Monetary policy and the exchange rate in Brazil*

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Abstract

This note presents evidence that higher interest rates may render a country's currency *less* attractive. Using data from the dates surrounding the monetary policy committee meetings in Brazil and the methodology of identification through heteroskedasticity we find that unexpected increases in interest rates caused the Brazilian currency to depreciate during the 2000-2006 period.

KEYWORDS: exchange rate, monetary policy, identification through heteroskedasticity.

JEL CLASSIFICATION: F3, E5.

1 Introduction

Theoretical models show that if interest rates adversely affect default risk or monetization risk, a monetary tightening may render the domestic currency *less* attractive. Sargent and Wallace (1981) show how raising interest rates might lead to increased expected inflation if households anticipate debt will eventually need to be monetized. Blanchard (2005) studies the Brazilian case and argues in the context of a multiple equilibria model that for high debt levels and risk premia, higher interest rates may spark currency depreciations. In the model of Akemann and Kanczuk (2005), the perverse effect of monetary tightenings kicks in when interest rates and the level of indebtedness are high enough so that the government prefers to default instead of increase the fiscal primary surplus.

There is indeed some empirical evidence that this perverse effect of high interest rates is not sheer theoretical curiosity. Furman and Stiglitz (1998) point that at times of currency attacks, temporarily higher interest rates may not help to defend a currency and some recent empirical work lends credence to their argument (Kraay (2002), Caporale *et al* (2005)).

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In this note, we argue that the negative effect of higher interest rates on the exchange rate is not necessarily confined to episodes of attacks to currency pegs. We present evidence that during the 2000-2006 period, monetary tightenings by the Brazilian Central Bank led on average to currency depreciations.

Brazil is a suitable country for testing the possibility of such negative effects of tight monetary policy. Since 2000, the Brazilian economy has run primary fiscal surpluses, implemented inflation targeting and let the exchange rate float freely. But in spite of that, the country has been a worldwide champion of high interest rates for quite a few years, rarely missing first or second place. For most of this period, Brazilian *real* interest rates have been hovering around 10% a year although the Brazilian EMBI risk measure has been on average around 4%. Moreover, the debt to GDP ratio in this period was higher than the average of other emerging economies (around 50%). In sum, Brazil meets the criteria of an economy prone to suffer from the perverse effect of high interest rates.

We estimate the effect of interest rates on the exchange rate using data from the dates surrounding the monetary policy committee meetings. In tackling the problem empirically, a first concern is to avoid the usual endogeneity and reverse causality problems that plague this sort of study. For that, we resort to Rigobon and Sack's (2004) methodology of identification through heteroskedasticity using data from the days immediately preceding, and immediately following, the monthly meetings of the Monetary Policy Committee (Copom hereafter). Using this technique, we present evidence that upward shocks to the interest rates tend to lead the Brazilian currency to *depreciate*. An increase of 100 basis points in interest rates is found to generate an average depreciation between 0 and 2%.[1]

2 Estimation

2.1 Monetary policy in Brazil

After abandoning a currency peg regime in 1999, the Brazilian Central Bank (BCB hereafter) opted to target inflation and let the exchange rate float. Under the new regime, the BCB has been following with rigor the usual procedures of accountability and commu-

[1] The methodology developed by Rigobon and Sack (2004) that we use here is not the only proposed alternative. Zettelmeyer (2004) regresses changes in exchange rates around meeting dates on the changes in interest rates over the same window using the change in the policy rate as an instrument. However, in the case of Brazil, data on the surprise in the policy rate is not available, and the assumption that the choice of the policy rate is not significantly influenced by economic and political news that do affect asset prices in general is a bit too strong due to the high frequency and magnitude of shocks that hit the Brazilian economy. We hence opted for the methodology of identification through heteroskedasticity. In any case, regressions using the short term rate as an instrument also yield a negative association between interest rates and the value of the Brazilian currency.

nication. These include, among other things, a monthly meeting of its monetary policy committee (Copom, hereafter), almost always on the third Wednesday of the respective month, when a decision on the prime rate is reached by a board of directors.[2]

The Copom's monthly decision about the prime rate undoubtedly exerts a strong influence on long term interest rates by suggesting what the BCB plans to do in the future, and it is precisely the greater variability of interest rates on those dates that allows us to isolate causation by instrumenting through heteroskedasticity.

2.2 Methodology and data

Our data set goes from January/2000 to December/2006. Because the Copom meetings take place on Wednesdays, our variables are constructed as follows: $\Delta s = s_{thursday} - s_{tuesday}$ and $\Delta i = i_{thursday} - i_{tuesday}$.[3]

When we run a simple OLS regression of the change in the exchange rate (Δs) on the variation of the interest rate (Δi) around Copom meetings, we find a significant positive coefficient, indicating that unexpected tightenings are correlated with currency depreciations. The result holds regardless of the length of interest rates we use. However, this does not imply causality because of endogeneity problems (the interest rate and the exchange rate are influenced by each other) and the presence of omitted variables in the regression (the interest rate and the exchange rate are influenced by other common variables). The following system of equations captures these features.

$$\Delta s_t = \alpha \Delta i_t + z_t + \eta_t \quad (1)$$

$$\Delta i_t = \beta \Delta s_t + \gamma z_t + \varepsilon_t \quad (2)$$

Where Δi_t is the change in the 1-year interest rate, Δs_t is the change in the spot exchange rate,[4] z_t is an omitted variable, ε_t is a monetary policy shock and η_t is a shock to the asset price.

In order to circumvent the endogeneity and omitted-variables problems, we use the methodology of identification through heteroskedasticity proposed by Rigobon and Sack (2004). The sample, consisting of values of Δs and Δi, is divided in two subsamples: the subset C corresponds to the dates when the Copom meets, and the subset N corresponds to dates (same week days) with no meeting. Denote the changes is interest rates and exchange rates in the "Copom" and "No-Copom" subsamples by Δi_C, Δs_C, Δi_N and

[2] For more details on the Brazilian inflation targeting framework, see Bogdanski *et al* (2000).

[3] We also included an extraordinary Copom meeting that occurred on a Monday.

[4] To be precise, $\Delta s_t = \Delta \log(S_t)$ and $\Delta i_t = \Delta \log(1 + i_t)$.

Δs_N, respectively, and the number of observations in each of the two sets by T_C and T_N, respectively.

The key assumption is that the variance of the shock to the interest rate (ε_t) in the dates belonging to set C is higher than the variance of the shock to the interest rate in the dates belonging to set N, while the variances of η_t and z_t are the same:

$$\begin{aligned} \sigma_\varepsilon^C &> \sigma_\varepsilon^N \\ \sigma_\eta^C &= \sigma_\eta^N \\ \sigma_z^C &= \sigma_z^N \end{aligned}$$

We also assume that z_t, ε_t and η_t have no serial correlation and are uncorrelated with each other.

As shown in Rigobon and Sack (2004), the assumptions on the behavior of the variability of shocks in the two subsamples allow us to identify α. The intuition is the following: in dates where Copom meets, there is a shock to equation 2, σ_ε increases, but there are no shocks to other variables. So, the overall relation between Δs and Δi should be different between the two subsamples, C and N.

A major result in Rigobon and Sack (2004) is that α can be consistently estimated by a standard instrumental variables approach, where the dependant variable ΔS, regressor ΔI and instruments w_i and w_s are as shown below:

$$\begin{aligned} \Delta I &\equiv \left[\frac{\Delta i_C'}{\sqrt{T_C}}, \frac{\Delta i_N'}{\sqrt{T_N}}\right]' \\ \Delta S &\equiv \left[\frac{\Delta s_C'}{\sqrt{T_C}}, \frac{\Delta s_N'}{\sqrt{T_N}}\right]' \\ w_i &\equiv \left[\frac{\Delta i_C'}{\sqrt{T_C}}, \frac{-\Delta i_N'}{\sqrt{T_N}}\right]' \\ w_s &\equiv \left[\frac{\Delta s_C'}{\sqrt{T_C}}, \frac{-\Delta s_N'}{\sqrt{T_N}}\right]' \end{aligned}$$

The traditional way of analyzing the impact of monetary policy decisions (the so-called event study approach) is to consider that unexpected changes in the policy rate are exogenous and use those to estimate equation 1. Rigobon and Sack (2004) show that such strong assumptions are unnecessary: with the assumptions on heteroskedasticity, one can consistently estimate α. Here, we argue that the methodology of identification through heteroskedasticity allows us to go one step further by permitting the use of the one-year rate as the regressor. As discussed above, the one-year rate is a better measure of monetary policy surprises, but the problem is that it is clearly endogenous. Using the method of identification through heteroskedasticity, however, we do not need to assume exogeneity. All we need is to assume that the one-year interest rate is directly affected by the Copom decisions but the exchange rate is only affected through the influence of the changes in the interest rate.

2.3 Test of the identifying assumption

Here we show that the variances of ε_t and η_t in both subsamples corroborate our assumptions: there is no evidence that channels linking the Copom meetings and shocks to η_t are important.

Solving for the reduced form of equations 1 and 2, we reach:

$$\Delta i_t = \frac{1}{1-\alpha\beta}\left[(\beta+\gamma) z_t + \beta\eta_t + \varepsilon_t\right] \quad (3)$$

$$\Delta s_t = \frac{1}{1-\alpha\beta}\left[(1+\alpha\gamma) z_t + \eta_t + \alpha\varepsilon_t\right] \quad (4)$$

Equations 3 and 4 and the assumptions about variances in the two subsamples lead to:

$$Var(\Delta i_C) - Var(\Delta i_N) = \frac{\sigma_\varepsilon^C - \sigma_\varepsilon^N}{(1-\alpha\beta)^2} > 0 \quad (5)$$

$$Var(\Delta s_C) - Var(\Delta s_N) = \alpha^2 \frac{\sigma_\varepsilon^C - \sigma_\varepsilon^N}{(1-\alpha\beta)^2} > 0 \quad (6)$$

Equations 5 and 6 show that the variances of Δi and Δs must increase in Copom dates but since the variance of Δs is substantially larger than the variance of Δi, the proportional increase in the variance of Δs must be smaller.

Table 1: Variances of Δi and Δs

	Sample C	Sample N	Change	(%)	p-value
$Var(\Delta i)$	3.39×10^{-5}	2.00×10^{-5}	1.39×10^{-5}	69.4%	0.0010
$Var(\Delta s)$	2.38×10^{-4}	2.21×10^{-4}	1.66×10^{-5}	7.5%	0.3312

Table 1 shows the variances of Δi and Δs in the two subsamples. The p-values reported in Table 1 refer to the F-test of equality of variances in both subsamples. We can reject at 1% that $Var(\Delta i)$ does not increase in subsample C. Using the above equations, the estimated change in $Var(\Delta s)$ corresponds to a value of $\alpha = 1.1$ (which coincides with our estimated α). The main concern regarding our estimation strategy is whether the variance of η_t increases in Copom dates. This would lead to large increases in $Var(\Delta s)$. Fortunately, we cannot reject that $Var(\Delta s)$ is the same in both subsamples, which allows us to proceed with the identification through heteroskedasticity methodology.

3 Results

Our main result is presented in the second and third column of table 2: our estimated α is around 1 and we can reject at the 5% level of confidence that α is negative. According to our estimates, an unexpected increase of 100 basis point in the interest rates leads to an increase in Δs (that is, a *depreciation* of the exchange rate) between 0 and 2% (approximately).

Table 2: IV Estimates

α	1.26	1.11	1.10
(std dev)	(0.14)	(0.53)	(0.53)
t-stat	9.12	2.10	2.08
Method	OLS	IV	IV
Instruments	—	w_i, w_s	w_i

The IV estimation is not highly accurate because the change in the variance of Δi in Copom dates does not increase so much, so the instrument w_i is not very strongly correlated with Δi. Also, as the proportional change in the variance of Δs is small, w_s is only weakly correlated with Δi, and including it as an instrument in the regressions does not produce any meaningful change.

The OLS estimation yields a higher coefficient and a smaller standard error. Given the problems of endogeneity and omitted variables discussed above, that is exactly what we should expect because the OLS estimator would be upward biased. The precision of the estimation does not allow us to assert that the results obtained by the IV and OLS methods are significantly different, but that is not relevant for the purpose of this paper. The main point is that α is significantly *not* negative even when we employ the methodology of identification through heteroskedasticity.

4 Concluding remarks

This note shows an example of negative effect of tight monetary policy on the value of a currency. In Brazil, where debt and interest rates were both high, unexpected monetary tightenings have tended to *depreciate* the currency.

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