Impacts of the Monetary Policy Committee decisions on the foreign exchange rate in Brazil

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Abstract The purpose of this paper is to measure the impact of interest rate decisions of the Monetary Policy Committee (MPC) on foreign exchange (FX) rate in Brazil. Two new daily measures of interest rate surprises are proposed using market and survey data. The results indicate a significant effect of MPC's decisions on FX returns. In particular, the surprise variable based on market data is statistically significant to explain FX returns and has a negative sign, as expected (a positive surprise implies an appreciation of the domestic currency). Moreover, this effect is symmetric, in terms of positive or negative surprises, and does not depend on the level of Selic interest rate. Nonetheless, the surprise variable is not significant to explain FX returns in recent years, under a single-digit interest rate regime. Robustness exercises—using GARCH models or including FX market official intervention series as additional controls—corroborate the previous findings.

Keywords: Exchange rate; Monetary policy; Interest rate surprise.
JEL Code: C12, C58, E43, E44, E52.

1. Introduction

Central banks closely monitor the daily exchange rate (FX) movements, since they impact future price dynamics and, thus, help in setting appropriate interest rate policies (Groen and Matsumoto, 2004). Indeed, the relationship between the interest rate and the foreign exchange rate has been extensively studied in the literature.

The classical approach is focused on the interest rate parity, which is a no-arbitrage condition representing an equilibrium state under which investors will be indifferent to invest on interest-bearing instruments in two countries. Such approach relies on certain assumptions, such as capital mobility, where

Submitted on October 11, 2021. Revised on December 11, 2021. Accepted on December 11, 2021. Published online in June 2022. Editor in charge: Marco Lyrio.
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investors can readily exchange domestic assets for foreign assets, and perfect substitutability of assets (that is, similar in riskiness and liquidity).[1]

In this paper, we focus on the link between interest rate *surprises* (i.e., after the interest rate decisions made by the MPC – Monetary Policy Committee) and the FX rate daily returns. The main idea is to capture the impact of non-anticipated interest rate monetary policy decisions on daily FX rate returns.

The empirical strategy adopted here is to estimate a conditional mean model of the FX-rate, using a standard OLS approach, at daily frequency, with focus on interest rate surprises after MPC decisions, under different model specifications. The robustness analysis is conducted in two main dimensions: (i) taking into account the FX-rate second moment using GARCH models; and (ii) enlarging the set of control variables with five new time series that represent government interventions in the FX market.

This way, we contribute to the literature in three manners. Firstly, we build new measures of interest rate *surprises* under two different concepts, using daily market and survey information. Secondly, our analysis is done using data from an emerging economy (Brazil) instead of developed markets.[2] As far as we know, this is the first paper to use such approach to investigate the impact of MPC decisions on the FX rate dynamics in Brazil.[3]

Thirdly, our setup allows investigating the existence of asymmetric effects on the referred statistical relationship, which are very important for the implementation of monetary policy, especially for an inflation targeting country (and emerging economy) like Brazil.

Our empirical findings point out that an unanticipated easing of 100 basis points leads to an FX rate depreciation of roughly 3.4 percentage points (p.p.). In other words, if a decrease of 0.50 p.p. is expected in the Selic target rate, but the actual decrease is of 1.50 p.p., this represents a negative surprise of −1.00 p.p., which leads to a 3.4 p.p. increase in the FX daily return.

The rest of the paper is organized as follows: Section 2 presents a brief literature review, Section 3 describes the methodology, Section 4 presents the results and Section 5 concludes.

[1] In particular, the Uncovered Interest Parity (UIP) assumes the no-arbitrage condition is satisfied without the use of a forward contract to hedge against exposure to exchange rate risk (e.g., Fama, 1984). On the other hand, the Covered Interest Parity (CIP) assumes the no-arbitrage condition is satisfied with the use of a forward contract to hedge against exposure to FX risk.

[2] Menkhoff (2013) points out crucial differences between emerging and developed FX markets.

[3] The MPC in Brazil is known (in Portuguese) as *Copom*, an acronym for *Comitê de Política Monetária*.

2. Literature review

A wide range of factors can affect the FX-rate, for instance: economic fundamentals, speculative transactions, and currency interventions, among others. However, the failure of the standard economic theory to explain foreign exchange rate behavior using key economic fundamentals (e.g., money supply, trade balance, national income) has been shown in the international economics literature since the classical papers by Meese and Rogoff (1983a,b).[4]

While macroeconomic theory has proposed several potential predictors of exchange rates (e.g., based on the purchasing power parity (PPP) hypothesis, the uncovered interest rate (UIP) parity condition or the monetary model), the forecasting contributions of such approaches have been under question since the influential findings of Meese and Rogoff.[5] Consequently, a vast literature has studied the forecast performances of empirical exchange rate models, and several explanations have been put forward. Just to mention a few examples:

- Mark (1995) argues that fundamental relationships (parity conditions) hold better in the long run;
- Kilian and Taylor (2003) claim FX rates can be predicted after properly considering nonlinearities;
- Bacchetta and Van Wincoop (2004, 2006) propose the *scapegoat* theory;[6]
- Christoffersen and Mazzotta (2005) and Sarno and Valente (2005) provide statistical/financial models that beat the random walk for *density* forecasting FX rates using higher (intra-day) frequencies;
- Molodtsova and Papell (2009) show Taylor rule models perform better than the monetary, PPP and forward premium models (especially for longer horizons);
- Wang and Wu (2012) argue that economic variables contain information that is useful for forecasting the *distributions* of exchange rates; and
- Rossi (2013) reviews the empirical evidence on FX rate forecasting in the presence of *instabilities*, concluding that the predictive content of many predictors in macroeconomics, finance and international finance

[4] The authors investigate the out-of-sample forecast accuracy of standard exchange rate models, during the post- Bretton Woods period, concluding that such models do not perform better than a simple random walk forecast.

[5] For instance, Bacchetta and Van Wincoop (2006) describe the random walk paradigm as "… *the major weakness of international macroeconomics*".

[6] The *scapegoat* theory suggests market participants may at times attach significantly more weight to individual economic fundamentals to rationalize the pricing of currencies, which are partly driven by unobservable shocks.

is unstable over time.

The literature on FX rate dynamics in Brazil has also been fruitful in recent years. For instance, see Minella et al. (2003), Bevilaqua and Azevedo (2005), Silva Jr. (2010), Wu (2012), Kohlscheen (2014b), and Gaglianone and Marins (2017).

Our paper is closely related to the study of Fatum and Scholnick (2008), which shows FX rates only respond to the surprise component of an *actual* U.S. monetary policy change. According to the authors, the failure to disentangle the surprise component from the actual monetary policy change can lead to an underestimation of the impact of monetary policy (or even to a false acceptance of the hypothesis that monetary policy has no impact on FX rates).[7]

Our work is also linked to the work of Kearns and Manners (2006), which investigates the impact of monetary policy on the exchange rate using an event study with intraday data of four countries (Australia, Canada, New Zealand, and the United Kingdom). According to the authors, carefully selecting the sample periods ensures the policy change is *exogenous* to the exchange rate. They conclude that an unanticipated tightening of 25 basis points leads to a rapid FX rate appreciation of around 0.35 percent.

In this paper, we also measure the impact of unanticipated interest rate monetary policy decisions on the FX rate. However, differently from Kearns and Manners (2006) or Fatum and Scholnick (2008), we go a step further here and seek to answer the following empirical questions: *What is the short-term impact of monetary policy interest rate decisions on foreign exchange rate in Brazil? Is this impact symmetric in terms of positive or negative surprises? Has it changed in recent years, under a lower interest rate regime?*

3. Methodology

We use daily data from January 2006 to August 2020.[8] We model the relationship between interest rate decisions and FX rate returns using a set of OLS models, in which the dependent variable is the (log) return of the Real-U.S. Dollar exchange rate (R$/US$) between days t and $t+1$.[9] The set of regressors is the following: Surprise arising from Copom[10] interest

[7] See also Rosa (2011) for a related discussion on the response of FX rates to U.S. monetary policy surprises.

[8] Time series for the set of control variables begin in January 2006.

[9] Closing prices extracted from Thomson Reuters.

[10] The Copom sets the target for the policy interest rate, called the Selic rate, to prevail during the period between regular Committee meetings. The meeting is held at every 45 days—totaling eight regular meetings a year—in two sessions (customarily on Tuesday and Wednesday). The

rate decisions (defined later in this section); Selic rate target (Selic target); dummy which identifies Copom meeting decision dates (Dummy Copom); Selic rate target first-difference (Selic target variation); and dummy for low interest rates periods, which is equal to 1 if Selic rate is below 10% per year, and equal to 0 otherwise (Dummy Low Interest).

It is important to highlight at this point that the dependent variable and all regressors (in particular, the interest rate surprises) are considered in our models one-day lagged of each other, that is, not contemporaneously. In this sense, the dependent variable $\Delta\ln(FX_{t+1})$, observed on day $t+1$, will be explained by regressors X_t, available on day t. It is important to highlight that the disclosure of the Selic rate target occurs after the closing of the markets considered. This way, we avoid the potential issue of endogeneity, pointed out by Kohlscheen (2014a),[11] and thus refrain from doing exogeneity tests between the FX rate change and the surprise variables.

We also include in the model the following set of *control variables*: Emerging Market Dollar Index first-difference[12] (EME DXY variation) and return of five-year CDS Brazil (Return of CDS Br 5Y).[13] In the first robustness check, we estimate GARCH (1,1) and GARCH-in-Mean models to take into account the second moment of the FX rate returns.

As an additional robustness check, we included in the models extra regressors to control for official government interventions in the FX market. To do so, we considered the Banco Central do Brasil (BCB) *spot* net interventions (US$ million) in the FX market,[14] as well as public offerings of foreign exchange *swap* contracts, as measured by the number of buy/sell swap contracts supplied by the BCB and announced on a given *communiqué* day.[15]

In respect to interest rate *surprises* in Brazil, Vieira and Gonçalves (2008) investigate the difference between swaps rates (1 and 12 months), *before* and *after* each Copom meeting. Their strategy was to focus on Taylor's rule resid-

"Selic" denomination comes from the fact it is the interest rate for overnight interbank loans, collateralized by government bonds traded in the Selic system (Special Settlement and Custody System).

[11] According to the author, the endogeneity issue might arise due to the possibility that monetary policy actions constitute a reaction to concomitant changes in the exchange rate or foreign monetary policy conditions.

[12] U.S. nominal dollar emerging market index, Federal Reserve, trade weighted indices, 19 emerging countries, Federal Reserve Bank of St. Louis.

[13] Source: Bloomberg.

[14] We considered the sum of settled contracts for spot, forwards, foreign currency loans and foreign currency repos, and repo lines of credit.

[15] Further details on the FX swap contracts are presented in the footnotes for Table 6 of the monthly report available at: https://www.bcb.gov.br/htms/infecon/demab/ma202001/NImprensa.zip.

uals. Nonetheless, these measures have non-negligible estimation errors.

More recently, Ferreira (2022) disentangles the effects of *forward guidance shocks* from conventional monetary policy shocks. The author measures forward guidance shocks from high-frequency futures prices to capture surprises around FOMC announcements in the U.S. A forward guidance shock is defined as a shock that increases the two-year government bond rate and the excess bond premium and decreases the CPI for period zero to five months.

In contrast, our proposed method is based on two short-run interest rate surprises. The first one, called *Focus Surprise*, is a survey-based concept, defined as the difference between the Selic target set at the Copom meeting and the median of the expectations over the Selic rate target, released on the Focus survey on the Friday of the week prior to the MPC meeting.[16]

The second one is called *DI Surprise*, and it is a market-based concept, as it is based on changes of the future interbank deposit rate in Brazil, DI rate, around the MPC meeting.[17] We filter *DI Surprise* values in order to select absolute figures greater than five basis points. The so-called *Filtered DI Surprise* variable is then used as regressor in models estimation. In Figure 1, we illustrate the time dynamics of monetary policy surprises using market data (*DI Surprise*), whereas in Figure 2 we present a simple numerical example.

We compute surprise values for each Copom meeting. In days without meetings, the surprise is zero by definition. Our sample covers 116 Copom meetings, between January 1, 2006 and August 4, 2020. In total, we identified 29 meetings with (*Filtered*) *DI Surprises*, where 20 of them are negative and 9 positive. We also identified 24 *Focus Surprises* (15 negative and 9 positive). The correlation between *Focus Surprises* and (*Filtered*) *DI Surprises* is 0.79.

We use closing prices for DI rates to define *DI Surprise* concept as illustrated in Figure 2. We also use opening prices concept to try to better isolate the effect of Copom decisions over DI rates. However, as the sample correlation between *Closing* and *Opening DI Surprises* is above 0.95, we only present *Closing DI Surprises* results. In Figure 3, we show the surprises series

[16] The *Focus survey* is a daily survey of professional forecasters carried out by the BCB. *Focus* is the main source of information regarding expectations for the Brazilian economy. It provides expectations about several economic variables, based on responses from more than 100 market participants, most of them financial institutions.

[17] The DI rate is an interbank deposit rate represented by the average of one-day loan rates for transactions between financial institutions not guaranteed by government bonds. It is calculated by Cetip (Center for Custody and Financial Settlement of Securities), a company that offers services related to registration, deposit, trading and settlement of bonds and other securities in the Brazilian market. The Selic and the DI rates are closely related, since both are overnight interest rates. In the period considered, the difference between them was 0.05 p.p. When there is a change in the Selic rate, the DI rate moves by the same magnitude.

Figure 1
Time setup of monetary policy surprise using market data (*DI Surprise*)

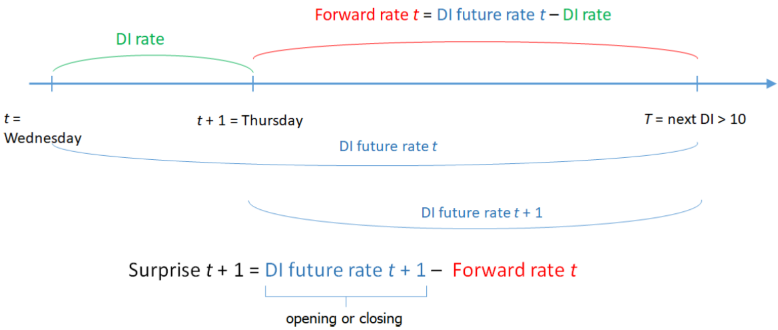


Figure 2
Example of a (*DI Surprise*)

Date 08/31/2011 (Wednesday)

- DI rate = 11.68% p.y.
- Next DI future = 11.59% p.y. (close) and maturity = 22 days
- Forward rate:

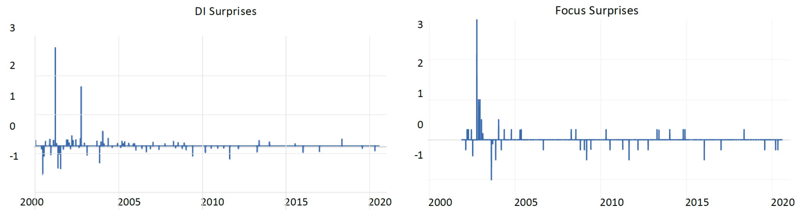
$$= \frac{11.59\% \times 22 - 11.68\%}{21} = 11.59\% \text{ p.y.}$$

Date 09/01/2011 (Thursday)

- Next DI future = 11.24% p.y. (close) and maturity = 21 days

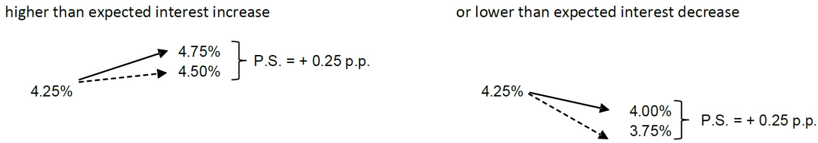
Surprise = 11.24% - 11.59% = - 0.35 p.p. (Focus surprise = - 0.50 p.p.)

Figure 3
DI* and *Focus Surprises



Note: Vertical axis scale is in percentage points per year (p.p. p.y.)

Figure 4
Positive surprises



since 2000, according to the two discussed concepts.[18]

To evaluate the possibility of asymmetric responses of the FX rate returns to Copom interest rate decisions, we split the surprises series into positive and negative ones. A positive surprise means the change in the Selic rate decided by Copom is greater than the expected increase or lower than the expected decrease, while a negative surprise means the change in the Selic rate decided by Copom is higher than the expected decrease or lower than the expected increase. In Figures 4 and 5, we illustrate these concepts. The dotted arrows illustrate the expected value of Selic and the solid arrows represent the decision.

[18] See Appendix A for graphs of other variables.

Figure 5
Positive surprises

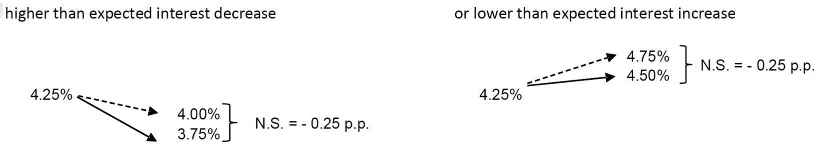


Table 1
OLS estimation results, dependent variable: FX rate daily returns

	Model A	Model B	Model C
Selic target	–0.005	–0.005	–0.005
Dummy Copom	0.001	0.001	0.001
Filtered DI Surprise	**–3.410**		**–3.140**
EME DXY variation	**0.753**	**0.749**	**0.753**
Return of CDS Br 5Y	**0.111**	**0.111**	**0.111**
Positive Filtered DI Surprise		**–4.235**	
Negative Filtered DI Surprise		**–3.214**	
Dummy Low Interest × Filtered DI Surprise			–1.125
adjusted R2	0.311	0.313	0.311
number obs.	3815	3791	3815

Note: Coefficients in bold are statistically significant at 10% level.

4. Empirical results

In Table 1, we show OLS estimation results for the conditional mean model of FX rate daily returns. We tested several model specifications, but we only present in Table 1 the three main ones, as specifications containing other variables (e.g., Selic target changes and Focus Surprise variables) never proved to be significant in our sample.

The main estimate of interest is the coefficient of *Filtered DI Surprise* in Model A (−3.41, marked in red in Table 1).[19] As expected, its negative sign indicates a negative interest rate surprise leading to an increase in the FX rate return, that is, a depreciation of the domestic currency.[20]

Regarding the assessment of a possible asymmetric effect of interest rate surprises on exchange rate returns, we note negative and positive surprises are significant and have negative signs, although the positive surprise coefficient is greater (see Model B in Table 1).

To further investigate this result, we use a Wald test to check the null hypothesis that the coefficient of Positive Surprise variable is equal to that of Negative Surprise (−4.235 and −3.214, respectively, according to Model B).

[19] Unlike control variables, Selic rate level and Dummy Copom are not significant in any model specification.

[20] The economic interpretation of a *DI Surprise* is the following: its coefficient of −3.41 (Model A in Table 1) means that, if a decrease of 0.50 p.p. was expected in the Selic target, but the actual decrease is 1.50 p.p. (Negative Surprise = −1 p.p.), this represents a 3.41 p.p. increase in the exchange rate return. In other words, the exchange rate would rise, for example, from the level R$/US$ 5.31 to R$/US$ 5.42.

Table 2
GARCH estimation results, dependent variable: FX rate daily returns

conditional mean equation								
	Model A				**Model B**			
	GARCH (1,1)		GARCH-M		GARCH (1,1)		GARCH-M	
Selic target	**−0.006**	**−0.006**	**−0.006**	**−0.006**	**−0.006**	**−0.006**	**−0.006**	**−0.006**
Selic target variation	**−0.379**	**−0.386**	**−0.379**	**−0.387**	**−0.382**	**−0.386**	**−0.382**	**−0.386**
Filtered DI Surprise	**−2.693**	**−2.734**	**−2.696**	**−2.740**	**−2.527**	**−2.740**	**−2.535**	**−2.743**
Dummy Copom	0.000		0.000		0.000		0.000	
EME DXY variation	**0.769**	**0.772**	**0.771**	**0.774**	**0.769**	**0.772**	**0.770**	**0.773**
Return of CDS Br 5Y	**0.112**	**0.112**	**0.112**	**0.112**	**0.112**	**0.112**	**0.112**	**0.112**
Dummy Low Interest × Filtered DI Surprise					−0.618		−0.601	
GARCH			−1.939	−1.710			−1.928	−1.688
adjusted R2	0.311	0.311	0.311	0.311	0.311	0.311	0.311	0.311
number obs.	3814	3814	3814	3814	3814	3814	3814	3814
conditional variance equation								
C	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
RESID(−1)^2	**0.122**	**0.124**	**0.122**	**0.124**	**0.122**	**0.123**	**0.122**	**0.123**
GARCH(−1)	**0.850**	**0.848**	**0.850**	**0.848**	**0.851**	**0.849**	**0.851**	**0.849**
Dummy Copom		**0.000**		**0.000**		**0.000**		**0.000**
Dummy Low Interest × Filtered DI Surprise						0.003		0.003

Note: Coefficients in bold are statistically significant at 10% level.

The test did not reject the null that both coefficients are equal at 5% significance level (p-value of 0.62). Therefore, we conclude there is no asymmetry in the response of FX rate returns on interest rate surprises in our sample.

We also investigate whether the short-term impact of monetary policy interest rate decisions on foreign exchange rate has recently changed, as we have been facing a historically lower base interest rate regime during last years. In Model C, we include an iteration of *Filtered DI Surprise* variable with *Dummy Low Interest* variable, as defined in Section 3.

We note during periods of low base interest rates (i.e., single digit ones) the interest surprise is not significant to explain a difference in the exchange rate returns. However, this result should be interpreted with caution, due to the small number of observations available so far to measure this effect.

Regarding the second moment of FX rate returns, we show in Table 2 several GARCH model estimates for robustness purposes. Note the coefficient on interest rate surprises are negative and of the same order of magnitude when compared to the previous estimates of Table 1.

Although the significance of the interest rate surprise remains robust when considering GARCH- type models, note there is no relevant GARCH-in-mean effect in the conditional mean model of exchange rate returns, indicating the second-moment dynamics has no impact on the conditional mean model of FX rate returns.

In Appendix B, we provide extra robustness results, now also controlling for the FX market official interventions. Table B1 includes two *dummies* to account for spot FX market interventions and official announcements of swap contracts.[21] The results are very similar to the ones presented in Table 1, given that these extra *dummies* are not statistically significant.

Table B2, instead, includes three additional control variables: spot interventions in US$ millions, and total number of offered swap contracts (buy and sell). Overall, the results are equivalent to the ones shown in Table 1. The spot intervention is not statistically significant in all cases. However, both the swap variables are statistically significant and exhibit negative (positive) sign for the buy (sell) contract, as expected. Moreover, the absolute effect of the buy swap contract is approximately 35% higher than the sell one.[22]

It is also worth highlighting that, in both Tables B1 and B2, our estimate of interest (*filtered DI surprise*) remains statistically significant and with negative sign, besides being of the same order of magnitude compared to the figure shown in Table 1.

In turn, Table B3 shows the results of the GARCH models, including the two dummies to account for government interventions. These two extra controls are not statistically significant in all cases and, thus, the other estimates are quite similar to those of Table 2.

5. Conclusions

Our study points out to a significant effect of Copom's interest rate decisions on exchange rate returns in Brazil. In particular, the surprise variable measure based on DI future contracts is significant and has a negative sign in all models. Moreover, this effect is independent of the Selic (target) level. In addition, their interactions with Selic target change and Surprise are not significant.

Regarding the assessment of a possible asymmetric effect of the Surprise variable on exchange rate returns, our findings indicate both negative and positive surprises are significant and have a negative sign, although the coefficient of the positive surprise is greater. Nonetheless, a Wald test did not reject the null hypothesis of symmetric effects at 5% significance level.

[21] These *dummies* are equal to 1, 0 or −1, respectively, when indicating FX market intervention from buy swaps (or positive *spot* net intervention), no intervention, and sell swaps (or negative *spot* net intervention).

[22] Official interventions through swap auctions are often aimed at ensuring the smooth functioning of the foreign exchange market and supplying a source for hedge operations (Kohlscheen and Andrade, 2014). Nonetheless, in our sample, the buy contracts are more frequently offered by the BCB compared to the sell ones. This empirical evidence can be due to the more numerous sharp FX rate *depreciation* episodes, observed in the sample, compared to the appreciation ones.

On the other hand, the Surprise DI variable is not significant to explain a difference in the exchange rate returns under a single-digit interest rate period (especially noted in recent years). However, this result should be viewed with caution, due to the few number of observations in this case.

Finally, the impacts of the Copom decisions on the FX rate in Brazil are quite robust when considering GARCH models to investigate the second moment of the FX rate,[23] or including official intervention time series as additional control variables.

Future extensions of the paper might include the construction of surprise measures for other countries, as proposed in this paper, despite different data availability, distinct market conditions and diverse MPC decisions frameworks adopted by other central banks.

Acknowledgments

We are especially grateful for the comments and suggestions given by Angelo Fasolo, Fabio Kanczuk, Euler de Mello, André Minella and Carlos Viana. We also benefited from helpful comments given by an anonymous reviewer as well as by participants of the Research Seminar of the BCB (July 16, 2020). The views expressed in the paper are those of the authors and do not necessarily reflect those of the Banco Central do Brasil. The authors have no conflicts of interest to declare that are relevant to the content of this article. No funding was received to assist with the preparation of this manuscript.

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A. Time series graphs

Figure A1

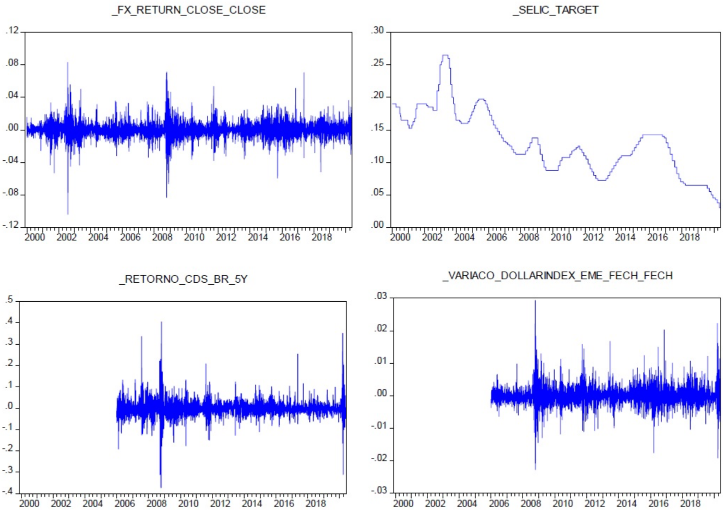


Figure A2

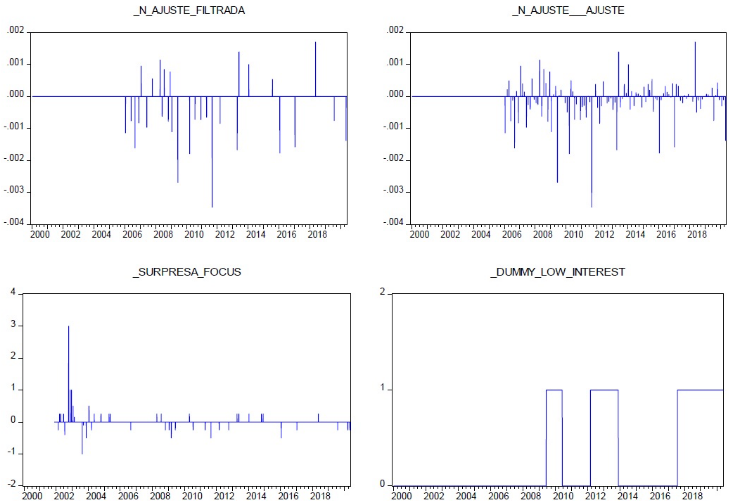
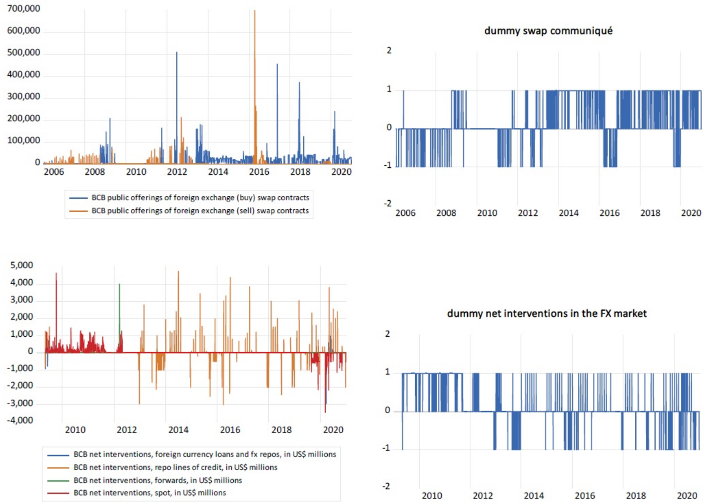


Figure A3



B. Robustness exercises with FX market interventions

Table B1
OLS estimation results, including two *dummies* for interventions

	Model A	Model B	Model C
Selic target	–0.006	–0.006	–0.006
Dummy Copom	0.001	0.001	0.001
Filtered DI Surprise	**–3.687**		**–3.391**
EME DXY variation	**0.772**	**0.767**	**0.772**
Return of CDS Br 5Y	**0.113**	**0.113**	**0.113**
Positive Filtered DI Surprise		**–4.679**	
Negative Filtered DI Surprise		**–3.403**	
Dummy Low Interest × Filtered DI Surprise			–1.1719
Dummy Spot interventions	1.1×10^{-4}	1.1×10^{-4}	1.1×10^{-4}
Dummy Swaps	-1.8×10^{-4}	-1.7×10^{-4}	-1.8×10^{-4}
adjusted R2	0.317	0.318	0.317
number obs.	3664	3657	3664

Note: Coefficients in bold are statistically significant at 10% level.

Table B2
OLS estimation results, including spot interventions and buy/sell swaps

	Model A	Model B	Model C
Selic target	**–0.009**	**–0.009**	**–0.009**
Dummy Copom	0.001	0.001	0.001
Filtered DI Surprise	**–3.636**		**–3.352**
EME DXY variation	**0.772**	**0.767**	**0.772**
Return of CDS Br 5Y	**0.113**	**0.113**	**0.113**
Positive Filtered DI Surprise		**–4.544**	
Negative Filtered DI Surprise		**–3.378**	
Dummy Low Interest × Filtered DI Surprise			–1.124
Spot interventions	7.1×10^{-7}	7.1×10^{-7}	7.1×10^{-7}
Swaps buy contracts	$\mathbf{-2.0\times10^{-8}}$	$\mathbf{-1.9\times10^{-8}}$	$\mathbf{-2.0\times10^{-8}}$
Swaps sell contracts	$\mathbf{1.4\times10^{-8}}$	$\mathbf{1.4\times10^{-8}}$	$\mathbf{1.4\times10^{-8}}$
adjusted R2	0.320	0.321	0.320
number obs.	3664	3657	3664

Note: Coefficients in bold are statistically significant at 10% level.

Table B3
GARCH estimation results, including two *dummies* for interventions

conditional mean equation	Model A				Model B			
	GARCH (1,1)		GARCH-M		GARCH (1,1)		GARCH-M	
Selic target	**−0.006**	**−0.006**	**−0.006**	**−0.006**	**−0.006**	**−0.006**	**−0.006**	**−0.006**
Selic target variation	**−0.375**	**−0.382**	**−0.375**	**−0.382**	**−0.378**	**−0.382**	**−0.378**	**−0.382**
Filtered DI Surprise	**−2.700**	**−2.740**	**−2.707**	**−2.748**	**−2.532**	**−2.747**	**−2.543**	**−2.753**
Dummy Copom	0.000		0.000		0.000		0.000	
EME DXY variation	**0.770**	**0.773**	**0.771**	**0.774**	**0.769**	**0.773**	**0.770**	**0.773**
Return of CDS Br 5Y	**0.113**	**0.112**	**0.112**	**0.112**	**0.113**	**0.112**	**0.112**	**0.112**
Dummy Low Interest × Filtered DI Surprise					−0.624		−0.610	
GARCH			−1.920	−1.621			−1.910	−1.605
Dummy Spot interventions	-7.1×10^{-5}	-7.5×10^{-5}	-7.9×10^{-5}	-8.1×10^{-5}	-7.2×10^{-5}	-7.8×10^{-5}	-8.0×10^{-5}	-8.4×10^{-5}
Dummy Swaps	-5.6×10^{-5}	-8.2×10^{-5}	-3.7×10^{-5}	-6.5×10^{-5}	-5.6×10^{-5}	-8.0×10^{-5}	-3.7×10^{-5}	-6.3×10^{-5}
adjusted R2	0.310	0.310	0.309	0.309	0.310	0.310	0.309	0.309
number obs.	3814	3814	3814	3814	3814	3814	3814	3814
conditional variance equation								
C	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
RESID(−1)^2	**0.122**	**0.124**	**0.122**	**0.124**	**0.122**	**0.123**	**0.122**	**0.123**
GARCH(−1)	**0.850**	**0.848**	**0.850**	**0.848**	**0.851**	**0.849**	**0.851**	**0.849**
Dummy Copom		**0.000**		**0.000**		**0.000**		**0.000**
Dummy Low Interest × Filtered DI Surprise						0.003		0.003

Note: Coefficients in bold are statistically significant at 10% level.

Table B4
GARCH estimation results, including spot interventions and buy/sell swaps

conditional mean equation	Model A				Model B			
	GARCH (1,1)		GARCH-M		GARCH (1,1)		GARCH-M	
Selic target	**−0.009**	**−0.008**	**−0.009**	**−0.008**	**−0.009**	**−0.008**	**−0.009**	**−0.008**
Selic target variation	**−0.380**	**−0.387**	**−0.379**	**−0.387**	**−0.382**	**−0.386**	**−0.382**	**−0.386**
Filtered DI Surprise	**−2.625**	**−2.664**	**−2.626**	**−2.665**	**−2.472**	**−2.668**	**−2.475**	**−2.669**
Dummy Copom	0.000		0.000		0.000		0.000	
EME DXY variation	**0.768**	**0.771**	**0.769**	**0.771**	**0.768**	**0.771**	**0.768**	**0.771**
Return of CDS Br 5Y	**0.112**	**0.112**	**0.112**	**0.112**	**0.112**	**0.112**	**0.112**	**0.112**
Dummy Low Interest × Filtered DI Surprise					−0.561		−0.556	
GARCH			−0.580	−0.241			−0.568	−0.218
Spot interventions	4.4×10^{-7}	4.3×10^{-7}	4.4×10^{-7}	4.3×10^{-7}	4.4×10^{-7}	4.3×10^{-7}	4.4×10^{-7}	4.3×10^{-7}
Swaps buy contracts	**-1.4×10^{-8}**	**-1.5×10^{-8}**	**-1.4×10^{-8}**	**-1.5×10^{-8}**	**-1.4×10^{-8}**	**-1.5×10^{-8}**	**-1.4×10^{-8}**	**-1.5×10^{-8}**
Swaps sell contracts	**1.4×10^{-8}**	**1.4×10^{-8}**	**1.4×10^{-8}**	**1.4×10^{-8}**	**1.4×10^{-8}**	**1.4×10^{-8}**	**1.4×10^{-8}**	**1.4×10^{-8}**
adjusted R2	0.313	0.313	0.313	0.313	0.313	0.313	0.313	0.313
number obs.	3814	3814	3814	3814	3814	3814	3814	3814
conditional variance equation								
C	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**
RESID(−1)^2	**0.121**	**0.123**	**0.121**	**0.123**	**0.121**	**0.122**	**0.121**	**0.122**
GARCH(−1)	**0.851**	**0.848**	**0.851**	**0.848**	**0.851**	**0.849**	**0.851**	**0.849**
Dummy Copom		**0.000**		**0.000**		**0.000**		**0.000**
Dummy Low Interest × Filtered DI Surprise						0.002		0.002

Note: Coefficients in bold are statistically significant at 10% level.