Default Risk and the Exchange Rate Puzzle in Brazil

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Abstract

This paper explores the exchange rate puzzle in Brazil, where contractionary monetary policy innovation often leads to domestic currency depreciation. By incorporating default risk into the analysis, the study finds that unanticipated interest rate hikes, when associated with unanticipated higher default risk, trigger currency depreciation. In contrast, when unanticipated default risk is smaller, the same policy action leads to currency appreciation and capital outflows. Using a small open economy model and high-frequency data from credit default swaps, the paper highlights the critical role of default risk in understanding these exchange rate dynamics. The findings offer new insights into the transmission of monetary policy in emerging markets and help explain part of the exchange rate puzzle.

Keywords— Monetary Policy, Default Risk, Exchange Rate Puzzle.

1 Introduction

In recent decades, many emerging economies have officially adopted inflation-targeting frameworks. Despite this shift, research on monetary policy transmission and its effects on macroeconomic variables has largely focused on advanced economies. More recently, however, there has been growing interest in understanding these dynamics within emerging markets. The structural and institutional complexities of these economies often weaken the effectiveness of interest rates as a standalone monetary policy tool (Cordella & Gupta, 2015; Frankel, 2010; Vegh et al., 2017). One key 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 typically lead to currency appreciation, emerging markets often display the opposite reaction, with currencies tending to depreciate following such policy adjustments (Hnatkovska et al., 2016).

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Using empirical data from Brazil, this paper demonstrates that monetary policy rate hikes is often related to rising sovereign default risk, which in turn contributes to currency depreciation, contrary to the conventional expectation of appreciation following tighter monetary policy. Importantly, the reaction of the exchange rate hinges on whether the interest rate increase is accompanied by a rise in perceived default risk. When interest rate surprises occur without a concurrent increase in default risk, the domestic currency typically appreciates.

The observed rise in default risk following an interest rate hike may stem from two sources. First, it could reflect deteriorating economic fundamentals, such as an endogenous slowdown in output. Second, it may result from informational content embedded in central bank communications, particularly information that implicitly conveys heightened concerns about fiscal sustainability or macroeconomic imbalances. An illustrative example of this latter mechanism can be found in the minutes of the October 2015 Copom[1] meeting:

"...However, the Committee notes that the lack of definition, and 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 creating 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. ...".

Following this communication, the 5-year credit default swap (CDS) spread on Brazilian government bonds (a market-based measure of sovereign default risk) increased by 18.4 basis points in a single day.

This study emphasizes that exchange rate responses are influenced not only by the direction of monetary policy, but critically by changes in sovereign default risk. Regardless of whether this risk revaluation arises from deteriorating economic fundamentals or from heightened concerns revealed through central bank communication, the core mechanism underlying the exchange rate puzzle is the increase in perceived default risk following a monetary policy rate hike.

I use a high-frequency identification approach to distinguish between two types of unanticipated monetary policy changes: those linked to a positive correlation with default risk measures and those linked to a negative correlation around monetary policy announcements. The method relies on financial market data surrounding monetary policy meetings, specifically analyzing fluctuations in credit default swaps and the risk premium of 10-year zero-coupon government bonds. By assessing the relationship between unexpected changes in the policy interest rate and simultaneous movements in these risk indicators, the analysis identifies interest rate adjustments that are positively related to default risk. The results reveal that when monetary policy surprises coincide with increases in CDS spreads around monetary policy announcements, they are typically associated with nominal exchange rate depreciations, highlighting a potentially important

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

link between default risk and the response of currency prices to interest rate shocks. Notably, a similar pattern emerges in other Latin American economies, such as Chile and Colombia.

While the empirical pattern is informative, identifying the distinct effects of monetary policy and shifts in country risk perception remains challenging, as these shocks often occur simultaneously and can have opposing theoretical implications for default risk. To address these identification issues and better isolate the underlying mechanisms, I employ a structural DSGE model of a small open economy, building on the framework developed by Gouvea et al. (2008). This model explicitly incorporates the interactions between monetary policy, macroeconomic conditions, and sovereign risk perception, allowing for a more precise decomposition of interest rate surprises, a clearer interpretation of exchange rate responses to the risk premium channel, and a variance decomposition that quantifies the relative contribution of monetary and risk shocks to observed movements in interest rates surprises.

Related Literature - The exchange rate puzzle was first explored in the seminal work of Grilli and Roubini (1995), which documented that nominal exchange rates in non-U.S. G7 countries tend to depreciate against the U.S. dollar following an interest rate hike. More recent studies have extended this analysis to emerging markets, uncovering similar patterns. For instance, Hnatkovska et al. (2016), using short-run restrictions in a VAR framework, show that unexpected interest rate increases lead to currency depreciation in emerging economies, in contrast to the appreciation typically observed in advanced economies. Likewise, Kim and Lim (2022) employ sign restrictions to identify monetary policy shocks, confirming that domestic currencies in seven emerging markets depreciate following such shocks. High-frequency identification methods have also been applied in related research. For example, Kohlscheen (2014) examines inter-day interest rate fluctuations in Brazil and identifies several unexpected monetary policy responses, including evidence of the exchange rate puzzle.

Explanations for this phenomenon in emerging markets have been grounded in theoretical models. Hnatkovska et al. (2016) develop a framework that attributes these differences to variations in liquidity demand. Alberola et al. (2021) emphasize the role of fiscal regimes in shaping the transmission of monetary policy to exchange rates, showing that when government debt lacks credible future fiscal surpluses, contractionary monetary policy shocks can trigger currency depreciation due to heightened concerns over debt sustainability. These findings underscore the complex interplay between monetary and fiscal policies and their combined effects on exchange rate dynamics in emerging markets. Similarly, Arellano et al. (2020) introduce a sovereign default model with monetary policy calibrated to the Brazilian economy, offering a theoretical explanation for currency depreciation following interest rate hikes.

Building on this line of research, the present paper highlights the crucial role of default risk in understanding exchange rate depreciation after monetary policy tightening. However, in contrast to the predominantly theoretical approaches in the literature, this study takes an empirical perspective, leveraging financial market data to demonstrate the significance of default risk in shaping exchange rate movements.

To the best of my knowledge, this document is the first to empirically examine the exchange rate puzzle in emerging economies by focusing on the role of default risk as a transmission channel. Two closely related studies are Pirozhkova et al. (2024) and Checo et al. (2024). Pirozhkova et al. (2024), in particular, identifies country risk shocks as an important mechanism through which monetary policy influences macroeconomic outcomes in South Africa, showing that such shocks lead to a depreciation of the rand against the U.S. dollar and the euro. Using principal component analysis (PCA), the authors isolate country risk as a key component of monetary policy transmission in emerging markets. However, unlike the present paper, they do not directly address the exchange rate puzzle, as they treat country risk as an independent dimension of monetary policy rather than a factor that mediates its effects on exchange rates.

The latter study takes a different approach, orthogonalizing 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 monetary policy shocks are orthogonalized in this way, the exchange rate puzzle disappears in emerging economies.

In contrast, this paper adopts a different empirical strategy. Rather than relying on PCA or orthogonalizing shocks with lagged macroeconomic variables, it leverages high-frequency changes in financial markets to isolate monetary policy shocks positively correlated with default risk. This perspective interprets the default risk information channel as a reflection of private information held by central banks before its public disclosure, offering new insights into how informational asymmetries shape 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 employ an Instrumental Variable Bayesian Vector Autoregression (IV-BVAR) model to identify and quantify the impact of macroeconomic variables in response to unexpected interest rate increases, distinguishing between positively correlated with default risk measures and those that are not. This section details the methodology used to construct proxy variables for these two distinct types of shocks, drawing on data from the Survey of Professional Forecasters and financial markets.

The first step is to construct variables that capture unexpected interest rate changes, both with and without a positive correlation with default risk. This is achieved using data from the Survey of Professional Forecasters and financial markets. The following section explains how these proxy variables serve as instrumental variables within the IV-BVAR framework. These instruments enable the identification of Impulse Response Functions (IRFs), which are subsequently used to examine how various macroeconomic variables respond 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 emphasize the importance of financial market reactions following monetary policy meetings as a crucial component of the information channel in monetary policy shocks. The identification process relies on two key elements:

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

2. **Financial Asset Information Reflecting Risk Perception Differences:** This variable leverages financial asset data to measure shifts in risk perception occurring right after monetary policy announcements. By distinguishing between monetary policy shocks that coincide with increases in default risk and those that do not, it provides a clearer perspective on how risk perceptions shape the transmission of monetary policy.

The methodology generates two orthogonal shocks using both components: one associated with monetary policy changes that incorporate default risk co-movement (u_t^r), and another linked to monetary policy shocks with a negative correlation with default risk (u_t^M). This analytical framework allows for a clear distinction between the effects of these two types of shocks,

In the initial step of the analysis, I use the "Survey of Informed Expectations from 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 crucial tool for monitoring and assessing professional forecasters' expectations regarding the Selic rate, the policy interest rate 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 its anticipated value. The anticipated rate is obtained as the average of professional forecasters' responses recorded on the day before the meeting.

In the second step, I compute the changes in risk premia surrounding monetary policy meetings. (CDS) are derivative instruments commonly used to hedge against the risk of default on specific securities. For Brazilian government bonds, the five-year CDS serves as a key indicator of the market's assessment of default risk over a five-year horizon. In a CDS contract, the buyer makes periodic payments in exchange for protection against the possibility of default. Consequently, changes in CDS prices provide valuable insights

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

into how financial markets perceive the risk associated with the Brazilian government's 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 leads to an increase in the CDS premium, this suggests that the market perceives a higher default risk, possibly due to concerns about country's fiscal position or overall economic stability after the meeting. Conversely, a decline in the CDS premium may indicate a reduction in default risk perception.[3] Thus, analyzing CDS spread movements around monetary policy events helps disentangle the role of default risk in shaping the broader macroeconomic response to monetary policy shocks.

I calculate the change in the CDS spread between one day after the monetary policy meeting and one day before, denoted as ΔCDS_t.[4] This adjustment allows me to isolate changes in risk perception immediately following the monetary policy meeting. Figure 1 presents a scatter plot comparing the variables S_t and ΔCDS_t, illustrating the relationship between unanticipated increases in the policy interest rate and shifts in risk perception.

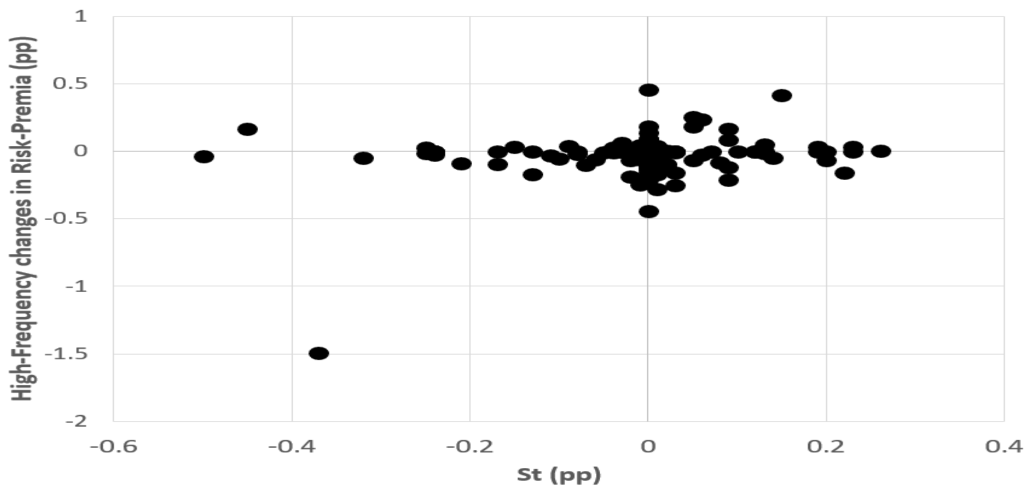

Figure 1: Scatter plot of high frequency movements.

Note: Scatter plot of S_t and ΔCDS_t around monetary policy announcements.

To isolate the portion of the unanticipated interest rate changes that have positive comovement with default risk measures (i.e., u_t^r), I employ the procedure proposed by

[3]As discussed later, the identification strategy is not without limitations, as standard monetary policy hikes could also influence high-frequency increases in CDS spreads.

[4]Most studies employing high-frequency strategies to identify shocks typically use 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 discussion on this issue, see Kohlscheen (2014).

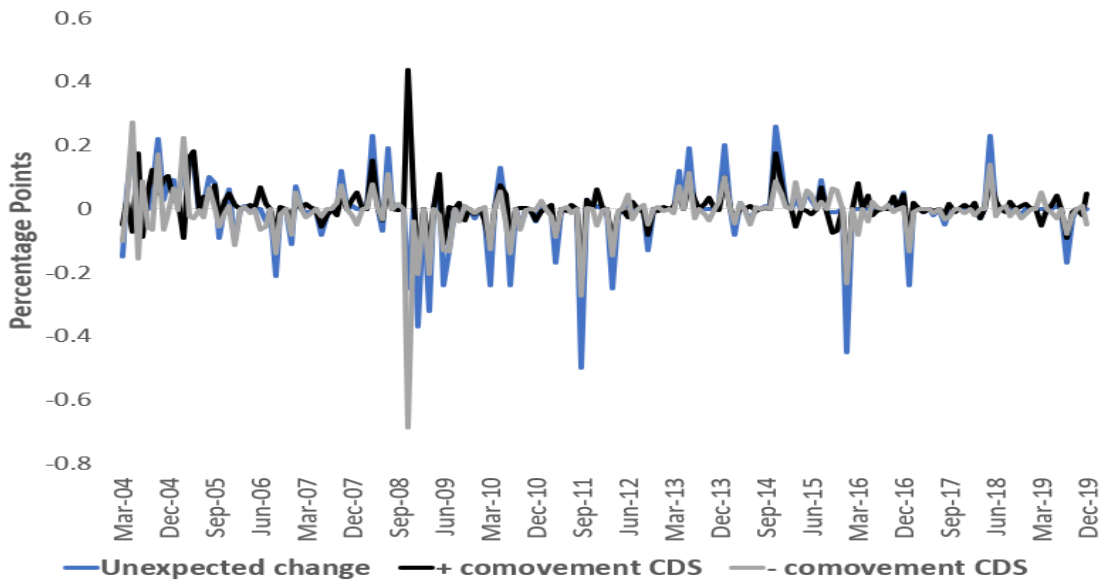

Figure 2: Unexpected increases in interest rate and components

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Note:Unexpected increases in the interest rate S_t, The part that has negative comovement with default risk u_t^M and the part of the unexpected increase that has positive comovement u_t^r.

Jarociński and Karadi (2020). This procedure posits that the unanticipated interest rate increase can be decomposed into two orthogonal shocks: one associated with default risk positive comovement (u_t^r) and the other containing unexpected innovations that have negative comovement with default risk measures (u_t^M). The identification of these shocks relies on the information embedded in ΔCDS_t and adheres to the sign restrictions outlined in Table 1. Specifically, u_t^r is expected to exhibit positive correlations with both ΔCDS_t and S_t, while u_t^M should display a negative correlation with ΔCDS_t and a positive correlation with S_t.

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

Table 1: Sign restrictions for identification.

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Note: Sign restrictions to identify unexpected innovations that have positive comovement with default risk (u_t^r) and unexpected innovations with negative comovement u_t^M.

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

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 capitalizes on the advantages of Bayesian VARs, which have become a widely recognized tool for estimating and analyzing macroeconomic responses to exogenous shocks. One key strength of Bayesian VARs is their ability to mitigate the curse of dimensionality, a common challenge in large VAR models, as highlighted by Miranda-Agrippino and Ricco (2019) and Kuschnig and Vashold (2021). For estimation, I use bayesian techniques with standard Normal Inverted-Wishart (NIW) prior. The tightness of the prior is set as in Giannone et al. (2015). This prior provides a robust framework for parameter estimation, effectively integrating prior beliefs with observed data to generate posterior distributions that enhance inference in the presence of limited sample sizes.

Additionally, I incorporate instrumental variables, building on the seminal contributions of Stock and Watson (2012) and Mertens and Ravn (2013) to identify the responses. This approach has played a crucial role in advancing our understanding of the effects of monetary policy, as evidenced 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, ensuring a more robust analysis of how macroeconomic variables react to monetary policy shocks. This framework allows for a clear distinction between policy shocks that exhibit a positive correlation with default risk measures and those that exhibit a negative correlation, providing deeper insights into the role of default risk in the transmission of monetary policy.

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

$$Y_t = \beta(L)Y_t + u_t \tag{1}$$

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):

$$u_t = A\varepsilon_t \tag{2}$$

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

$$\Sigma_u = E[u_t u_t'] = E[A\varepsilon_t \varepsilon_t' A'] = AA' \tag{3}$$

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:

$$IRF = (I - \hat{\beta}(L))^{-1}A \tag{4}$$

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 objective of this analysis is to determine whether unanticipated innovations that exhibit positive comovement with default risk have different effects compared to those with negative comovement. The instrumental variable plays a crucial role in disentangling and isolating these distinct responses. To assess the influence of default risk on the effects of monetary policy shocks (MPS), I use the instrumental variable u_t^r, which captures policy shocks positively correlated with default risk measures. Conversely, when analyzing the responses to MPS that are negatively correlated with default risk, 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 ($E[\varepsilon_{1,t}Z_t] = \alpha$) and exogeneity ($E[\varepsilon_{2:n,t}Z_t] = 0$) conditions. For ease of presentation, the first variable in the system is the interest rate, whose reduced-form residuals are assumed to be related to structural monetary policy shocks, either positively or negatively associated with default risk. Consider the covariance between the reduced-form innovations and the instrumental variable:

$$E[u_t Z_t] = E[A\varepsilon_t Z_t] = AE\begin{bmatrix}\varepsilon_{1,t}Z_t \\ \varepsilon_{2:n,t}Z_t\end{bmatrix} = A\begin{bmatrix}\alpha \\ 0\end{bmatrix} = \begin{bmatrix}A_{1,1}\alpha \\ A_{n,2:n}\alpha\end{bmatrix} \tag{5}$$

I assume $A_{1,1} = 1$ 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:

$$\frac{E[u_{i,t}Z_t]}{E[u_{n,t}Z_t]} = A_{i,n} \tag{6}$$

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

$$IRF = (I - \hat{\beta}(L))^{-1}A_{1:n,1} \tag{7}$$

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 impulse response functions (IRFs) are computed with a forecast horizon of 24 months, and the results are presented with a 90.0% highest posterior density intervals (posterior coverage bands).[5] I use monthly data from January 2004 to December 2019, thereby avoiding potential distortions introduced by the COVID-19 pandemic and its effects on the monetary policy transmission mechanism. For time series exhibiting significant seasonal variation, I apply the x13 method implemented by Sax and Eddelbuettel (2018) to effectively remove seasonal effects.

I include the following variables in the analysis: the Federal Funds interest rate, which controls for the international liquidity stance and helps estimate the responses of the nominal exchange rate and GDP independent of interest rate differentials; a monthly estimate of Gross Domestic Product; the Consumer Price Index; and the Housing Price Index, which is commonly used in the literature to address potential price puzzle concerns (Bernanke & Mihov, 1998). Additionally, I incorporate real total credit outstanding, the nominal exchange rate with respect to the US dollar (domestic currency per one US Dolar), net capital flows as a percentage of GDP, narrow money (M1), and the interbank interest rate as a proxy for the central bank's policy interest rate.[6] All variables are expressed in logarithms, except for FED interest rate, Capital flows, and the policy interest rate, which are reported in percentage terms. A detailed description of the data sources and computational procedures is provided in Appendix A.1.

3.1 Responses of Macroeconomic Variables to monetary policy

Figure 3 presents the impulse responses to an unexpected interest rate increase, without decomposing the shocks into components related to default risk and non-default risk. That is, I use the variable S_t as the instrument. The IRFs depict the responses of macroeconomic variables to a 1.0% unanticipated increase in the interest rate, following the standard approach in monetary policy transmission studies (Gertler & Karadi, 2015). Notably, after the interest rate hike, there is a decline in GDP, real total credit outstanding, M1, and the Housing Price Index, aligning with the predictions of conventional theoretical models on the effects of monetary tightening.

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

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

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

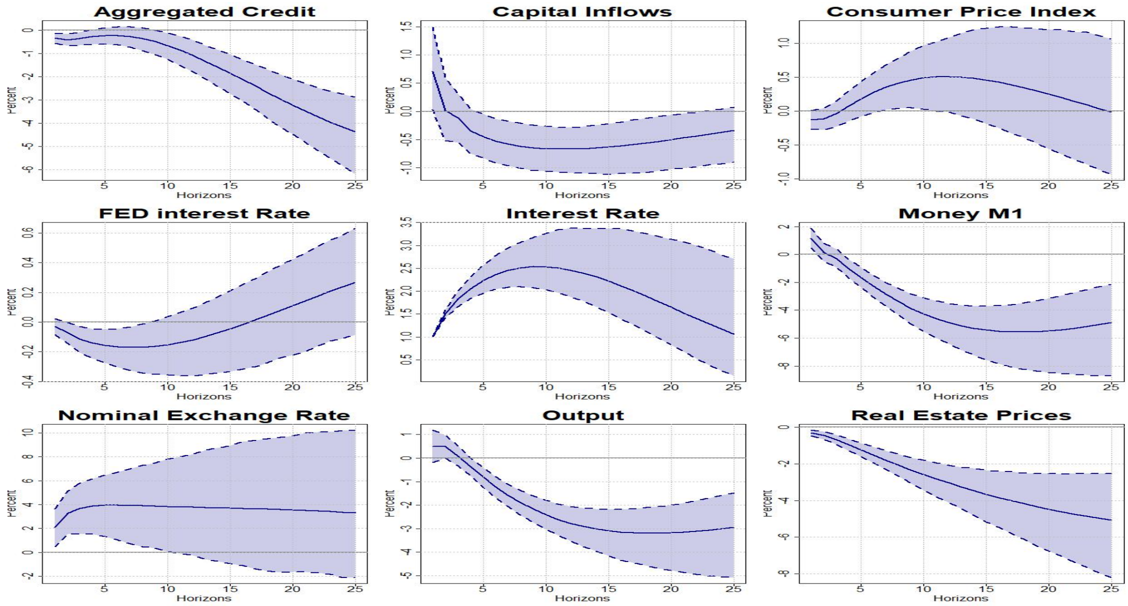

Figure 3: IRF to unexpected increase in interest rate.

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Note: IRF of macroeconomic variables to MPS instrumented with unexpected increase in monetary policy interest rate, S_t. Shaded areas are 90.0% posterior coverage bands.

exchange rate within the first year following the shock. Additionally, the CPI rises by 0.5% over the same period.

Understanding the role of default risk in unanticipated interest rate increases provides valuable insights into the exchange rate puzzle. Figure 4 presents the IRFs for interest rate changes instrumented with the variable u_t^r. This figure illustrates the dynamic response of macroeconomic variables to unexpected interest rate increases that exhibit positive comovement with default risk measures. Notably, the responses in Figure 4 closely resemble those in Figure 3, but with a more pronounced impact on capital flows, the nominal exchange rate, and the Consumer Price Index (CPI). Specifically, following a 1.0% increase in the interest rate, the capital flow ratio decreases by 0.8 percentage points within the first year, the nominal exchange rate depreciates by 8.0%, and the CPI rises by 1.2%.

Finally, I analyze the response of macroeconomic variables to interest rate changes that exhibit negative comovement with default risk measures. Figure 5 presents the IRFs using u_t^M as the instrument. Notably, the responses of domestic variables in this case align with conventional macroeconomic theoretical models. Following an unanticipated increase in the interest rate, GDP, aggregate credit, and prices decline. In contrast, capital flows exhibit no significant change, while the domestic currency appreciates. Specifically, a 1.0% increase in the interest rate leads to a 1.3% decline in the CPI within the first year and an 8.2% appreciation of the nominal exchange rate.

The preceding findings suggest that the exchange rate puzzle, as documented in the literature on emerging markets, may be attributed to the role of default risk in the

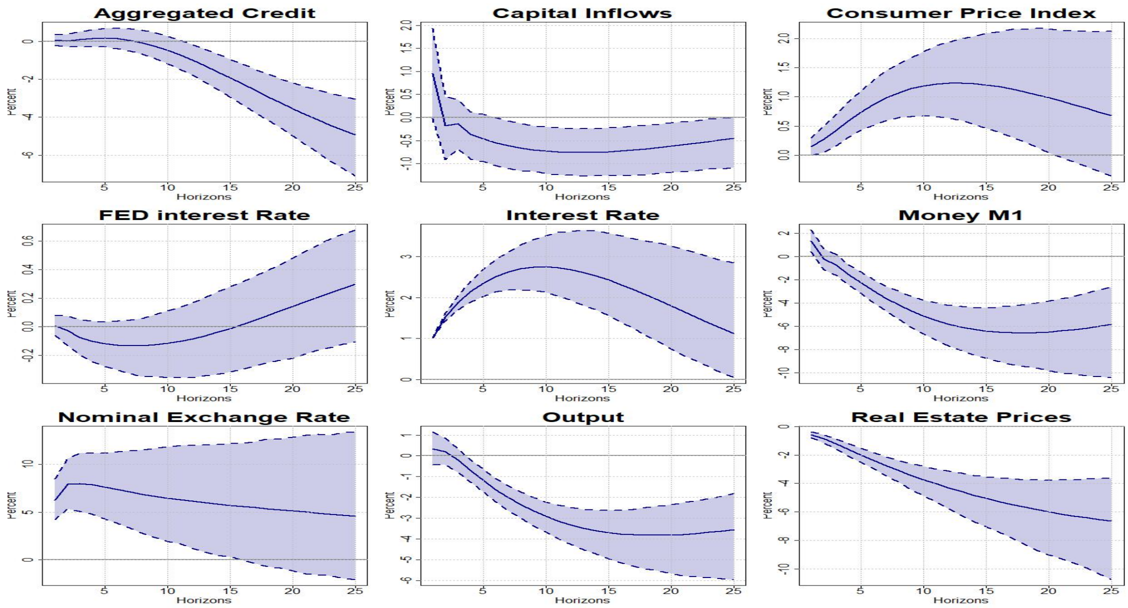

Figure 4: IRF to monetary policy positively related to default risk

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Note: IRF of macroeconomic variables to MPS instrumented with the u_t^r which are monetary policy changes that have positive comovement with changes in CDS. Shaded areas are 90.0% posterior coverage bands..

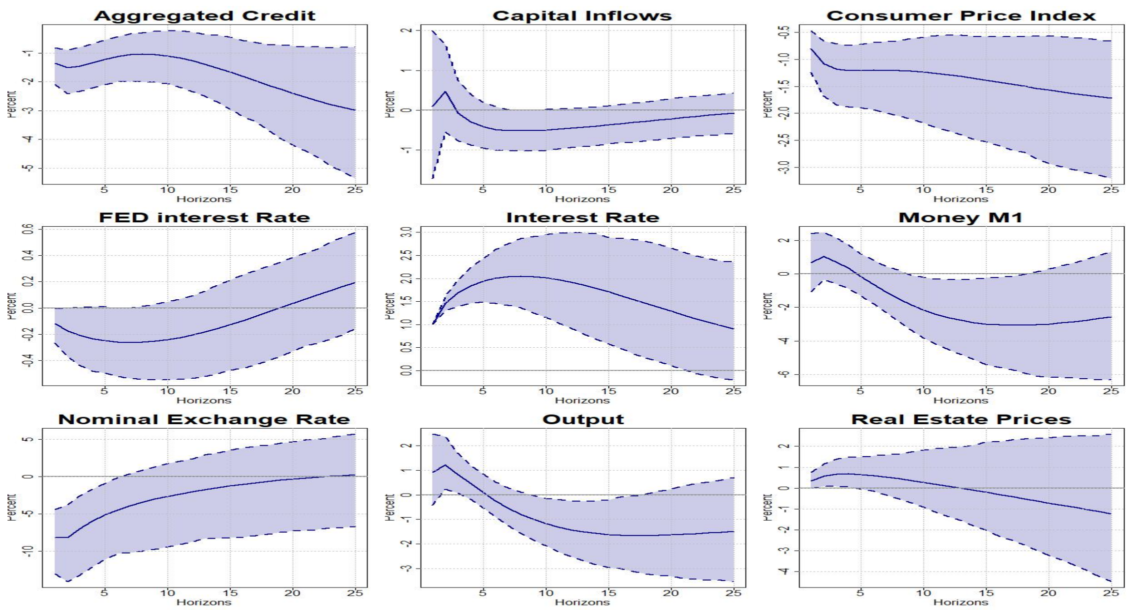

Figure 5: IRF to monetary policy negatively related to default risk

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Note: IRF of macroeconomic variables to MPS instrumented with the u_t^M which are monetary policy changes that have negative comovement with changes in CDS. Shaded areas are 90.0% posterior coverage bands.

estimation of monetary policy surprises. By accounting for fluctuations in default risk, I can isolate monetary policy innovations whose effects on the economy align more closely with the predictions of conventional macroeconomic models. These results underscore the importance of incorporating default risk into the analysis of monetary policy transmission in emerging economies. Default risk plays a crucial role in shaping the responses of key macroeconomic variables, particularly the exchange rate, and should therefore be considered when evaluating the broader impact of monetary policy.

There are two main concerns regarding the empirical strategy adopted in this paper. The first relates to the reliance on financial market data, particularly default risk indicators, in a high-frequency framework to analyze the exchange rate puzzle, rather than directly using high-frequency changes in the nominal exchange rate. To address this concern, I implement a reverse identification strategy that instead uses high-frequency movements in the exchange rate itself to isolate monetary policy shocks. This alternative approach (presented in Appendix 1.B) confirms the baseline findings: exchange rate depreciations following interest rate hikes are systematically associated with increases in CDS spreads. This supports the notion that the proposed mechanism, centered on default risk, plays a central role in driving exchange rate responses.

The second concern is that CDS spreads may reflect general macroeconomic information, not default risk perceptions. To disentangle these effects, Appendix 1.C presents an alternative specification where I use high-frequency changes in stock market values, following the approach in Jarociński and Karadi (2020). The rationale is as follows: if monetary announcements primarily convey general economic news (e.g., stronger growth prospects), then rising interest rates accompanied by stock market gains should be associated with an appreciating currency. However, the evidence does not support this pattern. Thus, the results suggest that CDS spreads contain distinct information related to default risk, beyond what is captured by stock prices, despite some overlap due to general equilibrium effects. This further reinforces the view that risk perception, as proxied by CDS, is the key channel at play.

4 Robustness analysis

In this section, I conduct robustness checks on the previously presented results by modifying the identification strategy. First, I use changes in the 10-year zero-coupon yield curve as a financial market instrument to capture shifts in default risk perception following the monetary policy meeting. Second, I apply a "poor man's" strategy to construct the instruments u_t^r and u_t^M, providing a simpler method to distinguish between monetary policy shocks that exhibit positive comovement with default risk measures and those that exhibit negative comovement. This alternative approach allows for further validation of the initial findings, ensuring that the results remain consistent across different identification strategies.

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

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

ii) They implement inflation-targeting frameworks for monetary policy, providing a consistent policy approach that facilitates the study of monetary policy transmission.

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

iv) Comparable high-frequency variables, including data from professional forecaster surveys and financial markets, can be constructed for both Chile and Colombia, enabling the application of the same empirical methodology used for Brazil.

4.1 Zero Coupon Yields

Market interest rates, particularly those associated with government bonds, provide crucial insights into default risk in emerging markets (De Leo et al., 2022). 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 methodology employed by Cieslak and Schrimpf (2019) in their research on advanced economies. The use of long-term interest rates offers a more comprehensive assessment of shifts in risk perception, as these yields encapsulate a broader range of information embedded in financial markets. By focusing on longer maturities, this approach ensures that the analysis captures both immediate and forward-looking changes in market expectations regarding default risk.

I assume that financial markets incorporate all available information into asset prices. Consequently, 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 serves as the short-term, risk-free interest rate in the economy. Similarly, the risk premium just before the meeting is determined as 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 posits that financial markets continuously reflect all available information in asset prices. By employing this framework, I ensure that the estimated risk premium accurately captures market expectations and their adjustments in response to monetary policy decisions.

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.

$$v_t = rp_{t+1} - rp_{t-1} = (i_{t+1}^T - i_{t+1}^p) - (i_{t-1}^T - E_{t-1}[i_t^p]) = (i_{t+1}^T - i_{t-1}^T) - S_t \qquad (8)$$

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.

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

Table 2: Sign restrictions with zero coupon yields

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Note: Sign restrictions to identify unexpected innovations that are positively correlated to default risk measure (u_t^r) and unexpected innovations negatively correlated to default risk u_t^M using zero coupon yields as the financial market variable.

Figures A5 and A6 in Appendix C present the responses of macroeconomic variables to unexpected interest rate increases, instrumented with u_t^r and u_t^M, respectively. The results closely align with the baseline specification. When the interest rate shock exhibits positive comovement with default risk measures (u_t^r), a significant decline in capital flows is observed, along with currency depreciation and an increase in prices. Conversely, when the interest rate shock exhibits negative comovement with default risk measures (u_t^M), the domestic currency appreciates, prices decline, and capital flows increase significantly.

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, I adopt a simplified identification strategy. I classify unexpected changes into two groups: when the unanticipated change in the policy rate (S_t) has the same sign as ΔCDS_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 straightforward way to distinguish between the effects of monetary policy shocks associated with default risk, improving the interpretability of the results.

Figures A7 and A8 in Appendix C present the results of this robustness check. Consistent with the previous analysis, the findings remain stable despite the methodological modification. The inclusion of default risk continues to clarify the responses of capital flows, CPI, and nominal exchange rate following a monetary policy rate change. These results reinforce the robustness of the identified transmission mechanisms and highlight the significant role of default risk in shaping 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 notable differences in the availability of economic expectations surveys. Unlike Brazil, which conducts a daily survey, the surveys in Chile and Colombia are less frequent. In Chile, the average lag between the survey and the monetary policy meeting is 4.5 days, whereas in Colombia, this lag extends to 13.5 days. Additionally, the time span of the data series is shorter: in Chile, the series begins in November 2007, while in Colombia, the first available observation dates to August 2014. Despite these differences, the identification of IRFs using the IV-BVAR framework remains feasible, allowing for the computation of responses even with shorter survey periods. However, these discrepancies may affect the efficiency of the estimation process.

The results for Colombia are presented in Figures A9 and A10 in Appendix C.[7] The responses closely resemble those observed for Brazil. When using u_t^r to instrument the unanticipated increase in the interest rate, currency depreciation and an increase in the aggregate price level follow the monetary policy contraction. Other macroeconomic variables respond in line with conventional models, displaying a decline in GDP, lower real estate prices, and a reduction in aggregate debt. Conversely, when instrumenting the interest rate innovation with u_t^M, economic activity, real estate prices, and credit still decline after the rate hike, but the exchange rate appreciates in response to the contraction. In this case, CPI exhibits non-significant responses.

Figure A11 in Appendix C illustrates the response of macroeconomic variables to interest rate changes instrumented with u_t^r in Chile. The observed reactions present some puzzling dynamics, particularly concerning the exchange rate, prices, and economic and credit activity. Following a contractionary monetary policy shock that exhibits positive comovement with default risk measures, these variables increase, with the exchange rate depreciating. In contrast, Figure A12 in Appendix C presents the responses to monetary policy surprises instrumented with u_t^M. In this case, the exchange rate appreciates following the contraction, which helps mitigate the puzzling responses of GDP and aggregated credit. However, CPI still rises. Notably, in both cases, capital flows exhibit no significant reaction.

5 A Small-open Economy

The empirical analysis of this paper reveals that surprise increases in interest rates are sometimes associated with rising CDS spreads and other times with declines, and that these surprises often trigger exchange rate movements, particularly depreciations when accompanied by increases in sovereign risk. While this evidence is informative and suggests a link between monetary policy shocks and default risk, identifying the precise mechanisms at play remains challenging. One key difficulty is that monetary policy surprises frequently coincide with changes in market perceptions of country risk, meaning that observed movements in interest rates and CDS spreads may reflect a combination of policy effects and shifts in default risk. Furthermore, theory offers no clear guidance: a contractionary monetary policy shock could strengthen the currency and reduce external vulnerabilities, thereby lowering CDS spreads; alternatively, it could weaken economic activity and deteriorate fiscal prospects, increasing country risk.

Given these identification challenges, the empirical strategy, though valuable, is lim-

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

ited in its ability to disentangle the effects of monetary policy from those of changing sovereign risk perceptions. To complement the empirical analysis and provide a clearer interpretation of the observed dynamics, I employ a structural model that explicitly captures the interactions between monetary policy, macroeconomic fundamentals, and sovereign risk. Specifically, I use a small-open economy DSGE model, building on the benchmark framework introduced by Gouvea et al. (2008), to examine how different types of shocks—monetary and risk-related—shape the behavior of macroeconomic variables and sovereign risk indicators in response to unanticipated changes in interest rates.[8]

This structural framework provides three key advantages. First, it allows for a more precise decomposition of interest rate surprises by isolating the component driven by sovereign risk shocks from that related to conventional monetary policy shocks. Second, it enhances the understanding of the underlying mechanisms driving exchange rate responses to unanticipated interest rate hikes, particularly through its interaction with the risk premium. Finally, it enables a variance decomposition of unexpected interest rate increases, quantifying the share attributable to movements in the risk premium versus that driven by monetary policy decisions.

In this model, there are two 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 incorporates an exogenous rule for the international interest rate spread, which captures the cost faced by the domestic economy when borrowing in international financial markets. This spread is influenced by several factors: the level of international debt (in foreign currency) as a percentage of GDP, an exogenous component reflecting the country's risk perception, and the general risk aversion of foreign investors. When the country risk perception and general risk aversion rise (signaling an increase in country risk premium) the international interest rate spread widens. As a result, borrowing costs for the domestic economy increase, as investors demand a higher return to compensate for the elevated risk associated with holding domestic debt.

The economy is subject to thirteen distinct shocks, including those related to the inflation target, fiscal target, preferences, investment, labor, technology, world GDP, world inflation, world interest rates, monetary policy, government spending, foreign risk aversion, and country risk perception. I assume that these shocks occur in two stages within the same period. First, all shocks unrelated to monetary policy and country risk perception materialize at the beginning of the period, at which point agents make decisions regarding quantities and prices without knowledge of the forthcoming monetary

[8]Gouvea et al. (2008) presents the SAMBA model, a DSGE framework utilized by the Central Bank of Brazil for policy analysis and medium-term forecasting. While more recent versions exist, this version is chosen for two key reasons: *i)* it provides a clear representation of a small-open economy with a New Keynesian structure that incorporates monetary policy, and *ii)* it treats the international interest rate as an exogenous process, simplifying the modeling of capital flows.

policy and country risk perception shocks. Subsequently, these two remaining shocks are realized, affecting the new interest rate and the updated foreign investors' risk premium, which then feed into agents' decision-making in the following period.

This timing assumption is particularly relevant when examining the role of default risk information in shaping monetary policy shocks. By sequencing the realization of shocks in this manner, the model mirrors the real-world dynamics in which financial markets and economic agents respond to monetary policy decisions that, in turn, incorporate previously unavailable information about sovereign risk. This assumption aligns with empirical findings indicating that monetary policy announcements are often accompanied by changes in CDS spreads, suggesting that central bank decisions reveal new information regarding a country's creditworthiness.

The literature on the information effects of monetary policy frequently relies on models in which agents update their beliefs following a monetary policy announcement.[9] While this paper does not adopt an endogenous learning framework, it employs the alternative timing assumption described above as a simplified way to capture the idea that monetary policy decisions convey information about a country's risk premium. This modeling choice explicitly accounts for the central bank's role in simultaneously responding to two distinct shocks (one associated with monetary policy itself and another linked to default risk). By incorporating this structure, the model provides a clearer understanding of how default risk perceptions interact with monetary policy actions, influencing macroeconomic outcomes in ways that may not be fully captured by conventional models that treat monetary policy as an isolated exogenous shock.

In the following sections, I first describe the structure of the economy, with particular emphasis on the monetary policy authority and the interest rate faced by foreign investors.[10] Next, I outline the information structure governing the economy, followed by the estimation strategy for the model parameters. Finally, I conduct simulations to demonstrate that an unanticipated increase in the short-run interest rate, accompanied by an increase in the risk premium, leads to nominal exchange rate depreciation and a reduction in foreign debt (i.e., capital outflows). This result aligns with the empirical findings, reinforcing the importance of incorporating default risk dynamics in the analysis of monetary policy transmission.

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

[9]See, for example, Nakamura and Steinsson (2018).

[10]For a more detailed discussion of the model equations, see Gouvea et al. (2008). The linearized version of these equations is provided in Appendix B.

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. Risk premium depends on the foreign debt-to-GDP ratio and 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 **calvo1983empty citation**.

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-output 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 Monetary Authority

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

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

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

$$r_t = \gamma_r r_{t-1} + (1-\gamma_r)[\gamma_\pi E_t[\pi_{t+1}] + \gamma_y y_t^{VA}] + z_t^r \tag{9}$$

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.[11] 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 A13 in Appendix C.

5.3 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:

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

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

$$\hat{\phi}_t = -\psi \Big[b_{t+1}^{y*}\Big] + \nu z_t^{\phi *} + z_t^{\phi} \tag{10}$$

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, and b_{t+1}^* is the level of foreign bonds households hold over output. $z_t^{\phi *}$ is the country risk perception. Its shock is released together with the monetary policy shock at the end of each period but before the decision on the interest rate by the central bank. Finally, z_t^{ϕ} is the foreign risk aversion, whose shock is released at the beginning of the period. The latter two exogenous variables are assumed to follow an AR(1) process:

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

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

Where $\varepsilon_t^{\phi*}$ is i.i.d normally distributed with mean zero and variance $\sigma^2_{\phi*}$. Note that an increase in $\varepsilon_t^{\phi*}$ 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. The difference between this shock and ε_t^{ϕ} is in the timing of their release during the same period, which will be useful for estimation. An increase in both shocks leads to capital outflows (due to higher interest on debt), 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 shock in $\varepsilon_t^{\phi*}$ are in Figure A14 in Appendix C.

5.4 Information Structure

I adopt the same set of equations as those presented in Gouvea et al. (2008), but I introduce a different information structure at each decision-making stage. Specifically, I assume that all shocks, except for the monetary policy shock and the country risk perception shock, are released at the beginning of each period. The latter shocks, however, are realized at the end of the period, just before the central bank sets the interest rate. This methodology follows the timing strategy proposed in Christiano et al. (2015).

Let $Z_t = \{Z_t^b, Z_t^e\}$ represent the set of all thirteen exogenous shocks in the economy, where Z_t^b denotes the subset of shocks released at the beginning of the period, and Z_t^e includes the monetary policy shock and the country risk perception shock, which are released at the end of the period before the central bank's decision.[12] This timing structure defines the flow of information within each period as follows:

1. Agents know the values of r_{t-1} and ϕ_{t-1}.
2. Z_t^b is released.
3. Households, firms, and fiscal authorities make decisions without knowing the new values of r_t and ϕ_t, relying instead on their expectations of these variables.
4. Z_t^e is released.
5. The monetary authority sets r_t, and international investors learn the value of ϕ_t for the next period.

This information structure is particularly useful for this study, as it allows for a precise measurement of unanticipated changes in both the interest rate and the risk premium. By structuring the timing of shocks in this way, the model ensures that these unanticipated changes are evaluated relative to the information available just before the monetary policy shock and the country risk perception shock are realized. This approach captures how new information about default risk interacts with monetary policy decisions, enhancing the understanding of their joint impact on macroeconomic dynamics.

Let S_t^r denote the unanticipated increase in the interest rate.

$$S_t^r = r_t - E_{t-\tau}[r_t] \tag{11}$$

[12]The value of international interest rate and domestic interest rate in the households budget constraint is the one including the current values of Z_t^b withouth the values of Z_t^e.

Where r_t is the central bank interest rate at time t and $E_{t-\tau}[r_t]$ the interest rate before knowing the value of Z_t^e. This variable is analogous to the unexpected interest rate change defined in Section 2.1. Notice that, given the Taylor rule in equation (9), a shock in $\varepsilon_t^{\phi *}$ affects the new value of r_t through changes in $E_t[\pi_{t+1}]$ coming from the inflationary pressures of higher risk premium.

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

$$S_t^d = \hat{\phi}_t - E_{t-\tau}[\hat{\phi}_t] \tag{12}$$

Where $\hat{\phi}_t$ is the risk premium of internationally issued bonds at time t and $E_{t-\tau}[\hat{\phi}_t]$ the risk premium before knowing the value of Z_t^e. 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.

5.5 Estimation

I employ Bayesian methods to estimate the posterior mean values and distributions of the model parameters, following the approach outlined in Gouvea et al. (2008). This methodology combines the likelihood function with the prior distribution of the parameters to carry out the estimation process.[13] The data is detrended using the one-sided Hodrick-Prescott filter, covering the period from 2004:Q1 to 2019:Q4.

I use the following variables:

$$X_t = [y_t^{VA}, c_t, i_t, g_t, r_t^*, r_t, n_t, \pi_t, \Delta s_t, q_t, S_t^r, S_t^d, \phi_t],$$

where y_t^{VA} is the log of real Gross Domestic Product, c_t is the log of real private consumption expenditure, i_t is the log of real gross capital formation, g_t is the log of government expenditure, r_t^* is the FED funds rate, r_t is the SELIC rate, n_t is the log of total registered employees, π_t is the quarterly change in the log of the consumer price index, Δs_t is the quarterly change in the log of the nominal exchange rate, and q_t is the real exchange rate. Aditionally, S_t^r is the quarterly average of the unanticipated change in the interest rate (which is the quarterly average of S_t from the empirical section), S_t^d is the quarterly average of the variable ΔCDS_t from Section 2.1, and ϕ_t is the average value of the CDS spread in each quarter. The last two variables are included to discipline the model in determining the relative importance of country risk perception shocks and foreign investors' risk aversion.

[13] For a detailed explanation of Bayesian estimation methods, see An and Schorfheide (2007); for a review, refer to Fernández-Villaverde and Guerrón-Quintana (2021). I use 20,000 draws for the MCMC algorithm, with the Random-Walk-Metropolis-Hastings sampler. The proposal density is the normal distribution with a covariance matrix from the inverse hessian at the mode. I compute the identification using the posterior mean of the parameter space. I use Matlab 2022a and Dynare version 5.3. See **Adjemian2024dynareempty citation**.

I adopt the same fixed parameter values as those specified by Gouvea et al. (2008). Specifically, I set $\beta = 0.98$, $\alpha = 0.4$, $\delta = 0.0245$, $\rho_r = 0.0$, and $\delta_a = 1.0$. The steady-state relationships remain consistent with the benchmark model. All the parameters from equilibrium conditions are estimated using the estimated values reported in Gouvea et al. (2008) as prior means. Additionally, the priors for the stochastic processes align with those used in their study.[14] Results are in Table 3.

5.6 Simulation exercise

I simulate the economy over 9800 observations. Figure A15 in Appendix C 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.[15] Following the methodology outlined in Section 2, I decompose S_t^r into a component driven by country risk shocks and another component free of risk-related information. This decomposition employs the unexpected change in the country 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, international debt (used as a proxy for capital flows, CF), the change in the nominal exchange rate, and the short-term interest rate. 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.

Figure 7 presents the responses to unanticipated interest rate changes positively correlated with default risk surprises, while Figure 8 depicts the responses to unanticipated changes negatively correlated with 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. 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: capital inflows are observed, and the exchange rate appreciates at the moment the shock (recall that this variable is that quarter change in the nominal exchange rate).

Finally, the interaction of two structural shocks drives movements in the variable S_t^r. 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 4. Notably, structural

[14]To assess the identifiability of the model's estimated parameters, I follow Uribe (2022) and implement the test proposed by Iskrev (2010). This approach involves computing the derivative of the predicted autocovariogram of the observables to the estimated parameter vector. Identifiability is confirmed if the resulting derivative matrix has full rank, corresponding to the number of estimated parameters. This rank condition holds when evaluating the model parameters at their posterior mean.

[15]The correlation coefficient between S_t^r and ε_t^r is 0.8075.

Param.	Prior Dist	P. Mean	P. S.d.	Mean	90% low	90% high
σ	normal	0.823	0.50	0.711	0.695	0.726
ψ	normal	0.040	0.02	0.015	0.014	0.016
κ	gamma	1.014	0.25	0.982	0.976	0.990
h	beta	0.218	0.05	0.273	0.272	0.275
$\bar{\omega}_b$	beta	0.239	0.08	0.193	0.189	0.196
θ	beta	0.906	0.05	0.842	0.841	0.843
ν	gamma	0.338	0.20	0.012	0.003	0.019
ϱ	gamma	1.406	0.20	1.367	1.363	1.372
δ_s	gamma	3.997	1.50	2.142	2.097	2.190
γ_r	beta	0.682	0.05	0.609	0.606	0.611
γ_π	normal	1.523	0.15	1.570	1.565	1.575
γ_y	normal	0.839	0.20	1.455	1.442	1.467
γ_g	beta	0.695	0.05	0.650	0.649	0.651
γ_b	beta	0.170	0.10	0.321	0.317	0.326
ρ_a	beta	0.500	0.25	0.341	0.333	0.351
ρ_c	beta	0.500	0.25	0.559	0.545	0.574
ρ_i	beta	0.500	0.25	0.628	0.621	0.635
ρ_n	beta	0.500	0.25	0.974	0.966	0.983
ρ_g	beta	0.500	0.25	0.741	0.735	0.748
ρ_s	beta	0.900	0.08	0.922	0.920	0.924
ρ_π	beta	0.900	0.08	0.798	0.795	0.800
ρ_ϕ	beta	0.400	0.20	0.002	0.000	0.004
$\rho_{\phi*}$	beta	0.850	0.10	0.796	0.792	0.799
ρ_{m*}	beta	0.250	0.15	0.136	0.131	0.140
ρ_{r*}	beta	0.900	0.05	0.873	0.871	0.875
$\rho_{\pi*}$	normal	0.000	0.25	0.240	0.219	0.260
$\sigma_{\bar{pi}}$	inv_gamma	0.020	2.00	0.764	0.697	0.839
$\sigma_{\bar{g}}$	inv_gamma	0.010	2.00	4.145	4.058	4.226
σ_c	inv_gamma	1.200	2.00	0.588	0.555	0.621
σ_n	inv_gamma	0.500	2.00	0.042	0.034	0.050
σ_i	inv_gamma	2.500	2.00	0.881	0.826	0.928
$\sigma_{\phi*}$	inv_gamma	0.500	2.00	0.139	0.126	0.153
σ_r	inv_gamma	1.000	2.00	0.054	0.049	0.059
σ_ϕ	inv_gamma	0.250	2.00	0.810	0.689	0.936
σ_g	inv_gamma	0.300	2.00	0.439	0.414	0.461
σ_a	inv_gamma	1.000	2.00	0.016	0.013	0.018
σ_{m*}	inv_gamma	0.800	2.00	0.240	0.212	0.266
$\sigma_{\bar{pi}*}$	inv_gamma	0.300	2.00	0.012	0.010	0.013
σ_{r*}	inv_gamma	0.050	2.00	0.006	0.006	0.007

Table 3: Estimated parameters, prior information and posterior results.

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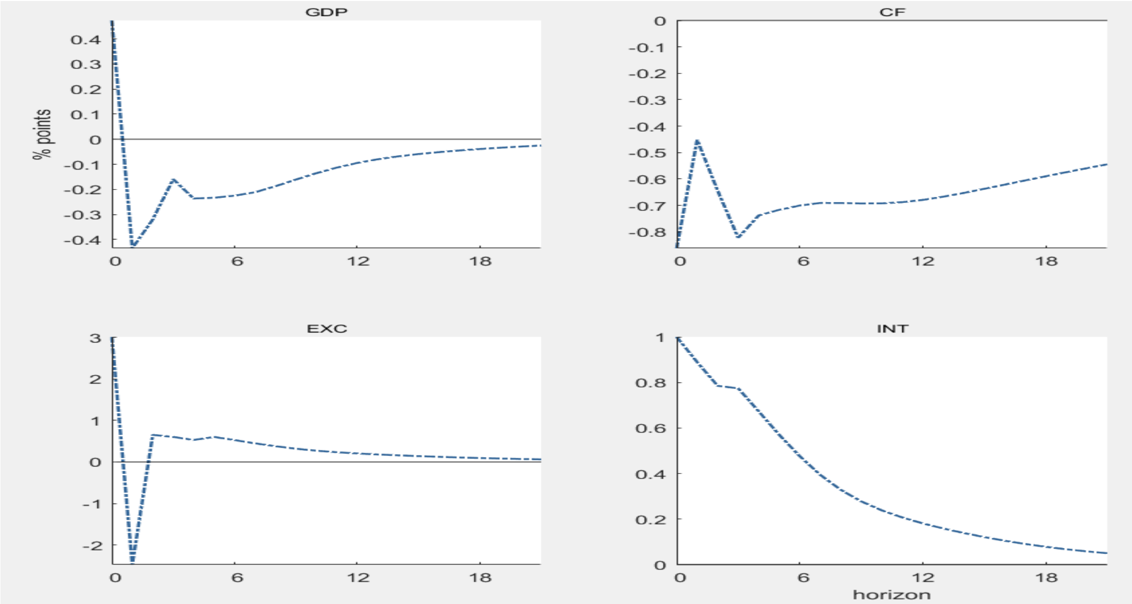

Figure 6: IRF to an unanticipated change in interest rate (simulated variables).

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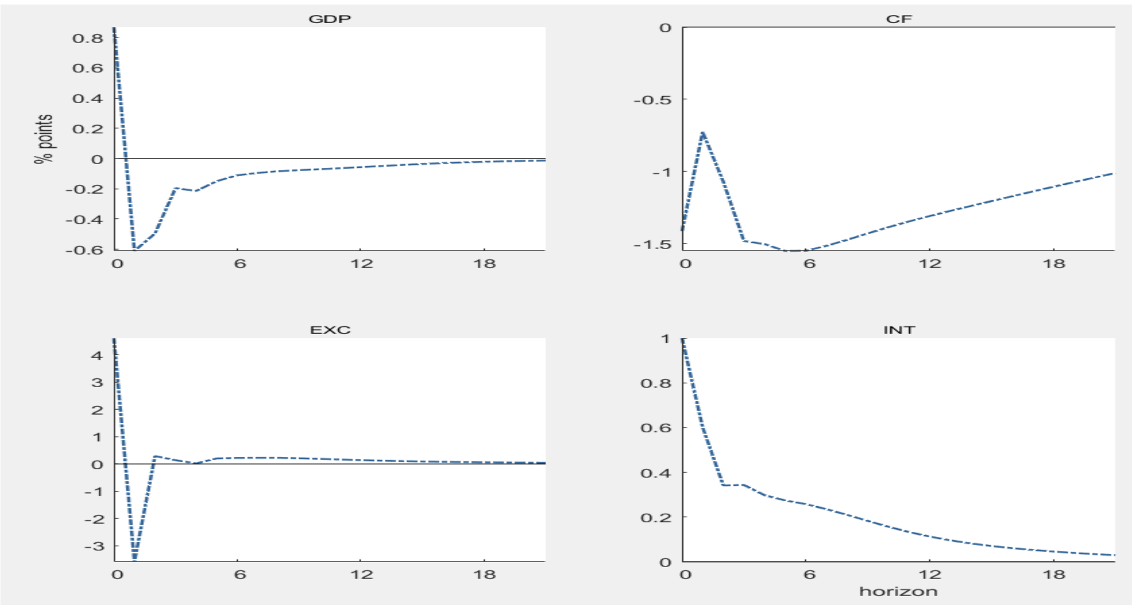

Figure 7: IRF to interes rate increases with default risk increases (simulated variables).

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Note: IRF of simulated variables to an unanticipated change in interest rate positively correlated to risk change.

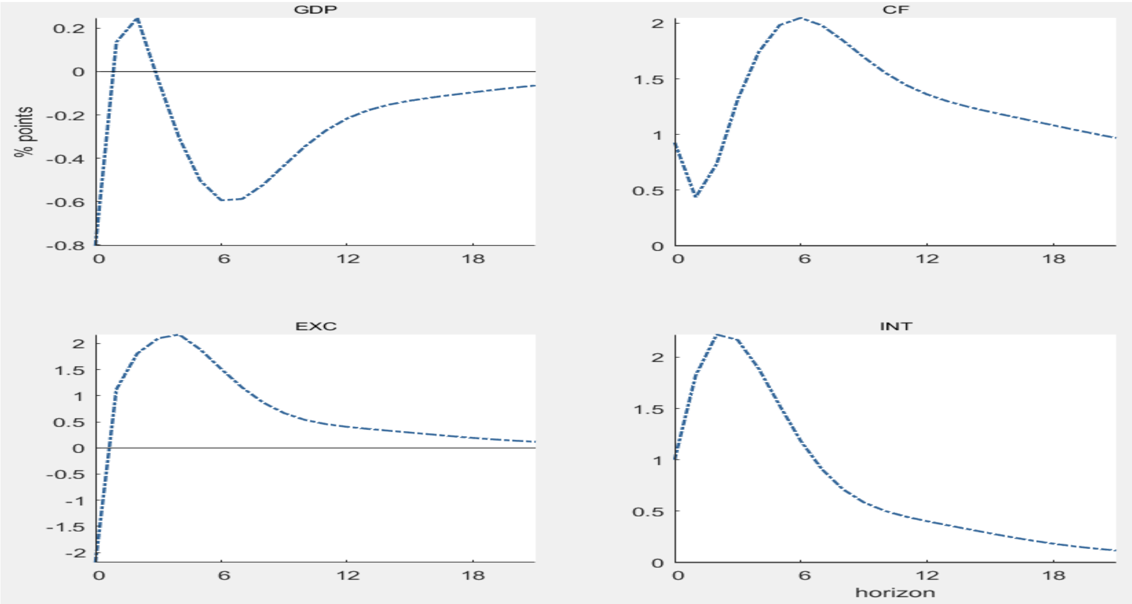

Figure 8: IRF to interes rate increases with default risk decreases (simulated variables).

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Note: IRF of simulated variables to an unanticipated change in interest rate negatively correlated to risk change.

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 74.50%, while the variance explained by ε_t^ϕ is 25.50%.

Structural Shocks	Contribution (%)
ε_t^r	75.90
ε_t^ϕ	24.10

Table 4: Unconditional Variance Decomposition.

Note: Variance decomposition of the unanticipated innovation of the interest rate.

6 Conclusions

The effectiveness of monetary policy in emerging markets is a critical concern for policymakers, given the complex dynamics and increased vulnerability of these economies to external shocks. Recent evidence showing that a contractionary monetary policy shock may lead to domestic currency depreciation highlights the limitations of relying solely on interest rates as the primary tool for monetary policy.

This paper explains the observed currency depreciation, attributing it to the role of default risk in interest rate surprises. An unanticipated monetary policy tightening may reflect the central bank's response to an elevated default risk scenario, one that markets may not fully recognize. When this information is disclosed during the policy announcement, the market's reassessment of the default risk situation leads to capital outflows and currency depreciation.

Using data from the 5-year credit default swap to capture the role of default risk in shaping the response of macroeconomic variables to the central bank's interest rate, this study finds that a 1.0% tightening in monetary policy leads to an 8.0% depreciation of the domestic currency within the first year when interest rate innovations are positively correlated with high-frequency changes in CDS. In contrast, when there is a negative correlation, the same policy action results in an 8.2% appreciation. These findings remain robust when using 10-year zero-coupon bonds instead of the yield curve to identify the importance of default risk. Furthermore, this mechanism helps explain part of the exchange rate puzzle observed in other Latin American economies, such as Chile and Colombia.

The findings are interpreted using a medium-scale small-open economy model developed by Gouvea et al. (2008). This model provides a framework for understanding the dynamic interactions between domestic and foreign economic variables, highlighting the role of risk premium adjustments in the transmission of monetary policy. In particular, the model predicts that when an unexpected interest rate hike is accompanied by an increase in the risk premium, it leads to currency depreciation. This outcome arises because the higher interest rate signals a deterioration in the country's risk profile, which prompts a reassessment of the domestic currency's value by international investors.

In contrast, when the monetary policy shock occurs without a corresponding adjustment in the risk premium, the model produces results consistent with standard New Keynesian theory. In this case, the interest rate hike primarily affects domestic aggregate demand and inflation expectations, leading to outcomes such as a reduction in output and a decrease in the price level. The absence of a risk perception shock means that the exchange rate response follows typical patterns observed in New Keynesian models, where an interest rate increase leads to currency appreciation, as capital flows are attracted by higher returns. Thus, the model underscores the importance of incorporating default risk into the analysis of monetary policy transmission in emerging markets, as the presence or absence of risk premium adjustments significantly alters the macroeconomic response to policy shocks.

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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 High-frequency nominal exchange rate

In this section, I use the procedure of Jarociński and Karadi (2020) to classify monetary policy surprises into two categories: those associated with a positive correlation with high-frequency depreciation of the Brazilian real and those associated with a negative correlation. This alternative approach allows me to assess whether differences in default risk behavior are systematically related to the observed exchange rate response following a policy shock.

The results reveal a striking pattern. Monetary policy increases that lead to immediate currency depreciation are systematically accompanied by a sharp increase in the default risk measure, as captured by CDS spreads (Figure A1). Conversely, interest rate policy increases associated with currency appreciation show declining default risk (Figure A2). This finding corroborates the central mechanism proposed in the main analysis: the interaction between monetary policy shocks and shifts in perceived sovereign risk is a critical determinant of the exchange rate response.

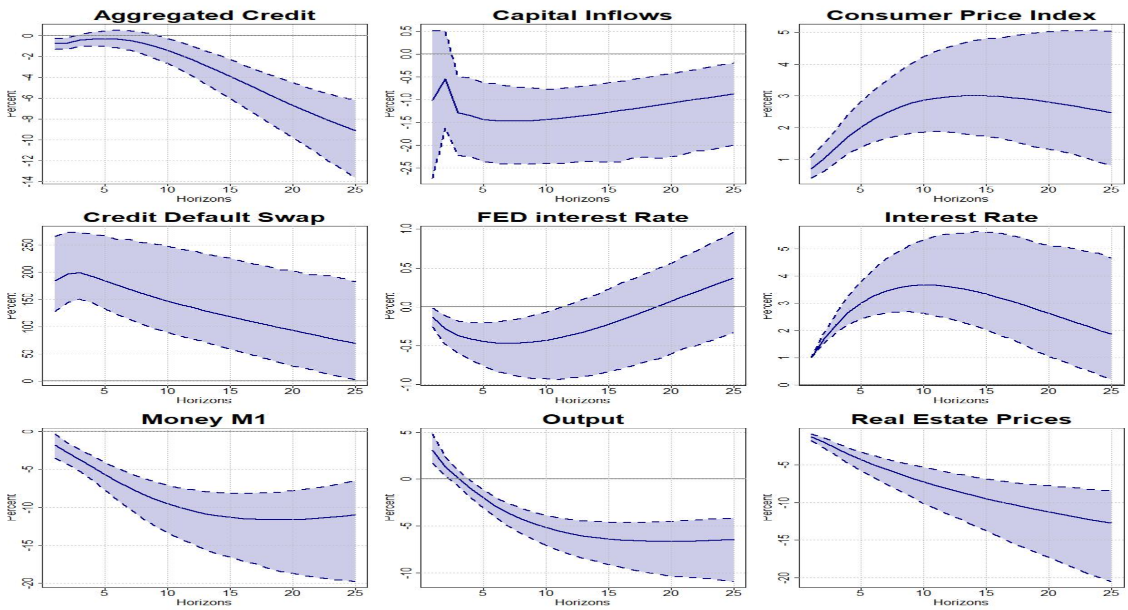

Figure A1: IRF to interest rate increase with high-frequency depreciation.

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Note: IRF of macroeconomic variables to MPS instrumented with monetary policy changes that have positive comovement with the high-frequency depreciation of the nominal exchange rate. Shaded areas are 90.0% posterior coverage bands.

By isolating episodes based on the exchange rate reaction, this exercise strengthens the interpretation that the exchange rate puzzle is not a mechanical response to interest rate changes alone but is mediated by shifts in market perceptions of credit risk. It also emphasizes that understanding the behavior of default risk is essential to accurately characterize the transmission of monetary policy in emerging markets.

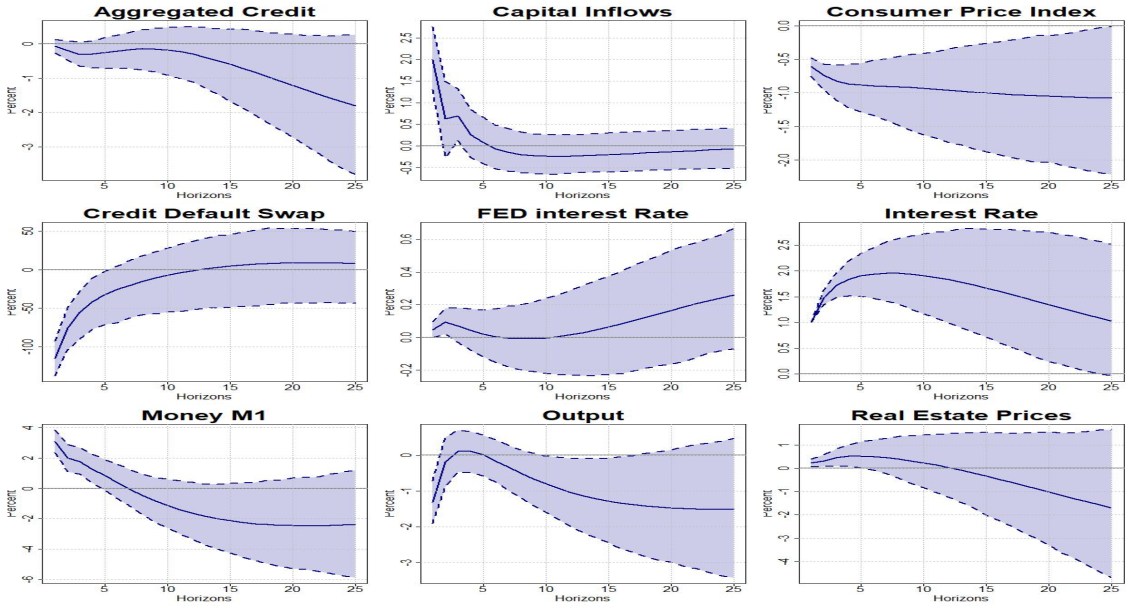

Figure A2: IRF to interest rate increase with high-frequency appreciation.

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Note: IRF of macroeconomic variables to MPS instrumented with monetary policy changes that have negative comovement with the high-frequency depreciation of the nominal exchange rate. Shaded areas are 90.0% posterior coverage bands.

C High-frequency stock market prices

To investigate whether the exchange-rate puzzle is primarily driven by movements in default risk or by broader macroeconomic information, I follow the methodology of Jarociński and Karadi (2020) and classify monetary policy announcements based on the sign of the intra-day stock market response. Specifically, I sort events according to whether equity prices rise or fall in the immediate aftermath of the announcement, and re-estimate impulse response functions (IRFs) accordingly.

When policy rate hikes are accompanied by declines in stock market valuations, the dynamics closely resemble those observed when monetary tightening is associated with increases in CDS spreads. As shown in Figure A3, these episodes feature sharp reductions in capital inflows and a statistically significant depreciation of the nominal exchange rate, and consumer price increases. Real variables, such as aggregate credit, output, and real estate prices, contract significantly. These results are consistent with financial markets interpreting the policy surprise as adverse news, either due to an endogenous tightening of economic conditions or heightened concerns about default risk.

By contrast, when rate hikes are accompanied by stock market increases, which likely reflect favorable macroeconomic information (e.g., improved growth prospects or policy credibility), the responses differ markedly. As shown in Figure A4, capital inflows are observed, but the nominal exchange rate and consumer prices remain broadly unchanged. Credit and output still weaken moderately over time. The stark contrast between these two sets of IRFs suggests that stock prices, while informative about general macroeconomic conditions, do not capture the same default-risk component as CDS spreads. This distinction strengthens the main intuition of the document: it is the perception of sovereign risk that drives the exchange-rate depreciation following monetary policy shocks.

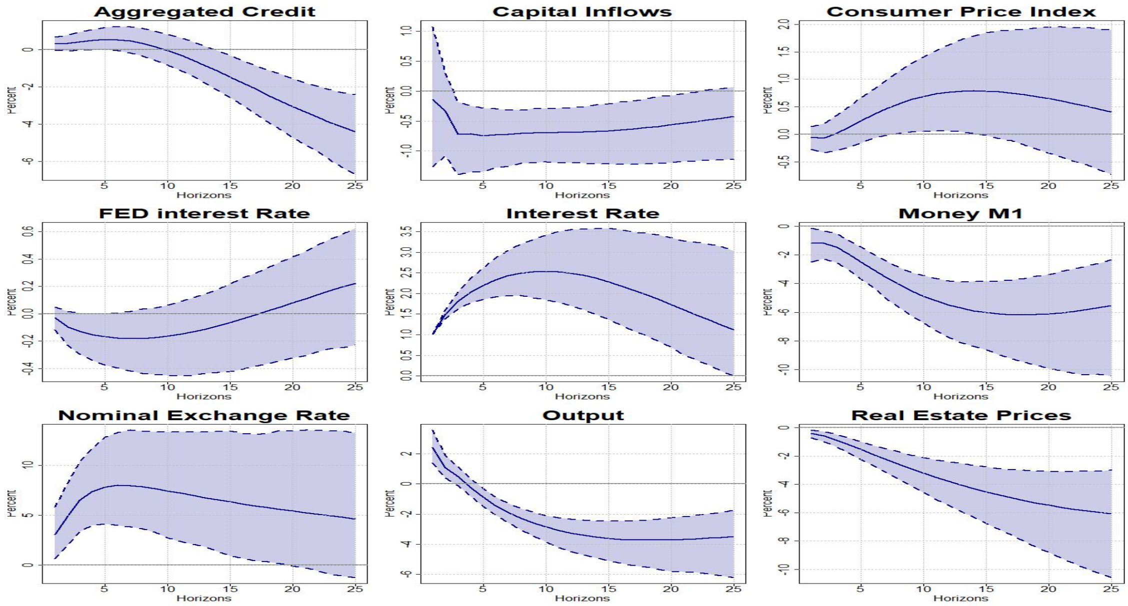

Figure A3: IRF to interest rate increase with high-frequency stock market decreases.

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Note: IRF of macroeconomic variables to MPS instrumented with monetary policy changes that have negative comovement with the high-frequency stock market returns. Shaded areas are 90.0% posterior coverage bands.

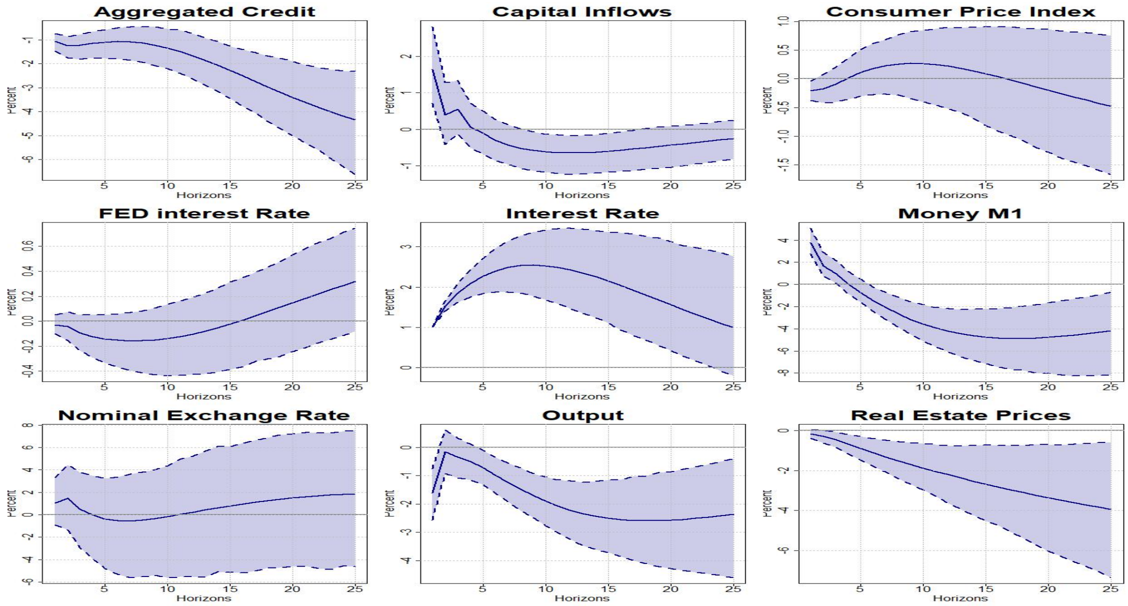

Figure A4: IRF to interest rate increase with high-frequency stock market increases.

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Note: IRF of macroeconomic variables to MPS instrumented with monetary policy changes that have positive comovement with the high-frequency stock market reutrns. Shaded areas are 90.0% posterior coverage bands.

D Model Equations

The linearized version of the model in Gouvea et al. (2008) is the following:

Consumption of optimizing households:

$$\begin{aligned} c_{o,t} = {} & \left(\frac{1}{1+h}\right) E_t\left[c_{o,t+1}\right] + \left(\frac{h}{1+h}\right) c_{o,t-1} \\ & - \frac{1}{\sigma}\left(\frac{1-h}{1+h}\right) E_t[r_t - \pi_{t+1}] + \frac{1}{\sigma}\left(\frac{1-h}{1+h}\right)(1-\rho_c) z_t^c \end{aligned} \tag{13}$$

Consumption of rule-of-thumb households:

$$c_{rot,t} = w_{r,t} + n_{rot,t} \tag{14}$$

Aggregate consumption:

$$c_t = (1-\bar{\omega}_c)c_{o,t} + \bar{\omega}_c c_{rot,t} \tag{15}$$

Labor supply of optimizing households:

$$n_{o,t} = \frac{1}{\eta}\left[w_{r,t} - \frac{\sigma}{1-h}(c_{o,t} - hc_{o,t-1}) - z_t^n\right] \tag{16}$$

Labor supply of rule-of-thumb households:

$$n_{rot,t} = \frac{1}{\eta}\left[w_{r,t} - \frac{\sigma}{1-h}(c_{rot,t} - hc_{rot,t-1}) - z_t^n\right] \tag{17}$$

Aggregate labor supply:

$$n_t = (1-\bar{\omega}_n)n_{o,t} + \bar{\omega}_n n_{rot,t} \tag{18}$$

UIP condition:

$$q_t = E_t q_{t+1} - \left[(r_t - E_t\pi_{t+1}) - (r_t^* + \phi_t - E_t\pi_{t+1}^*)\right] \tag{19}$$

Aggregate demand for labor:

$$n_t = y_t - (1-\varrho)a_t - [\varrho + \alpha(1-\varrho)]w_{r,t} + \alpha(1-\varrho)r_{k,t} + \varrho mct \tag{20}$$

Aggregate demand for capital services:

$$k_t + u_t = y_t - (1-\varrho)a_t - (1-\alpha(1-\varrho))r_{k,t} + (1-\varrho)(1-\alpha)w_{r,t} + \varrho mct \tag{21}$$

Risk premium:

$$\phi_t = -\psi b_{y^*,t+1} + \nu z_t^{\phi} + z_t^{\phi *} \tag{22}$$

Capital Euler equation:

$$q_t^I = E_t\left[\beta(1-\delta)q_{t+1}^I + (1-\beta(1-\delta))r_{k,t+1} - (r_t - \pi_{t+1})\right] \tag{23}$$

Investment Euler equation:

$$i_t = \frac{1}{\delta_s(1+\beta)}q_t^I + \frac{\beta}{1+\beta}E_t i_{t+1} + \frac{1}{1+\beta}i_{t-1} + \frac{(1-\rho_i\beta)}{1+\beta}z_t^I \tag{24}$$

Law of motion of capital:

$$k_{t+1} = (1-\delta)k_t + \left(\frac{I}{K}\right)i_t \tag{25}$$

Export equation:

$$x_t = m_t^* + \kappa q_t \tag{26}$$

Import equation:

$$m_t = y_t - \varrho(q_t - mc_t) \tag{27}$$

Capital utilization:

$$r_{k,t} = \delta_a u_t \tag{28}$$

Real marginal cost:

$$mc_t = s_d\left[\alpha r_{k,t} + (1-\alpha)w_{r,t} - a_t\right] + (1-s_d)q_t \tag{29}$$

Phillips curve:

$$\pi_t = \lambda mc_t + \lambda_b\pi_{t-1} + \lambda_f E_t\pi_{t+1} \tag{30}$$

Reduced-form parameters of the Phillips curve:

$$\lambda = \frac{(1-\theta\beta)(1-\bar{\omega}_b)(1-\theta)}{[\theta + \bar{\omega}_b(1-\theta(1-\beta))]} \tag{31}$$

$$\beta_b = \frac{\bar{\omega}_b}{[\theta + \bar{\omega}_b(1-\theta(1-\beta))]} \tag{32}$$

$$\beta_f = \frac{\theta\beta}{[\theta + \bar{\omega}_b(1-\theta(1-\beta))]} \tag{33}$$

Law of motion of net foreign assets:

$$b_{y^*,t+1} = \Phi R^* \left[b_{y^*,t} + nxy_t + B^{y^*} \left(y_{t-1}^{VA} - y_t^{VA} + \frac{1}{s_{va}}(q_t - q_{t-1}) - \pi_t^* \right) \right] + B^{y^*}(\phi_t + r_t^*) \tag{34}$$

Net exports:

$$nxy_t = \frac{s_x}{s_{va}} x_t - \frac{s_m}{s_{va}} m_t - \frac{s_x - s_m}{s_{va}} y_t^{VA} - \frac{s_m}{s_{va}} \left(\frac{1-s_x}{s_{va}} \right) q_t \tag{35}$$

Taylor rule:

$$r_t = \gamma_r r_{t-1} + (1-\gamma_r) \left[\gamma_\pi E_t(\pi_{t+1} - \bar{\pi}_{t+1}) + \bar{\pi}_t + \gamma_y y_t^{VA} \right] + z_t^r \tag{36}$$

Fiscal policy rule:

$$g_{y,t} = \gamma_g g_{y,t-1} + (1-\gamma_g) \left[\gamma_s s_{y,t-1} - \gamma_b b_{y,t} \right] + z_t^g \tag{37}$$

Primary surplus:

$$s_{y,t} + \bar{s}_{y,t} = -g_{y,t} \tag{38}$$

Government debt:

$$b_{y,t+1} = R \left[b_{y,t} + g_{y,t} - B^y \left(y_t^{VA} - y_{t-1}^{VA} \right) + \pi_t^{VA} \right] + B^y r_t \tag{39}$$

Government expenditure:

$$g_t = y_t^{VA} + \frac{s_{va}}{s_g} g_{y,t} - \frac{s_m}{s_{va}} q_t \tag{40}$$

Final good market equilibrium condition (resource constraint) - gross output:

$$y_t = s_c c_t + s_i i_t + s_g g_t + s_x x_t \tag{41}$$

Value added (GDP):

$$y_t^{VA} = \frac{1}{s_{va}} y_t - \frac{s_m}{s_{va}} m_t \tag{42}$$

Value-added inflation (GDP deflator):

$$\pi_t^{VA} = \pi_t - \frac{s_m}{s_{va}}(q_t - q_{t-1}) \tag{43}$$

Inflation target:

$$\bar{\pi}_t = \rho_\pi \bar{\pi}_{t-1} + \varepsilon_t^\pi \tag{44}$$

Fiscal target:

$$\bar{s}_{g,t} = \rho_g \bar{s}_{g,t-1} + \varepsilon_t^g \tag{45}$$

Household's preference:

$$z_{c,t} = \rho_c z_{c,t-1} + \varepsilon_t^c \tag{46}$$

Labor supply:

$$z_{n,t} = \rho_n z_{n,t-1} + \varepsilon_t^n \tag{47}$$

Investment shock:

$$z_t^I = \rho_i z_{t-1}^I + \varepsilon_t^I \tag{48}$$

Foreign investor's risk aversion:

$$z_t^{\phi^*} = \rho_{\phi^*} z_{t-1}^{\phi^*} + \varepsilon_t^{\phi^*} \tag{49}$$

Country risk premium shock:

$$z_t^{\phi} = \rho_{\phi} z_{t-1}^{\phi} + \varepsilon_t^{\phi} \tag{50}$$

Technology:

$$a_t = \rho_a a_{t-1} + \varepsilon_t^a \tag{51}$$

Monetary policy:

$$z_t^r = \rho_r z_{t-1}^r + \varepsilon_t^r \tag{52}$$

Fiscal policy:

$$z_t^g = \rho_g z_{t-1}^g + \varepsilon_t^g \tag{53}$$

World imports:

$$m_t^* = \rho_m m_{t-1}^* + \varepsilon_t^{m^*} \tag{54}$$

World inflation:

$$\pi_t^* = \rho_{\pi^*} \pi_{t-1}^* + \varepsilon_t^{\pi^*} \tag{55}$$

World interest rate:

$$r_t^* = \rho_r r_{t-1}^* + \varepsilon_t^{r^*} \tag{56}$$

E Figures

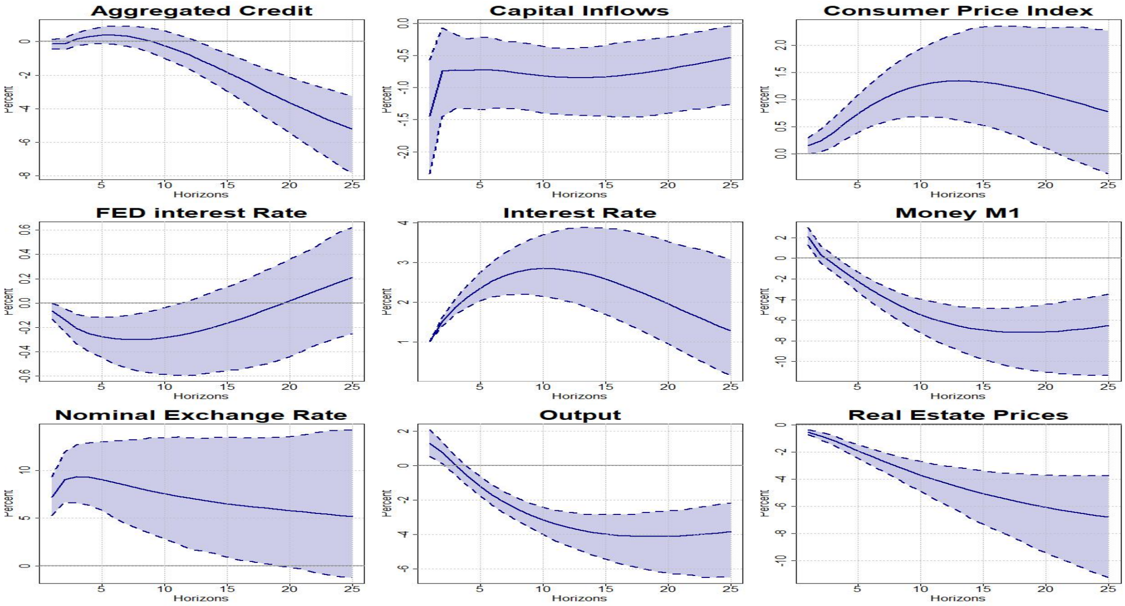

Figure A5: IRF to interest rate increase intrumented with u_t^r.

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Note: IRF of macroeconomic variables to MPS instrumented with the u_t^r which are monetary policy changes that have positive comovement with v_t. Shaded areas are 90.0% posterior coverage bands.

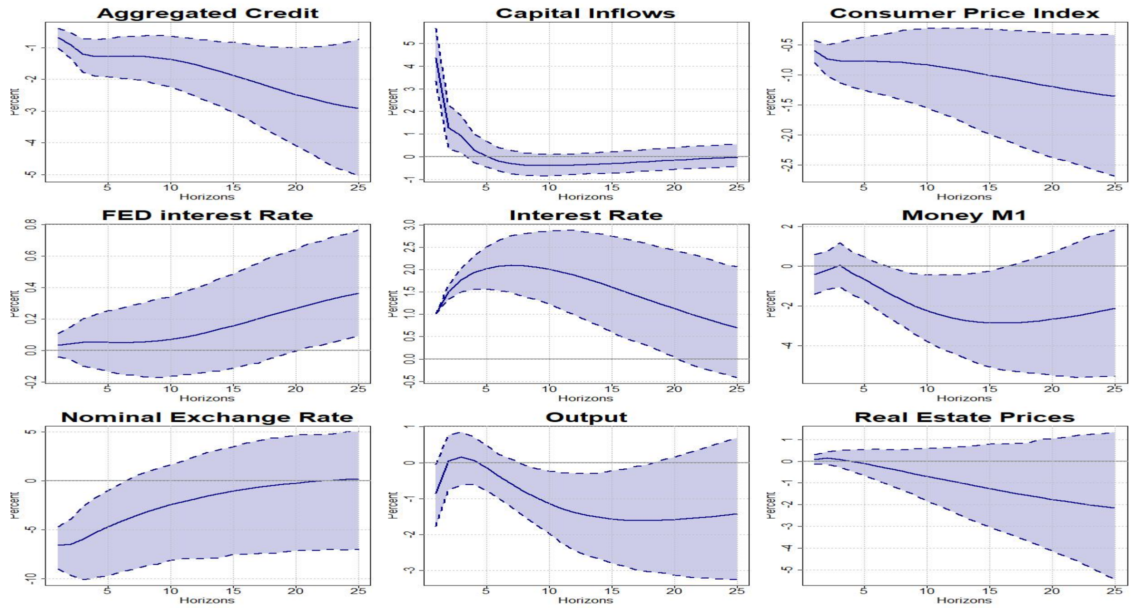

Figure A6: IRF to interest rate increase intrumented with u_t^M.

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Note: IRF of macroeconomic variables to MPS instrumented with the u_t^M which are monetary policy changes that have negative comovement with v_t. Shaded areas are 90.0% posterior coverage bands.

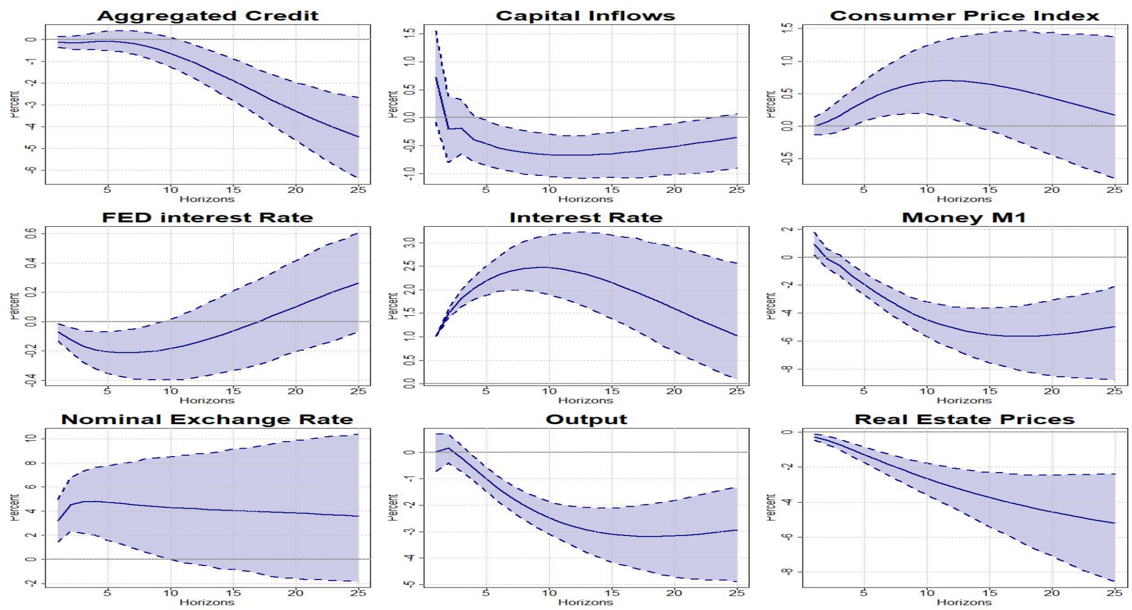

Figure A7: IRF to interest rate increase intrumented with u_t^r.

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Note: IRF of macroeconomic variables to MPS instrumented with the u_t^r which are monetary policy changes that have positive comovement with CDS. Identification using poor man's strategy. Shaded areas are 90.0% posterior coverage bands.

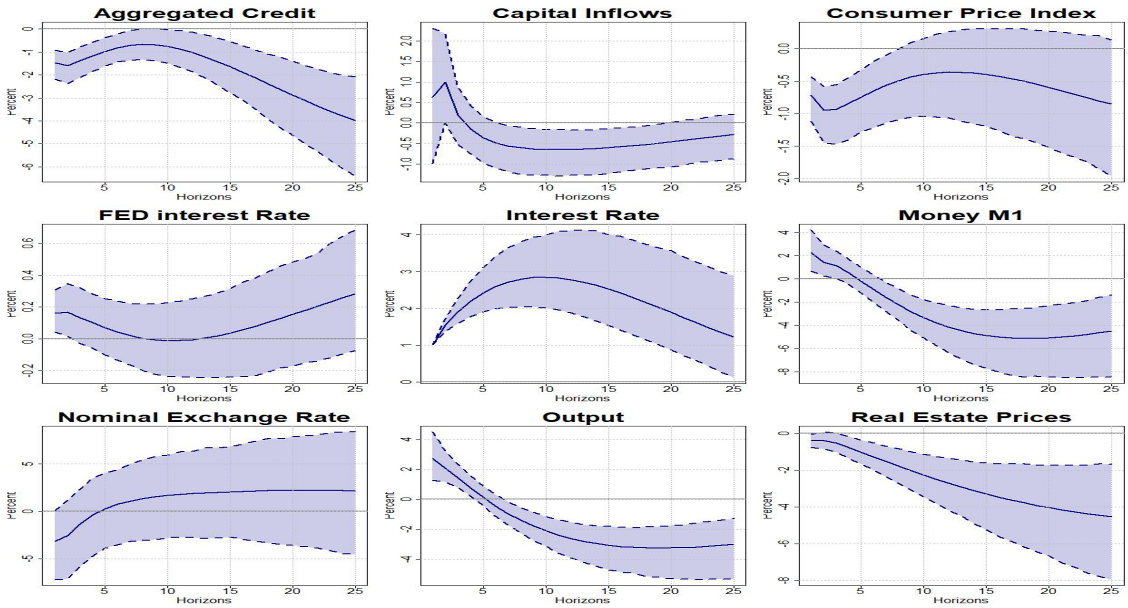

Figure A8: IRF to interest rate increase intrumented with u_t^M.

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Note: IRF of macroeconomic variables to MPS instrumented with the u_t^r which are monetary policy changes that have negative comovement with CDS. Identification using poor man's strategy. Shaded areas are 90.0% posterior coverage bands.

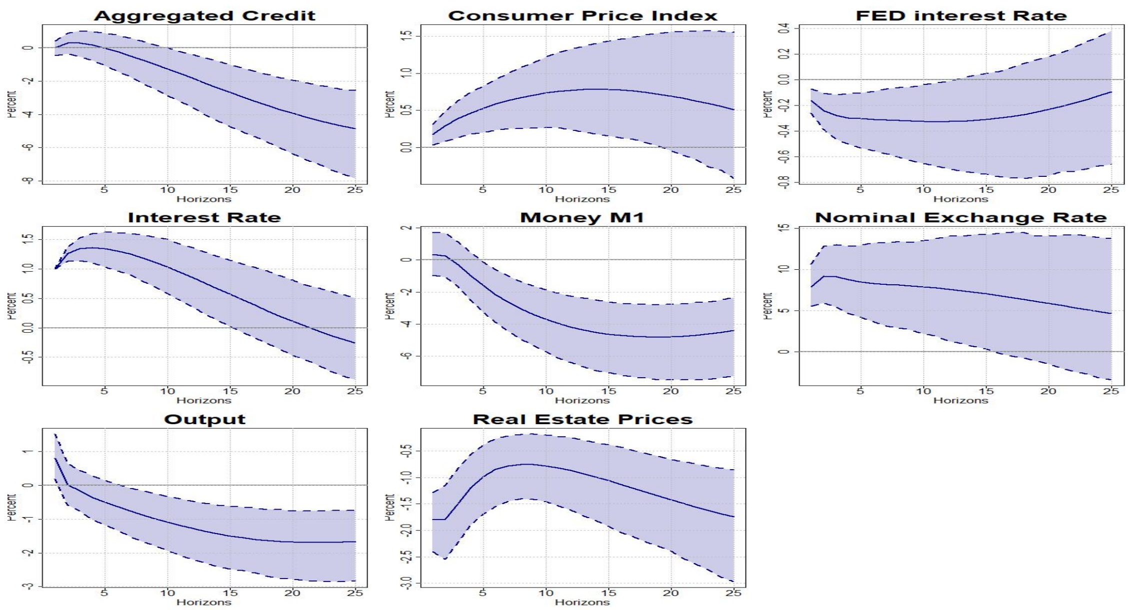

Figure A9: IRF to interest rate increase intrumented with u_t^r in Colombia.

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Note: IRF of macroeconomic variables to MPS instrumented with the u_t^r which are monetary policy changes that have positive comovement with CDS in Colombia. Shaded areas are 90.0% posterior coverage bands.

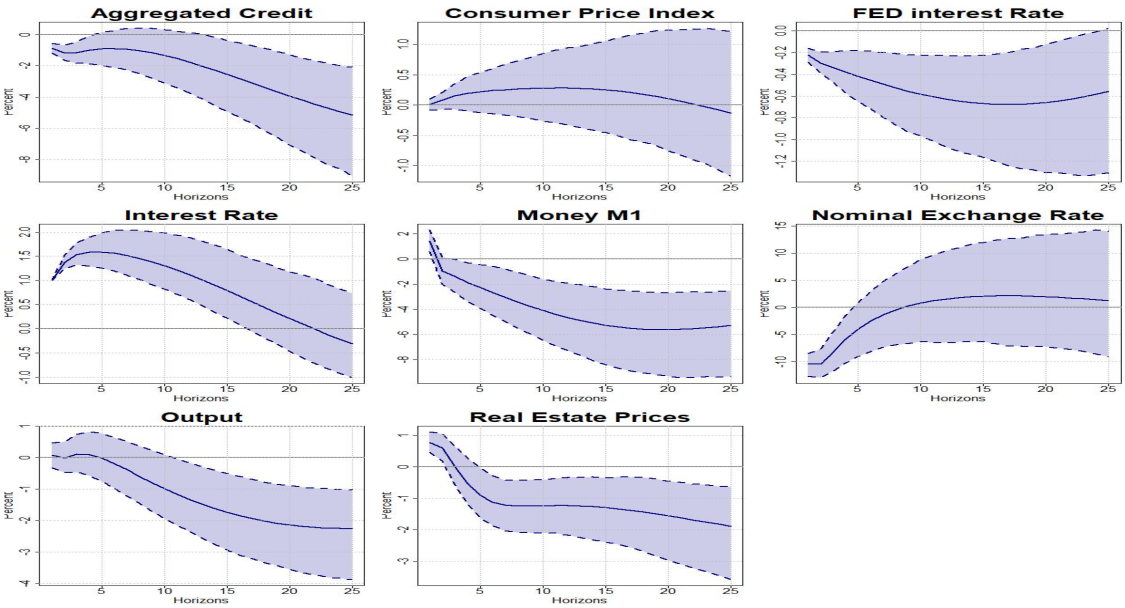

Figure A10: IRF to interest rate increase intrumented with u_t^M in Colombia.

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Note: IRF of macroeconomic variables to MPS instrumented with the u_t^M which are monetary policy changes that have negativecomovement with CDS in Colombia. Shaded areas are 90.0% posterior coverage bands.

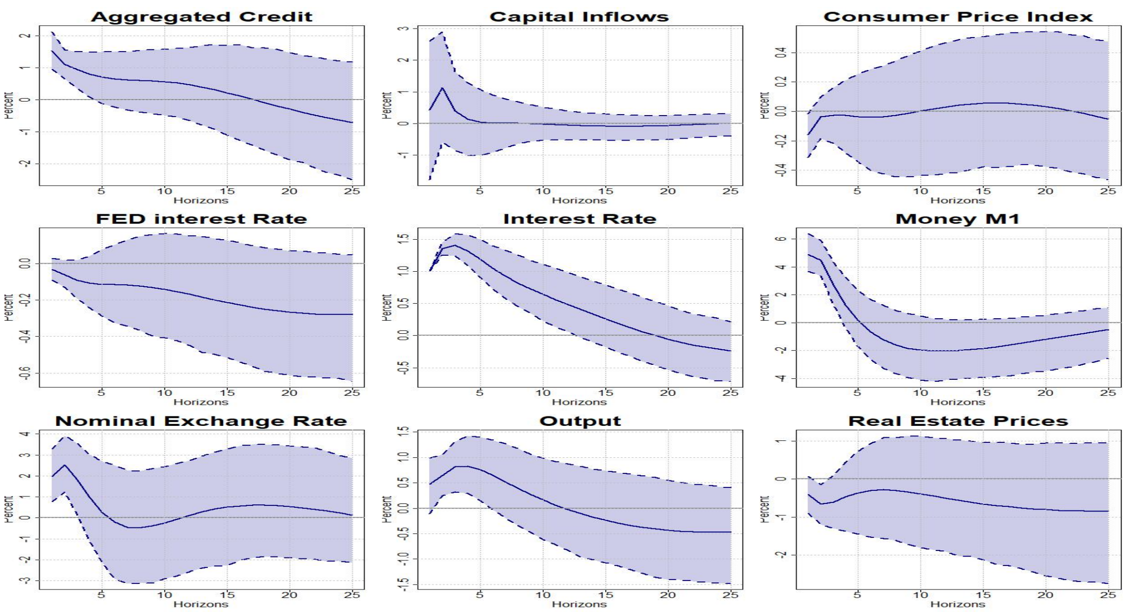

Figure A11: IRF to interest rate increase intrumented with u_t^r in Chile.

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Note: IRF of macroeconomic variables to MPS instrumented with the u_t^r which are monetary policy changes that have positive comovement with CDS in Chile. Shaded areas are 90.0% posterior coverage bands.

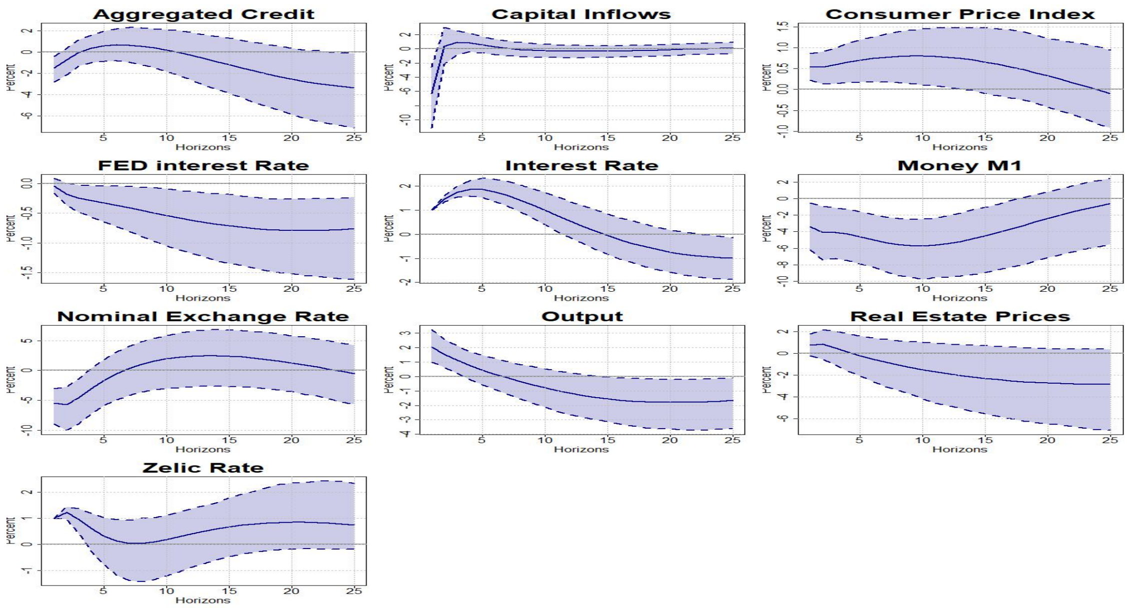

Figure A12: IRF to interest rate increase intrumented with u_t^M in Chile.

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Note: IRF of macroeconomic variables to MPS instrumented with the u_t^M which are monetary policy changes that have negative comovement with CDS in Chile. Shaded areas are 90.0% posterior coverage bands.

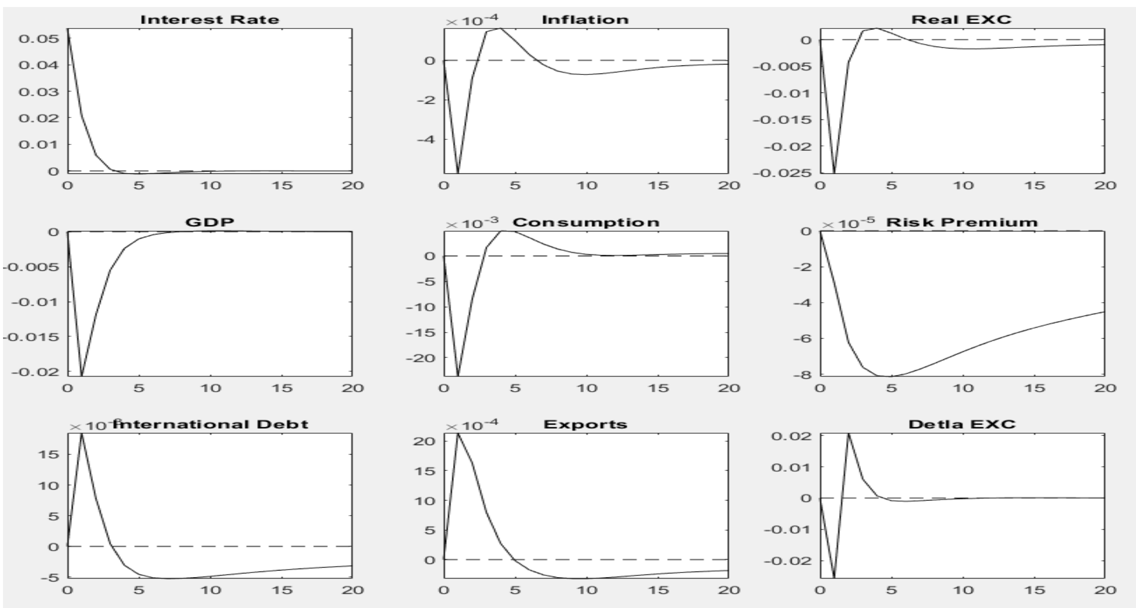

Figure A13: IRF of model variables to a monetary policy shock.

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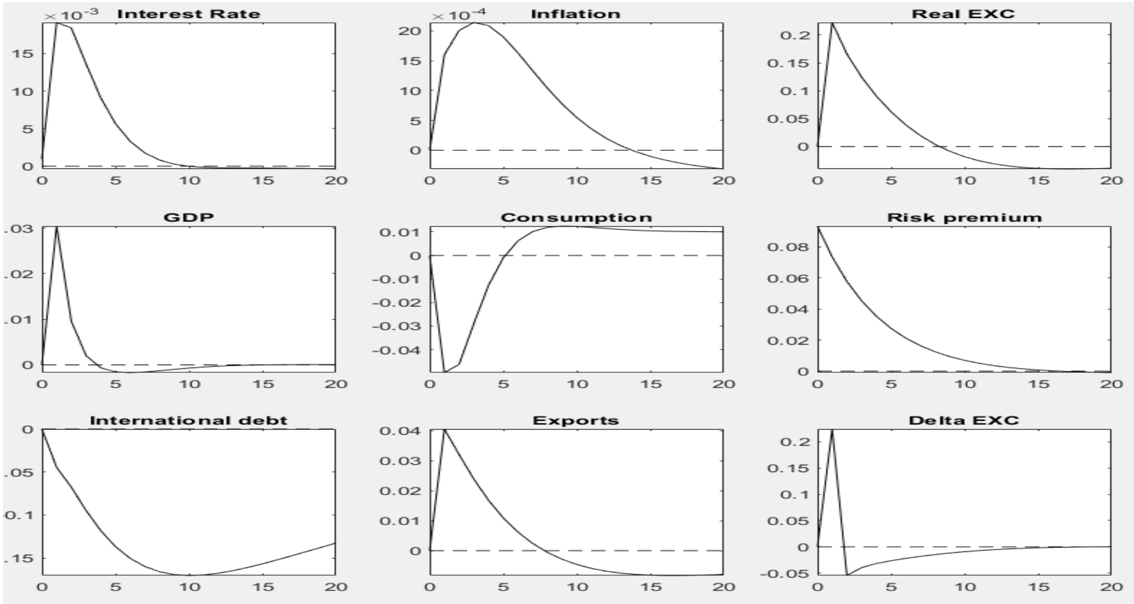

Figure A14: IRF of model variables to a country risk perception shock.

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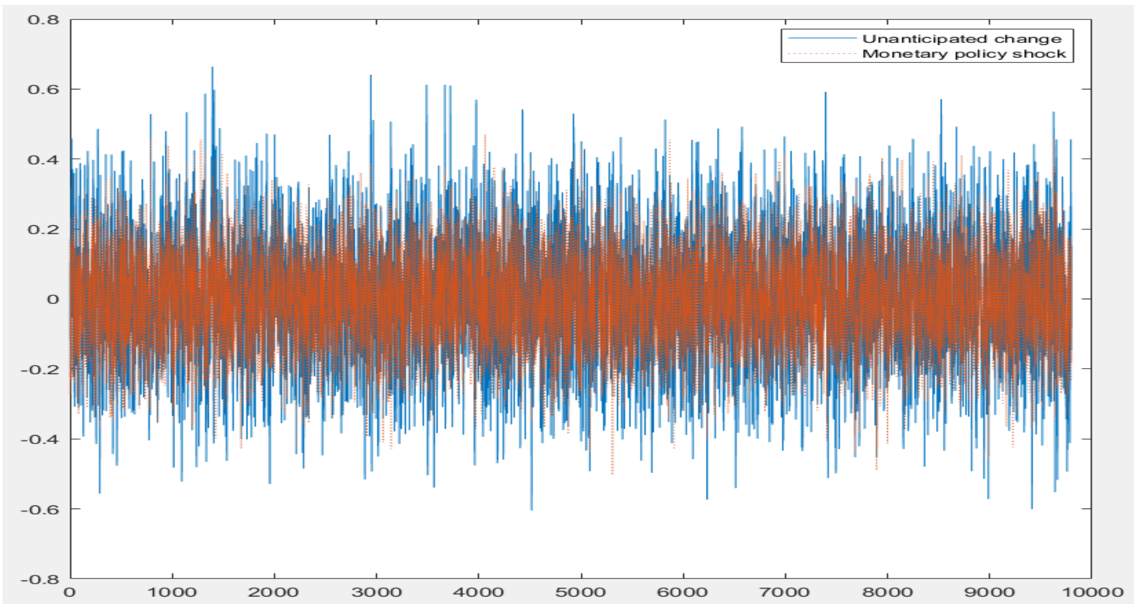

Figure A15: Simulated unanticipated change in interest rate S_t^r and the true monetary policy shock ε_t^r

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