:

$$R_t^f = R^* \times \phi_t$$

Where R^* is the international risk-free interest rate and it is taken as given by the domestic household. ϕ_t is the risk premium of the bond which satisfies the following relation:

$$\phi_t = \psi' \times exp\Big(-\psi \Big[\frac{D_t B_{t+1}^*}{P_t Y_t} - \frac{DB}{PY}\Big] + \psi_g z_t^g + \nu z_t^\phi \Big)$$

The latter equation can be expressed in log-linear terms as follows:

[8]The value added satisfies $P_t^{VA} Y_t^{VA} = P_t Y_t - P_t^M M_t$ which is the difference between the nominal GDP and the nominal value of the imports.

$$\hat{\phi}_t = -\psi \left[b^{y*}_{t+1} \right] + \psi_g z^g_t + \nu z^\phi_t \tag{11}$$

Where all the variables are expressed as log deviations from their long-term trend. $\hat{\phi}_t$ is the risk-premium of international interest rate, b^*_{t+1} is the level of foreign bonds held by households in domestic goods prices and y_t is the real GDP. The second term in the right-hand side equation is a reduced form way to include the fact that international financial markets may respond to fiscal behavior. Hence, an unexpected increment in the fiscal expenditure leads to an increase in risk perception. Finally z^ϕ_t is the exogenous risk perception of international investors. The latter is assumed to follow an AR(1) process:

$$z^\phi_t = \rho^\phi z^\phi_{t-1} + \varepsilon^\phi_t$$

Where ε^ϕ_t is i.i.d normally distributed with mean zero and variance σ^2_ϕ. Note that a shock in ε^ϕ_t leads to an unanticipated increase in the risk perception of international investors which implies a reduction in the level of international bonds held by the households. This reduction can be understood as an increase in capital outflows as it is a reduction in foreign debt for the domestic country. It leads to a depreciation of the domestic currency and then an increase in inflation because of the increase in import prices. These inflation pressures imply an unanticipated increase in the monetary policy interest rate. The theoretical IRFs of some variables to this shock are in Figure A11 in Appendix B.

5.5 Simulation exercise

Examining the immediate impact of various shocks on short-term interest rates (both for foreign and domestic bonds) sheds light on the mechanisms driving currency depreciation following an unexpected increase in the central bank's policy rate. Interestingly, fiscal and risk perception shocks are associated with an increase in the risk premium, whereas a contractionary monetary policy shock leads to its reduction. This difference is key to unraveling the role of default risk information in the depreciation after unexpected increases in the domestic interest rate.

Consider a scenario in which all three shocks (monetary policy, fiscal, and risk perception) occur simultaneously, each registering positive values. In this context, an unanticipated increase in the central bank's interest rate arises, partly as a response to heightened default risk associated with the shocks. Crucially, this unexpected rate hike, influenced by rising risk perception, may contribute to the depreciation of the domestic currency. This interpretation is consistent with empirical evidence, supporting the idea that unanticipated interest rate increases, driven by factors linked to risk perception, can lead to currency depreciation, aligning with observed patterns in real-world data.

Assume that the sole sources of uncertainty in the economy are exogenous risk perception, fiscal shocks, and monetary policy shocks.[9] Let S^r_t denote the unanticipated

[9]This assumption ensures that these are the only shocks unveiled at the time of the central bank's announcements.

increase in the interest rate.

$$S_t^r = r_t - E_{t-1}[r_t] \tag{12}$$

Where r_t is the central bank interest rate at time t and $E_{t-1}[r_t]$ is the expectation of interest rate at time t with information up to time $t-1$ (i.e the expected interest rate before knowing the shocks). This variable is the analog to the unexpected change in interest rate define in Section 2.1.

Now, let S_t^d be the unanticipated increase in risk premium.

$$S_t^d = \hat{\phi}_t - E_{t-1}[\hat{\phi}_t] \tag{13}$$

Where $\hat{\phi}_t$ is the risk premium of internationally issued bonds at time t and $E_{t-1}[\hat{\phi}_t]$ is the expectation of risk premium at time t with information up to time $t-1$ (i.e the expected risk premium before knowing the shocks). I use both variables to show that there are different responses of the macroeconomic variables to unanticipated changes in interest rate, depending on the behavior of the unexpected risk premium change, by using the procedure in Sections 2 and 3.

I simulate the economy over 1800 observations.[10] Figure A12 in Appendix B presents both the unanticipated change in the interest rate (S_t^r) and the true monetary policy shock (ε_t^r) illustrating the strong correlation between the two series.[11] Following the methodology outlined in Section 2, I decompose S_t^r into a component driven by risk shocks and another component free of risk-related information. This decomposition employs the unexpected change in the risk premium (S_t^d) and sign restrictions as described by Jarociński and Karadi (2020).

Using the IV-BVAR approach described in Section 3, I estimate the IRFs of the simulated variables in the model for each of the previously identified unanticipated shocks. The system of equations includes GDP, inflation (CPI), the change in the ratio of international debt to GDP (used as a proxy for capital flows, CF), the change in the nominal exchange rate (EXC), and the short-term interest rate (INT). Figure 6 illustrates the responses to changes in the interest rate instrumented with S_t^r, serving as the simulated model's counterpart to Figure 3. Notably, despite the strong correlation between S_t^r and the true monetary policy shock (ε_t^r), the IRFs reveal capital outflows and currency depreciation following the unanticipated interest rate innovation.

[10]Gouvea et al. (2008) estimate the model using Bayesian techniques applied to quarterly data. I adopt the same parameters to illustrate the theoretical impulse response functions of the model. This approach is used as the parameters were initially estimated for the Brazilian economy, ensuring consistency with the original model specifications. Nonetheless, the variance of ε_t^{ϕ}, the autoregressive coefficient of the fiscal rule (ρ^g), and the response of foreign risk perception to monetary policy (ψ_g) are estimated using indirect inference. This method minimizes the distance between the sign responses of the impulse response function (IRF) for the first four quarters of the simulations and those derived from the BVAR model in Section 3. The estimated values are 0.01, 0.1, and 0.16, respectively.

[11]The correlation coefficient between S_t^r and ε_t^r is 0.86.

Figure 7 presents the responses to unanticipated interest rate changes associated with default risk, while Figure 8 depicts the responses to unanticipated changes unlinked to risk perception. The results indicate that when unexpected interest rate increases are driven by changes in risk perception, capital outflows occur, and the nominal exchange rate depreciates. Additionally, GDP and prices rise during the first two quarters. In contrast, when the unexpected interest rate increase is unrelated to risk perception, the responses align with the traditional mechanisms of New Keynesian (NK) models: GDP and CPI decline, capital inflows are observed, and the exchange rate appreciates.

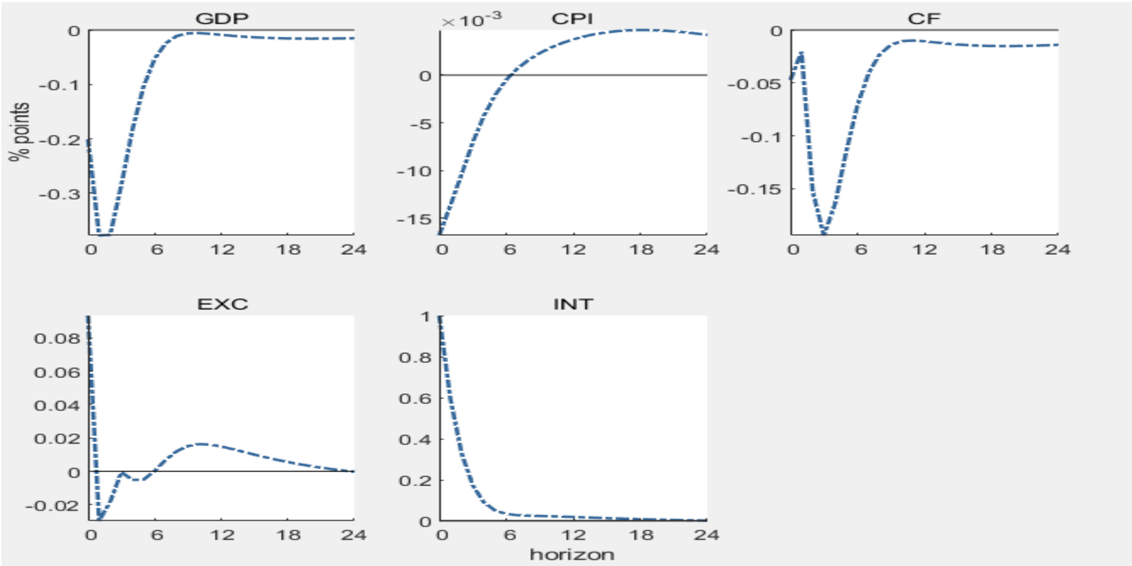

Figure 6: IRF of simulated variables to an unanticipated change in interest rate.

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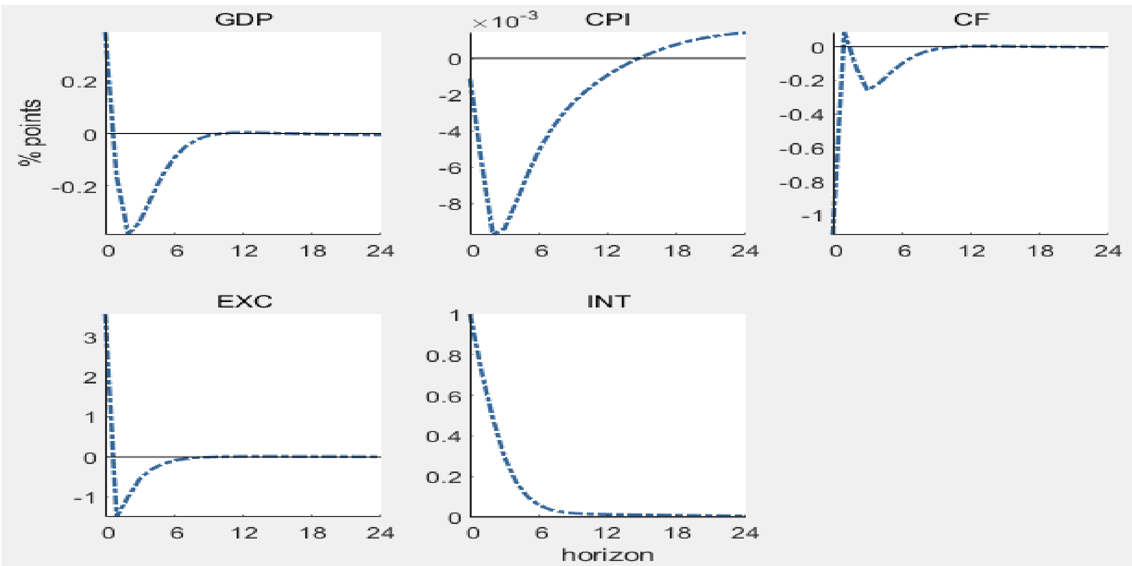

Figure 7: IRF of simulated variables to an unanticipated change in interest rate associated with risk shock.

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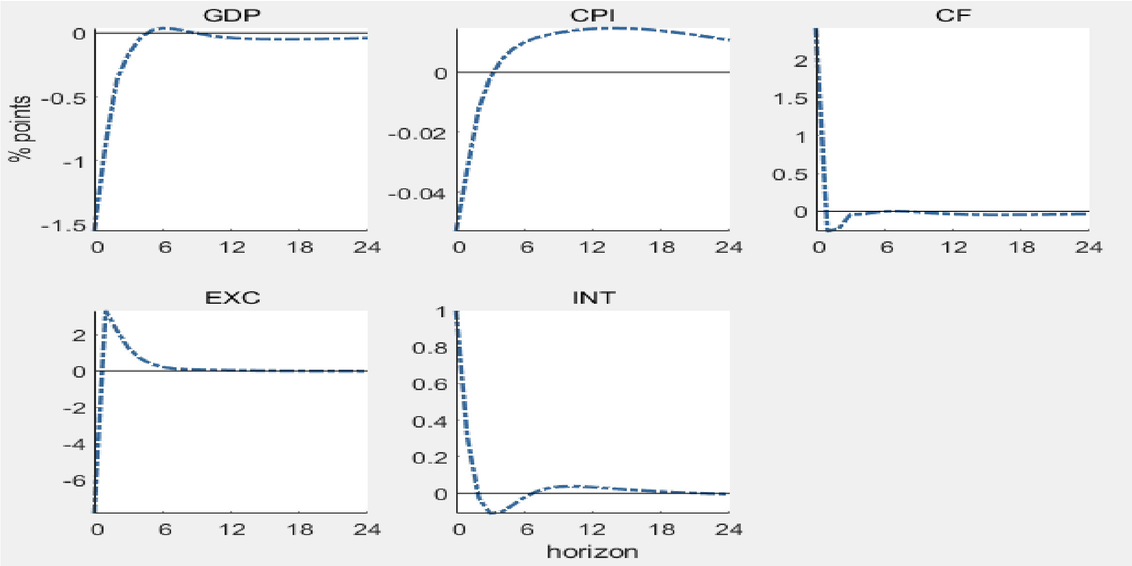

Figure 8: IRF of simulated variables to an unanticipated change in interest rate free of risk information.

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Finally, movements in the variable S_t^r are driven by the interaction of three structural shocks. I calculate the percentage of the variance of the unanticipated innovation of the interest rate explained by these shocks. The results are presented in Table 3. Notably, structural monetary policy shock is not the sole driver of changes in the unanticipated interest rate movements. Specifically, the percentage of the variance of S_t^r explained by ε_t^r is 72.1%, while the variance explained by ε_t^g and ε_t^ϕ are 17.3% and 10.6%, respectively.

Structural Shocks	Contribution (%)
ε_t^r	72.1
ε_t^g	17.3
ε_t^ϕ	10.6

Table 3: Variance decomposition of the unanticipated innovation of the interest rate.

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6 Conclusions

The effectiveness of monetary policy in emerging markets is a critical issue for policymakers, given the intricate dynamics and heightened susceptibility of these economies to external shocks. Recent evidence highlighting that a contractionary monetary policy shock may cause domestic currency depreciation underscores the limitations of relying exclusively on interest rates as the monetary policy tool.

This paper explains such currency depreciation, attributing it to default risk information embedded in the interest rate surprises. An unanticipated monetary policy tightening may reflect the central bank´s response to a higher default risk scenario, which the markets might not fully acknowledge. When this information is revealed during the policy announcement, the market's reassessment of the default risk scenario triggers capital outflows and currency depreciation.

Using data from the 10-year zero-coupon yield of Brazilian government bonds to capture default risk information embedded in the central bank's interest rate, this study finds that a 1.0% tightening in monetary policy leads to a 9.0% depreciation of the domestic currency within the first year when default risk information is considered. In contrast, excluding the influence of this information, the same policy action results in a 6.0% appreciation. These findings remain robust when employing Credit Default Swaps (CDS) instead of the yield curve to identify the default risk information. Furthermore, this mechanism helps to explain part of the exchange rate puzzle observed in other Latin American economies, such as Chile and Colombia.

The findings are interpreted through a medium-scale small-open economy model developed by Gouvea et al. (2008). This model predicts currency depreciation following an unexpected interest rate hike when it is associated with an unanticipated increase in the risk premium. However, in the absence of such risk premium adjustments, the monetary policy shock produces outcomes consistent with standard New Keynesian models.

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Appendices

A Data Computation and Sources

A.1 VAR Variables

- **FED:** I use the Federal funds rate of the United States to control for international liquidity stance. This will help me to estimate the response of the exchange rate and GDP free of interest rate differentials. Board of Governors of the Federal Reserve System (US), Federal Funds Effective Rate [FEDFUNDS], retrieved from FRED, Federal Reserve Bank of St. Louis, March 10, 2022;

  https://fred.stlouisfed.org/series/FEDFUNDS.

- **INT:** Interbank interest rate. I use this variable instead of the monetary policy rate to avoid the low variability of the latter in periods with no change. Daily CDI in annual terms.

  Central Bank of Brazil, retrieved on March 11,2022. https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries

- **GDP:** Logarithm of a monthly estimate of the GDP. I use the procedure in Chow and Lin (1971) to disaggregate the real GDP into monthly real GDP. I use use IBC, which it is a monthly index of real economic activity, as the auxiliar variable to compute the disaggregation (Sax & Steiner, 2013). Annual GDP at constant last year prices in R$ and monthly IBC seasonally adjusted. Central Bank of Brazil, retrieved on March 11,2022.

  https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries

- **DEBT:** Logarithm of the real total credit outstandings without debt of financial institutions. I include this variable to understand the credit channel of the monetary policy transmission. To obtain the real variable, I use the core-CPI deflator. Total Credit outstanding. Central Bank of Brazil, retrieved on March 11,2022. https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries

- **CPI:** Logarithm of the Consumer Price Index to understand the effect of monetary policy rate on the price level. National Consumer Price Index. Central Bank of Brazil, retrieved on March 11,2022. https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries

- **REP:** Logarithm of Housing Price indexes. I include this variable as it is also used in the literature to deal with potential price puzzle (Bernanke & Mihov, 1998). Residential Real Estate Collateral Value Index. Central Bank of Brazil, retrieved on March 11,2022. https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries

- **EXC:** Logarithm of the nominal exchange rate measured in units of domestic currency per unit of US Dollar. Nominal effective exchange rate. Central Bank of Brazil, retrieved on March 11,2022. https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries

- **CF:** Monthly estimation of net capital flows (CF) of Koepke and Paetzold (2020) as a percentage of the GDP.

- **M1:** Logarithm of the narrow money in the economy measured as total monetary base (currency) and demand deposits. This is included to control for the liquidity stance of the economy. M1 (end-of-period balance) New seasonally adjusted. Central Bank of Brazil, retrieved on March 11,2022. https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries

A.2 Unexpected Increase in Monetary Policy

- **Monetary Policy Interest Rate:** Central Bank base rate. Central Bank of Brazil, retrieved on March 11,2022. https://www3.bcb.gov.br/sgspub/localizarseries/localizarSeries.do?method=prepararTelaLocalizarSeries

- **Expected Interest Rate:** Expectativas informadas nos últimos 30 dias, Reuniao, Selic, média. Central Bank of Brazil, retrieved on March 11,2022. https://www3.bcb.gov.br/expectativas2/#/consultas

A.3 Risk Perception

- **5-year CDS**: Daily credit default swap. IFS Database and Refinitiv.

- **10-year zero coupon yield**: Daily return to Brazilian government bonds. IFS Database and Refinitiv.

B Figures

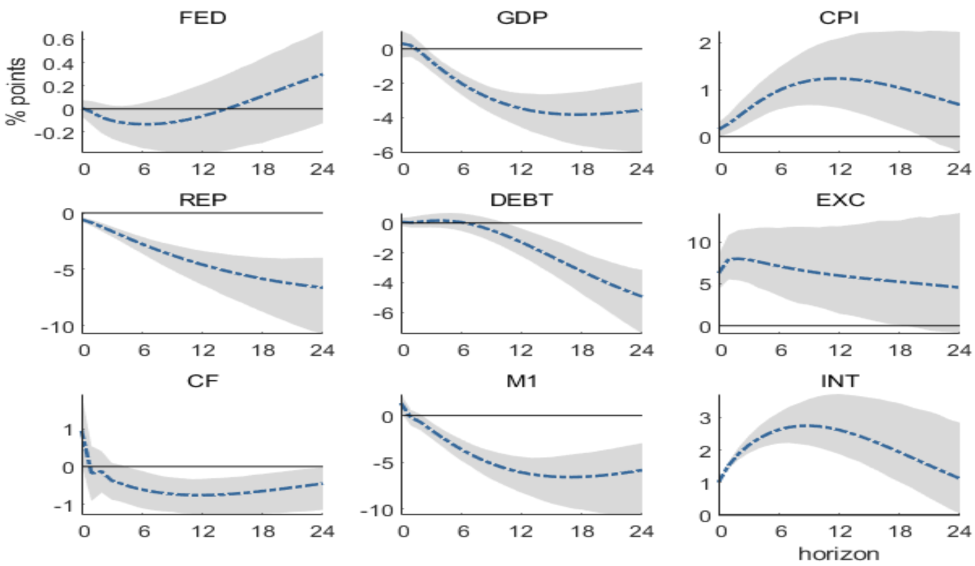

Figure A1: IRF of macroeconomic variables to MPS instrumented with the u_t^r that represents the default risk information of the monetary policy shock. Identification using CDS. Confidence intervals at 90,0%.

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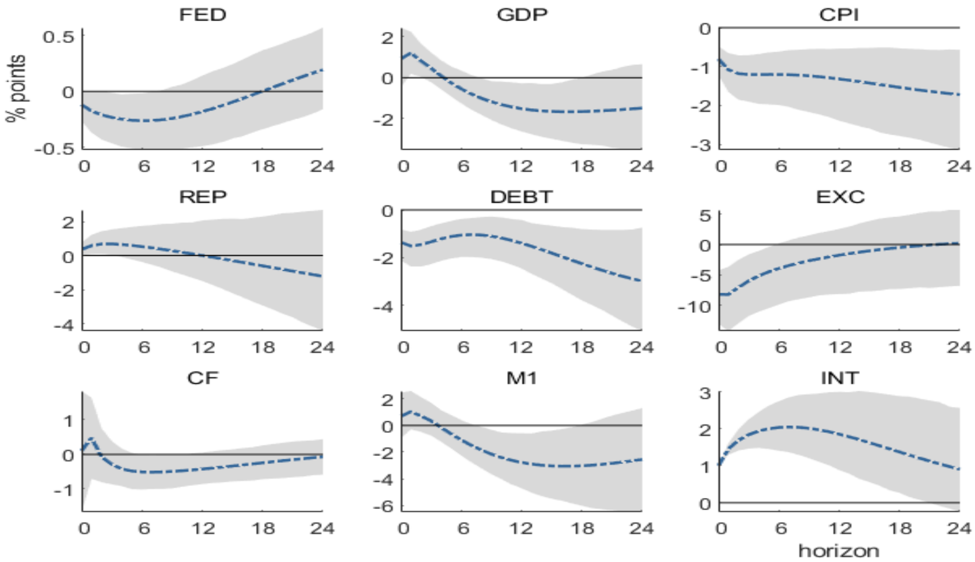

Figure A2: IRF of macroeconomic variables to MPS instrumented with the u_t^M that represents the monetary policy shock free of default risk information. Identification using CDS. Confidence intervals at 90,0%.

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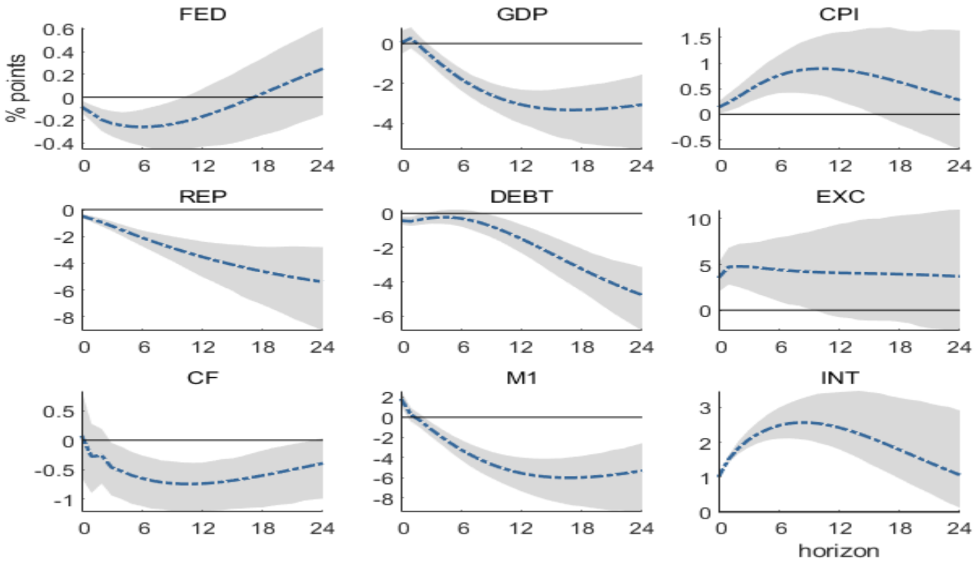

Figure A3: IRF of macroeconomic variables to MPS instrumented with the u_t^r that represents the default risk information of the monetary policy shock. Identification using poor man's strategy. Confidence intervals at 90,0%.

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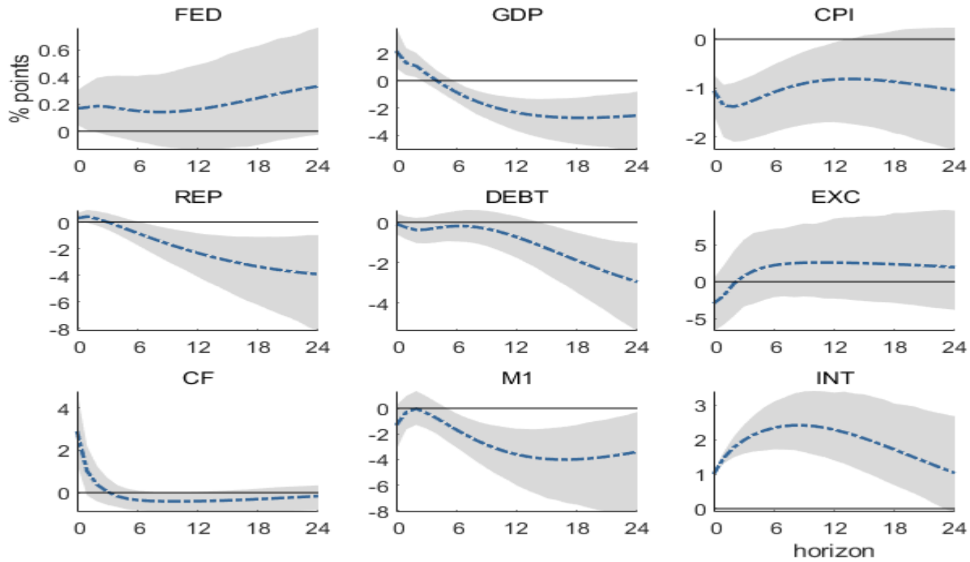

Figure A4: IRF of macroeconomic variables to MPS instrumented with the u_t^M that represents the monetary policy shock free of default risk information. Identification using poor man's strategy. Confidence intervals at 90,0%.

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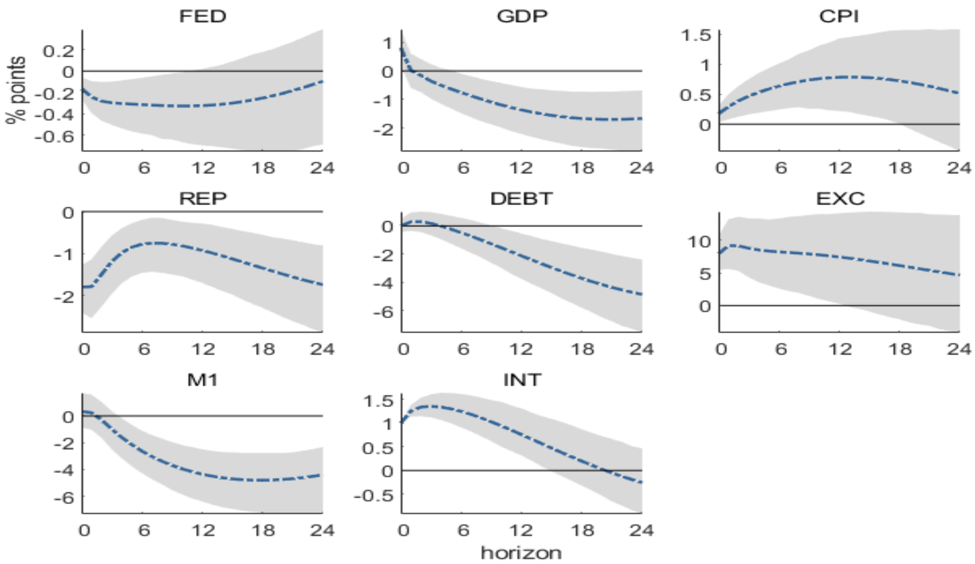

Figure A5: IRF of macroeconomic variables to MPS instrumented with the u_t^r that represents the default risk information of the monetary policy shock in Colombia. Identification using CDS. Confidence intervals at 90,0%.

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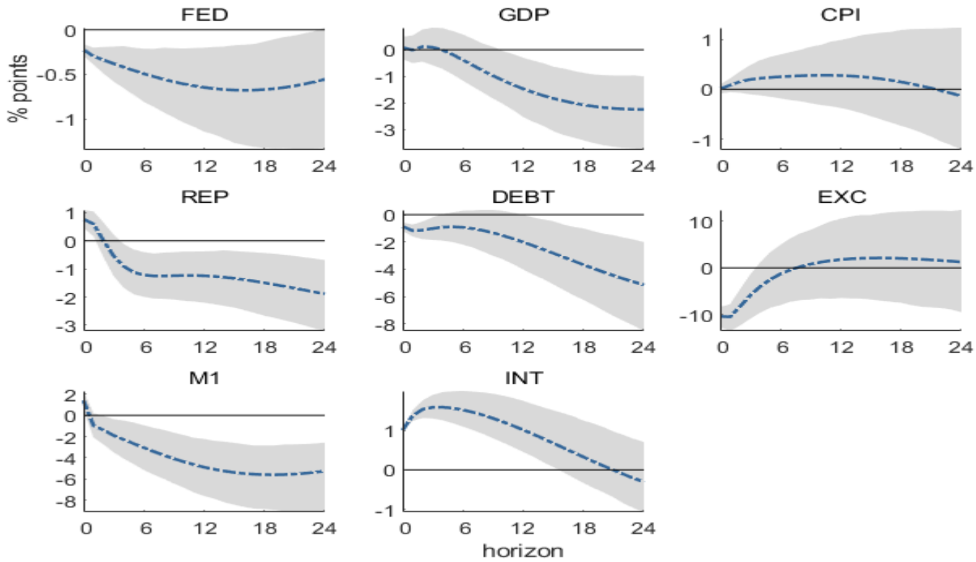

Figure A6: IRF of macroeconomic variables to MPS instrumented with the u_t^M that represents the monetary policy shock free of default risk information in Colombia. Identification using CDS. Confidence intervals at 90,0%.

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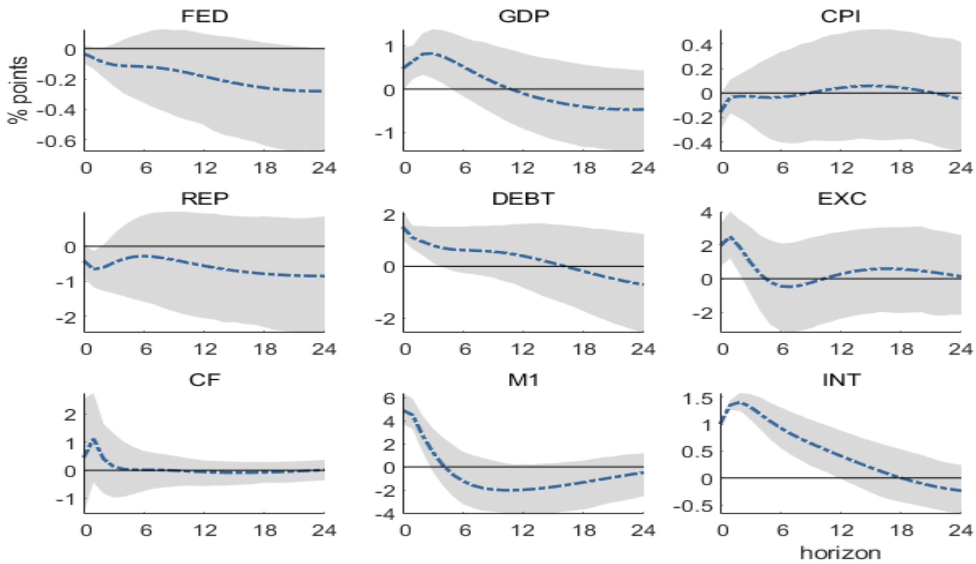

Figure A7: IRF of macroeconomic variables to MPS instrumented with the u_t^r that represents the default risk information of the monetary policy shock in Chile. Identification using CDS. Confidence intervals at 90,0%.

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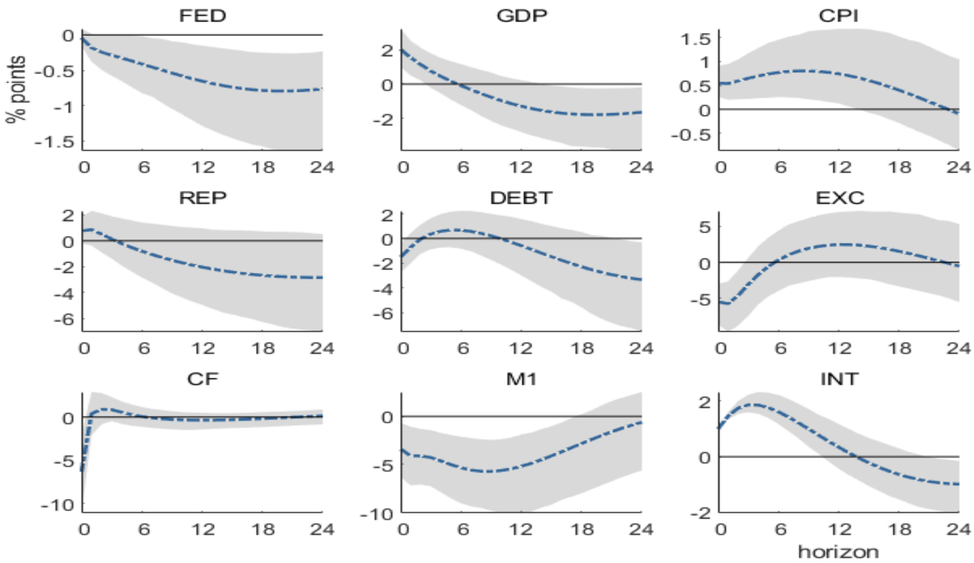

Figure A8: IRF of macroeconomic variables to MPS instrumented with the u_t^M that represents the monetary policy shock free of default risk information in Chile. Identification using CDS. Confidence intervals at 90,0%.

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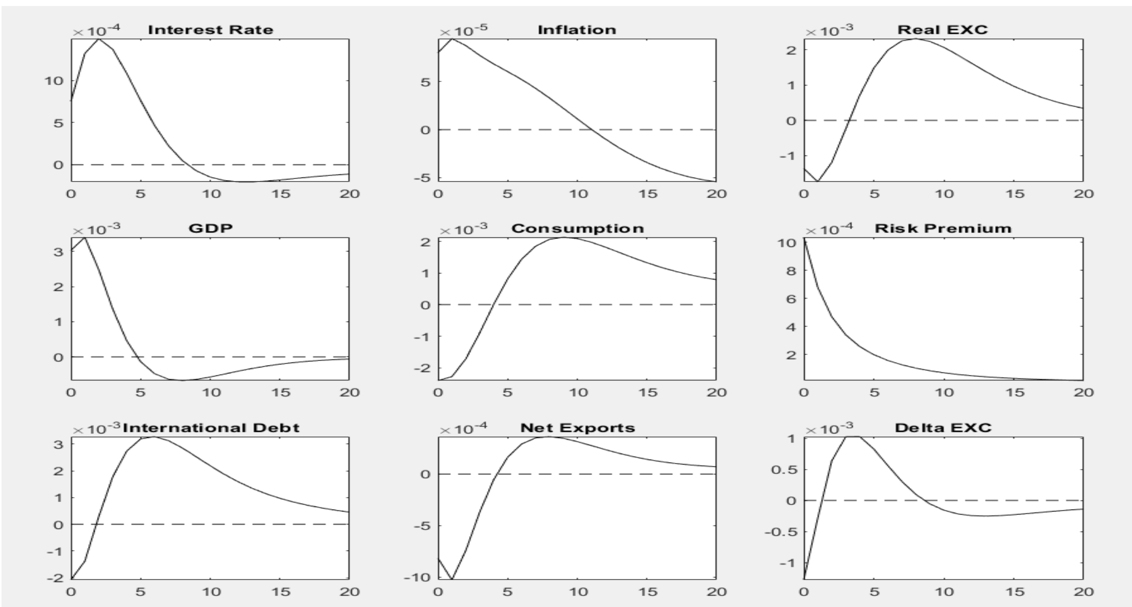

Figure A9: IRF of model variables to a fiscal shock.

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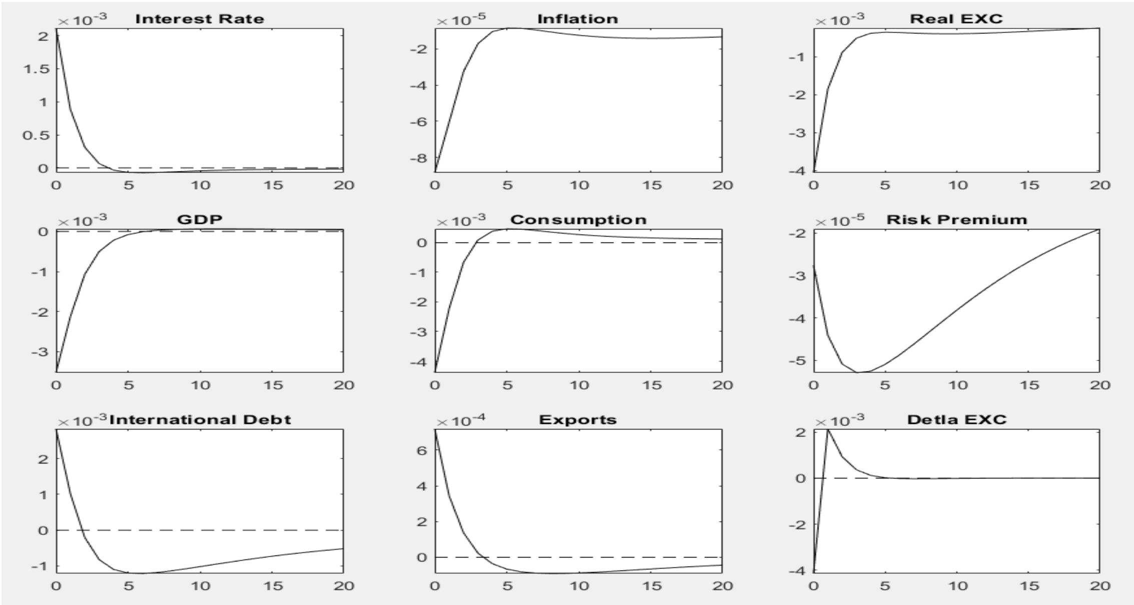

Figure A10: IRF of model variables to a monetary policy shock.

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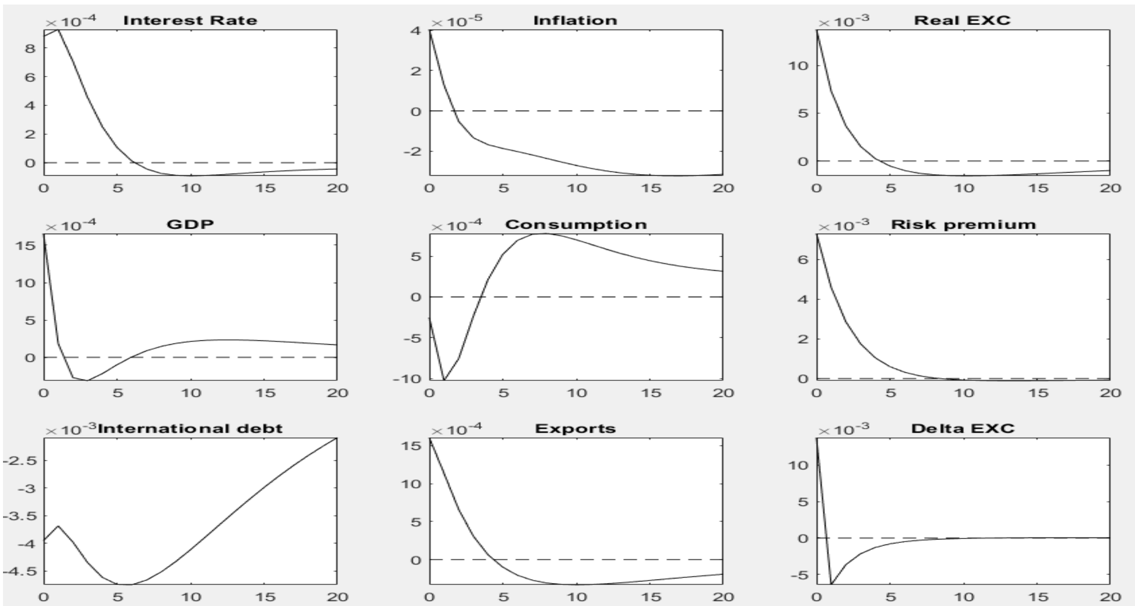

Figure A11: IRF of model variables to a risk perception shock.

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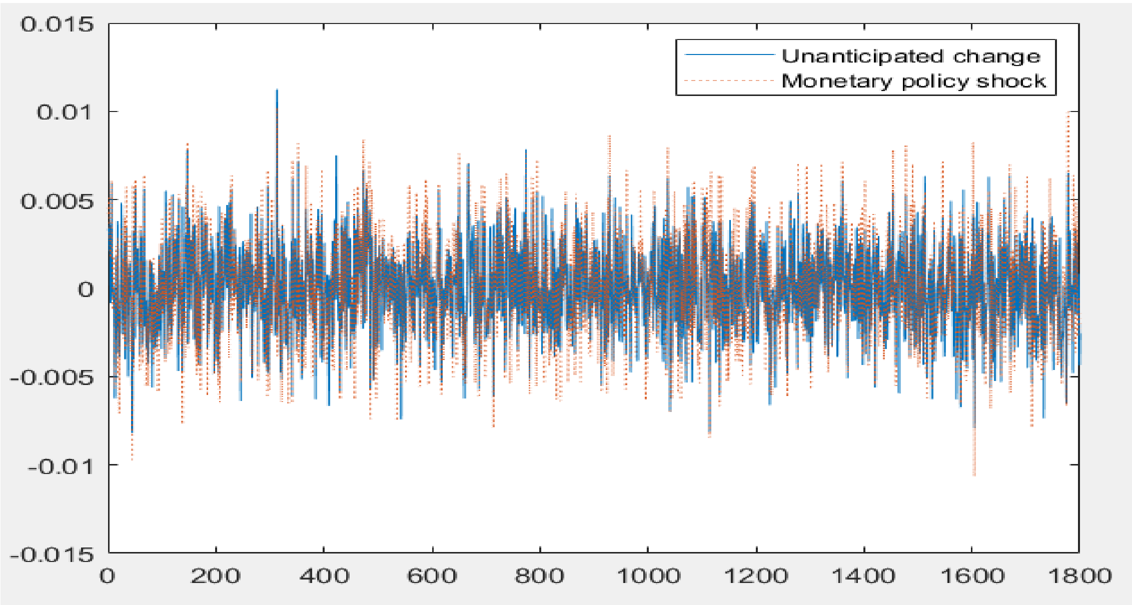

Figure A12: Simulated unanticipated change in interest rate S_t^r and the true monetary policy shock ε_t^r

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