MONETARY AND EXCHANGE RATE POLICY IN BRAZIL AFTER INFLATION TARGETING[♣]

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Abstract

After strong currency crisis, in January 1999, Brazil implemented flexible exchange rate regime combined with inflation targeting. Some economists believe that emerging markets do not allow the exchange rate to float as much they had announced and therefore they suffer from the fear of floating. However, in this article there is evidence to believe that central banks in the emerging markets care about inflation ratter than exchange rate. The remarkable result found in this article is that the aggressiveness of the interest rate reaction to inflation explains far more the current monetary and exchange rate policy in Brazil than the idea of the fear of floating.

Key-words: Monetary Policy, Exchange Rate Policy, Central Bank, Brazil.

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1. Introduction

Six years after the Central Bank of Brazil has implemented the inflation targeting regime quite a lot has been discussed about its attractiveness. Many emerging markets have experienced floating regime combined with inflation target, but even announcing an independently floating exchange rate regime[1], their currencies have not been allowed to float so much. Calvo and Reinhart (2002) found that these countries suffer from the "fear of floating" and they make intensive use of interest rate and foreign reserves interventions in order to limit their exchange rate volatility.

Eichengreen (2002) suggests that the central bank, even having concerns about the exchange rate variability, does not care about exchange rate in the same way it does with inflation. Moreover, while a central bank raises interest rates in order to smooth the depreciation of the domestic currency, mainly during "Calvo shock" (a sudden stop in the capital inflows), "it will not prevent the exchange rate from moving, as the strong 'fear of floating' view would suggest. (…) Thus, while the degree of exchange rate flexibility will be limited by central bank policy, such flexibility will not be entirely eliminated. The currency will still exhibit great flexibility than when it is pegged" (Eichengreen, 2002:15). The consequence of this argument is that the more temporary the Calvo shock the less the fear of floating.

Again, the central bank can not display the fear of floating when it has no instruments to prevent the exchange rate from adjusting to a new long run equilibrium. Certainly, it can raise the interest rate if the exchange rate depreciates, even though there is no real reason to believe that it will reduce the interest rate when the exchange rate appreciates. Then, the fear of floating approach would be unsuccessful.

One direct way to assess whether a central bank has suffered from fear of floating is by estimating the reaction

[1] Brazil has experienced an independently floating exchange rate regime according to IMF's *De Jure* classification (2004), and even in terms of Bubula and Ökter-Robe (2002)'s *De Facto* classification.

functions of the Central Bank on inflation pressure[2]. In this case, a central bank cares far more about inflation rather than it cares about exchange rate volatility. Then, this article presents some empirical evidences that support the idea that the Central Bank of Brazil has quite a lot concerns about inflation rate and inflation is definitely the focus that policymakers have. Estimates of the IS and Phillips Curves are presented followed by estimates of the reaction functions according to Clarida, Gali and Gertle (1997) after adjusting Taylor-type interest rate rule to take into account a forward-looking version.

Brazil maybe shows some aggravates such as relative high speed of pass through, the difficulty of forecasting inflation, liability dollarization and credibility issues, as highlighted by Eichengreen (2002) as elements that distinguish emerging markets from developed economies. The reader will find some considerations about credibility issues. In the Brazilian case the credibility building process in the monetary policy associated with the inflation forecast remains a big difficulty.

2. The Brazilian Experience

In January 1999, after a strong currency crisis, Brazil implemented the flexible exchange rate regime. More than six years late, has Brazilian currency floated less than predictable by its classification and exhibited the fear of floating? In other words, has the Central Bank of Brazil used foreign reserves and interest rate to limit exchange rate volatility? Even if Brazil has pursued this policy is it the *fear of floating* or a symptom of the *inability of fixing*[3]? Does a Central Bank in an emerging market really have the ability to prevent high exchange rate flexibility?

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[2] However, Calvo and Reinhart (2002) proposed to build an Exchange Rate Flexibility Index based on ratio between the exchange rate variance and the sum of the variances of the interest rate and the foreign reserves. See Holland (2005) for an assessment about this topic in Brazil.

[3] Herein *inability of fixing* does not mean that the central bank has tried to manage the exchange rate in the way it did during the pegged regime (1994-1998) and cannot anymore. It means that exchange rate stability can be a resting place in a country that shows high "domestic original sin" and trade imbalance.

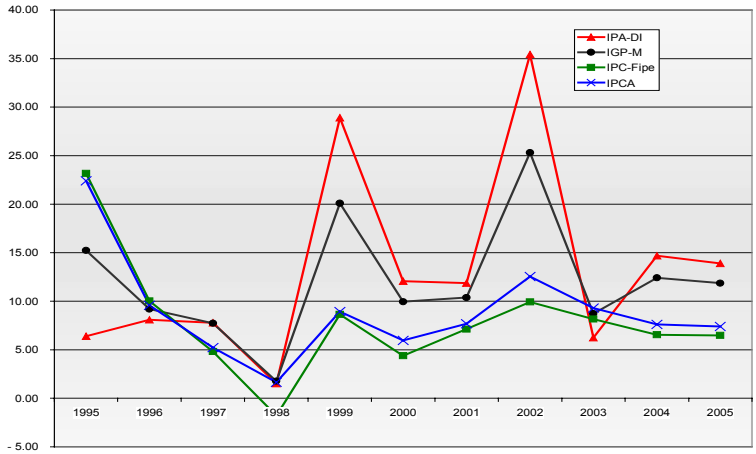
Controlling inflation rate at a low level can be dynamically inconsistent and Brazil might be one remarkable example. How can credibility problem in an emerging market like Brazil be considered? According to figure 1, the inflation rates variances are extraordinarily high even in this sample (1995-2005) of the recent history of price stabilization. During this period of time, the annual inflation rates averaged between 8.01 and 13.9 per cent and their variances measured by standard deviation varied from 5.3 to 10.2 per cent, in IPCA (Broad Consumer Price Index) and IPA (Wholesale Price Index), respectively.

Quite a lot has been debated in Brazil about the effectiveness of the inflation targeting regime. As one can see in the figure 2 the Central Bank of Brazil has had difficulties to manage the inflation rate index (IPCA) used to reach the center of the announced inflation band. The target could barely be reached only in 2003 and 2004 because central bank announced changes in the targets motivated by presidential election shock in 2002. In two consecutives years, 2001 and 2002, the inflation rate surpassed the target, igniting the debate about the attractiveness of the inflation targeting regimes in emerging markets like Brazil. According to Eichengreen (2002:37), "Credibility problems make inflation targeting less attractive. They imply more volatility and less flexible policy implementation. The question is then how quickly credibility can be gained and whether or not inflation targeting can be part of that process". That is definitely a remarkable issue nowadays in Brazil when after six years adopting inflation target remains the question whether or not it is time to be considered credible the central bank's commitment with low inflation.

Then, not only inflation rates have been pretty volatile, but also the announced targets to inflation have not been properly reached. Both these facts may be affecting the credibility building process in the monetary policy, even under tremendous effort of the central bank in demonstrating its commitment with the low inflation and fiscal balance[4].

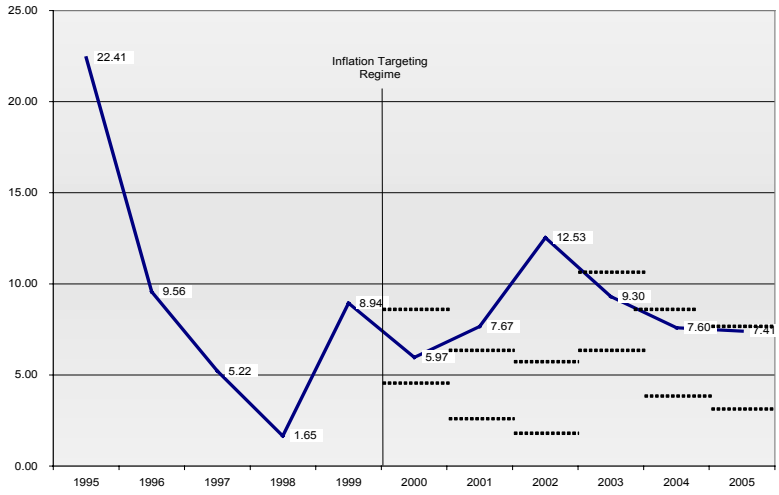
[4] Minella et all (2003) show a comprehensive analysis about the way Brazilian Central Bank has tried to build credibility under high exchange rate volatility.

Figure 1. Inflation Rates in Brazil (1995-2005)



Source: Central Bank of Brazil
Notes: IPA-DI (Wholesale Price Index); IGP-M (General Price Index); IPC (Consumer Price Index) and IPCA (Broad Consumer Price Index).

Figure 2. Inflation Rate (IPCA) and Inflation Band in Brazil (1995-2005)



Source: Central Bank of Brazil

It turns out that the policy issues somehow have to deal with a problem of causality and ambiguousness. Can inflation targeting regimes help emerging markets to build credibility?[5]

[5] Ball and Sheridan (2003) ask whether inflation targeting improves economic performance, as measured by the behavior of inflation, output,

The question could be established in different perspective. Is it possible Central Banks with low credibility (history of inflation) implement successfully inflation targeting regime?[6] On one hand, this monetary policy strategy rescue the important role played by central bank as the coordinator of the monetary policy. However, on the other hand, if the Central Bank suffers from the fear of floating, inflation targeting and hard peg are basically indistinguishable. Again, Brazil can be an emblematic country-case that experienced pegged exchange rate followed by inflation target and therefore one can clearly evaluate how the fear of floating looks like.

Once more Eichengreen (2002:39) sums up in appropriate words this phenomenon in emerging markets: "The greater exchange rate flexibility promised by inflation targeting will be possible, although the central bank's appetite for indulging in it will have limits". Then, there are sharp constraints upon to Central Banks' willingness and they have no ability to achieve by themselves exchange rate stability. What is behind the exchange rate volatility is neither necessarily the fear of floating nor inflation targeting *per se*. In addition, Brazil has the problem of the composition and level of government debt to be considered.

3. Monetary Policy in Practice in Brazil since 1999

No long Brazil has put in place an inflation targeting strategy in mid-1999 the Brazilian Central Bank' staff presented a basic framework according to a small-scale macroeconomic models used for disciplining discussions about monetary policy within the Central Bank (Bogdanski, Tombini and Werlang, 2001). Even in that time it was recognized that what the new monetary strategy did was inflation forecast ratter than reacting to present facts Brazilian policymakers should

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and interest rates and the author did not find significant difference between targeters and non-targeter.

[6] Bogdanski, Tombini and Werlang (2001) provide a fairly analytical background about the process of implementing inflation targeting in Brazil and in several parts of that article one can easily see the difficulties in that process, from the learning about the new monetary strategy to be adopted to the choice of the price index to be reference for the target.

follow a simple structural model combining an IS curve, a Phillips Curve, an UIP condition and a Taylor-type interest rate rule. Six years late this simple model is reviewed and estimates of these standard specifications can be found in order to start up the evaluation about the monetary policy in practice in Brazil. In other words, this section assesses the reaction functions the central bank has been really adopting. Regarding this problem can be a direct way to analysis if Brazil suffers from the fear of floating ratter than it cares about inflation. Therefore, if the reaction functions of the Brazilian Central Bank to inflation shocks are not higher enough in context of the low exchange rate volatility one can assume that this economy can not float as truly independently floating economies float.

Data set

It was used monthly data from July 1999 (when Brazil implemented the inflation targeting regime) to January 2005. Consumer price index was used to measure actual inflation and industrial production index (seasonally adjusted) to measure output and afterward smoothing the log of industrial production using linear trend and Hodrick-Prescott filter to obtain output gap. The interest rate is the Over-Selic. Exchange rate R$/US$ was deflated by consumer price index (Brazil) and wholesale price index (U.S.) to obtain real exchange rate. Finally, US Federal Funds Rate measures the international monetary policy that can be affecting Brazilian monetary policy.

The Practice

First of all, the IS Curve is estimated as the following general expression:

$$h_t = \beta_0 + \beta_1 h_{t-1} + \beta_2 h_{t-2} + \beta_3 r_{t-1} + \beta_4 Fiscal_{t-1} + DU_T + \varepsilon_t^h$$

where: h_t is the log of the output gap obtained by the difference between actual and potential GDP smoothing out the GDP series through both Hodrick-Prescott filter and linear trend; r_t is the log of the real interest rate [log(1+R)] estimated from Over-Selic; *Fiscal* is the Federal Domestic Debt as a percentage of

GDP; DU_T is dummy variable for energy crisis[7]; and ε_t^h is demand shock.

Table 1 shows three difference specifications of the IS Curve using HP filter and others three using linear trend in order to measure output gap. Estimations with HP filter were found far better than those with linear trend. In all of them estimated with HP filter the sign of the interest rate is negative and statistically significant. This apparently wrong sign has one possible explanation "that part of the supply shocks that hit the economy led to an increase in inflation and simultaneously to a reduction in output" (Minella et all, 2003:14). As the dummy variable for energy crisis was found significant and its introduction in the IS equation led to the reduction in the estimated parameter β_3, that is most likely the case of rationing in electricity that changed a lot the firms and households' behaviors for more than the official period of rationing. Our fiscal variable was not found statistically significant and can be easily explained for the fact that the domestic debt has dynamics predominantly finance in close association with country risk.

Next step is towards estimating the backward-looking Phillip Curve that can be expressed as the following:

$$\pi_t = \alpha_1 \pi_{t-1} + \alpha_2 \pi_{t-2} + \alpha_3 h_{t-1} + \alpha_4 \Delta p_t^F + \alpha_5 e_t + \varepsilon_t$$

where: π_t is the log of price inflation measured by Consumer Price Index; p_t^F is the log of foreign producer price index measured by Wholesale Price Index in the U.S.A.; e_t is the log of exchange rate variation[8]; and ε_t is supply shock. Table 2 shows easily that the backward-looking specification for Phillips curve outcomes definitely weak estimations.

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[7] The official period of rationing was May 2001-Feb 2002, but its effect perhaps had been extended more over time because the changes in behavior of the firms and households.

[8] Real depreciation was tested instead of nominal depreciation but it was found no significant.

Table 1: IS Curve (1999:07-2005:01)

	β_o (*Constant*)	β_1 (*Output Gap- 1st. lag*)	β_2 (*Output Gap- 2nd. lag*)	β_3 (*Lagged Interest Rate*)	β_4 (*Fiscal*)	DU (*Energy Crisis*)	R^2	DW	N
HP Filter	2.92** (0.81)	0.77** (0.12)	-0.30** (0.13)	-2.3** (0.76)			63%	2.0	65
HP Filter	1.46** (0.71)	1.25** (0.13)	-0.38** (0.10)	-1.46** (0.63)		2.65** (0.43)	76%	2.1	65
HP Filter	3.14 (2.7)	1.24** (0.13)	-0.37** (0.10)	-1.36** (0.65)	-0.43 (0.67)	2.62** (0.46)	76%	2.1	65
Linear Trend	0.74 (0.87)	0.29** (0.12)	-0.19 (0.12)	-0.47 (0.59)			10%	2.0	65
Linear Trend	1.72*** (0.95)	0.26* (0.12)	0.18 (0.12)	-1.25*** (0.66)		1.18** (0.51)	17%	2.1	65
Linear Trend	2.13 (2.07)	0.26** (0.12)	-0.18 (0.12)	-1.21*** (0.69)	-0.008 (0.03)	1.19** (0.50)	18%	2.1	65

*Notes: P-values in parentheses. *** significant at 10%; ** significant at 5%; *** significant at 1%. It was implemented dummy variables for Presidential Election (2002) and all were also significant at 5%.*

Table 2. Backward-Looking Phillips Curve

	α_1 (*Inflation 1st. lag*)	α_2 (*Inflation 2nd. lag*)	α_3 (*Lagged Output Gap*)	α_4 (*Foreign Price*)	α_5 (*Exchange Rate Depr.*)	R2	DW	SC	N
HP Filter	0.64** (014)	0.10 (0.14)	-0.03 (0.03)	0.008 (0.06)	-0.81 (2.52)	36%	1.99	1.56	61
Linear Trend	0.63** (0.14)	0.10 (0.13)	-0.05 (0.05)	-0.01 (0.06)	-1.01 (2.51)	40%	2.01	1.60	61
HP Filter	0.72** (0.09)		-0.03 (0.03)	0.002 (0.06)	-0.26 (2.4)	40%	2.06	1.54	61
Linear Trend	0.72** (0.09)		-0.05 (0.05)	-0.003 (0.06)	-0.44 (2.38)	39%	2.07	1.54	61

*Notes: P-value in parentheses. ** significant at 5%. It was also implemented dummy variables for Presidential Election (2002) and all were also significant at 5%. SC stands for Schwarz Criterion.*

Though the Brazilian Central Bank has no the same degree of autonomy over its monetary policy that the G3's central banks have, it is fair to say that the main operating instrument of monetary policy is a short term interest rate. According to Clarida, Galí and Gertler (1997)'s seminal article, the central bank has a target for nominal short term interest rate, r_t^*, that is based on the state of economy, and depends on both expected inflation and output:

$$r_t^* = \bar{r} + \beta(E[\pi_{t+n} \mid \Omega_t] - \pi^*) + \gamma(E[y_t \mid \Omega_t] - y_t^*) \qquad (1)$$

where $\bar{r}$ is the long run equilibrium nominal rate, π_{t+n} is the rate of inflation between periods t and $t+n$, y_t is real output, and π^* and y_t^* are bliss point of inflation and output (potential output), respectively. As the real rate can be expressed by $rr_t \equiv r_t - E[\pi_{t+n} \mid \Omega_t]$, (1) yield:

$$rr_t^* = \overline{rr} + (\beta - 1)(E[\pi_{t+n} \mid \Omega_t] + \gamma(E[y_t \mid \Omega_t] - y_t^*) \quad (2)$$

where $\overline{rr}$ is the long run equilibrium real interest rate. According to Clarida, Gali and Gertler (1997:5), "A straightforward but critical point is that the magnitude of the parameter β is key. If $\beta > 1$ the target real rate adjusts to stabilize changes in inflation (…) With $\beta < 1$, it instead moves to accommodate expected rise in inflation". Next to proceed to empirical specifications the authors assume that the actual rate partially adjust to the target:

$$r_t = (1-\rho)r_t^* + \rho r_{t-1} + v_t \quad (3)$$

where the parameter $\rho \in [0,1]$ captures the degree of interest rate smoothing[9], and v_t is an exogenous random shock i.i.d.

Defining $\alpha \equiv \bar{r} - \beta\pi^*$ and $x_t \equiv y_t - y_t^*$ and then rewriting (1):

$$r_t^* = \alpha + \beta E[\pi_{t+n} \mid \Omega_t] + \gamma E[x_t \mid \Omega_t] \quad (4)$$

Combining (4) and (3):

$$r_t = (1-\rho)\{\alpha + \beta E[\pi_{t+n} \mid \Omega_t] + \gamma E[x_t \mid \Omega_t]\} + \rho r_{t-1} + v_t \quad (5)$$

Finally, eliminating the unobserved forecast variables from the expression by rewriting the policy rule in terms of realized variables as the follows:

$$r_t = (1-\rho)\alpha + (1-\rho)\beta\pi_{t+n} + (1-\rho)\gamma x_t + \rho r_{t-1} + \varepsilon_t \quad (6)$$

where the error term $\varepsilon_t \equiv -(1-\rho)\{\beta(\pi_{t+n} - E[\pi_{t+n} \mid \Omega_t]) + \gamma(x_t - E[x_t \mid \Omega_t])\} + v_t$ is a linear combination of the forecast errors of inflation and output and the exogenous disturbance v_t. Let u_t be a vector of variables within the central bank's information set at the time it

[9] In an estimation by OLS using Over-Selic and Selic Target, for the sample 1999:08-2005:03, Brazil shows $\rho = 0.035$ and therefore $1-\rho$ = 0.96. All coefficients were found statistically significant at 5%.

chooses the interest rate (i.e. $u_t \in \Omega_t$) and $E[\varepsilon_t \mid u_t] = 0$. Then: $E[r_t - (1-\rho)\alpha - (1-\rho)\beta\pi_{t+n} - (1-\rho)\gamma\hat{y}_t - \rho r_{t-1} \mid \mathrm{u_t}] = 0$. To estimate the parameter vector $[\beta, \gamma, \rho, \alpha]$, the authors use GMM (generalized method of moments), and the instrument set $\mathrm{u_t}$ includes lagged values of output, inflation, interest rate and commodity prices. "Under our assumption, that implies the existence of value for $[\beta, \gamma, \rho, \alpha]$ such that the implied residual ε_t is orthogonal to the variables in the information set Ω_t. Under the alternative, however, the central bank adjusts the interest rate in response to change in some current and/or lagged variables, but not necessarily in connection with the information that those changes contain about future inflation and output." (Clarida, Galí and Gertler, 1997:9-10).

Clarida, Galí and Gertler (1997) also use the parameter estimates β and α to recover an estimate of the central bank's target inflation rate, π^*. Given $\alpha \equiv \bar{r} - \beta\pi^*$ and $\bar{r} = \overline{rr} + \pi^*$, $\alpha \equiv \overline{rr} + (1-\beta)\pi^*$, which implies: $\pi^* = (\overline{rr} - \alpha)/(\beta - 1)$. An extended model takes into account alternatives variables such as real exchange rate, foreign interest rate and money supply.

Assessing six years of free floating in Korea, Eichengreen (2004) followed the approach of Clarida, Galí and Gertler (1997) in order to answer how important inflation, the real economy and the exchange rate have been in the policy decision of the Bank of Korea. Eichengreen (2004) as well as Clarida, Galí and Gertler (1997) estimated forward-looking reaction functions employing Generalized Methods of Moments (GMM). In this case, the reaction function is basically a forward-looking version of a backward-looking reaction function proposed by Taylor (1993). The instrument set includes 1-6, 9, 12 lagged values of the output gap, inflation, log difference of the exchange rate. It is important to highlight that the ending point is twelve months prior to the latest available data in possession and this research did this following Clarida, Galí and Gertler (1997) and Eichengreen (2004) "because the year-ahead ex post inflation rate is one of our right hand side variables" (Clarida, Galí and Gertler, 1997:13).

This work follows them in the estimates of the reaction function of the Brazilian Central Bank and the results of the baseline model are showed in the tables 3 and the table 4 shows variants of this model. In our baseline model the instrument set includes lagged values of the industrial production index, inflation rate measured by CPI, real exchange rate depreciation[10] and interest rate Over-Selic. One can interpret the results as the following: "under the null, the central bank adjusts the interest rate each period so that (5) holds, with the expectations on the right hand side based on all the relevant information available to policymakers at that time" (Clarida, Galí and Gertler, 1997:9).

Table 3. GMM Estimate: Forward-Looking Inflation

β (*Inflation*)	γ (*Output Gap*)	ρ (*Lagged Dependent Variable*)	α (*Constant*)	ξ (*Real Depreciation*)	R^2	Adjusted R^2	Gap computed by
2.62** (0.85)	-1.2*** (0.79)	0.45** (0.13)	0.24** (0.09)	-0.18 (0.21)	25%	22%	HP Filter
2.33** (0.78)	-0.95*** (0.58)	0.46** (0.12)	0.21** (0.08)		21%	19%	HP Filter
4.35** (1.32)	-1.18*** (1.14)	0.65 (0.15)	0.31*** (0.18)	0.52 (0.41)	22%	20%	Linear Trend
4.28** (1.31)	-1.41*** (0.55)	0.61** (0.12)	0.19** (0.08)		21%	19%	Linear Trend

*Notes: P-values in parentheses. *** and ** significant at 10% and 5%, respectively. It was also implemented dummy variables for Presidential Election (2002) and all were also significant at 5%. The rate of real exchange rate depreciation is lagged one month. The instruments are a constant and lags 1-6, 9 and 12 of the overnight interest rate (Over-Selic), industrial production index, real exchange rate depreciation and inflation CPI. The sample was adjusted in 12-month less than the ending point of the available data set. Estimates are obtained by GMM with correction for MA(12) autocorrelation. Optimal weighing matrix obtained from first step 2SLS parameter estimates.*

Estimate of $\pi^* = \frac{\overline{rr} - \alpha}{\beta - 1}$ *for specifications (1) and (3):* $\pi^*(1) = 7.36$ *and* $\pi^*(3) = 2.75$, *respectively. These estimates assume that long run equilibrium real interest rate is equal to sample average (1999-2005) of rr = 9.52%. As the long term equilibrium inflation rate can vary a lot the average between than is 5.05. By using the sample average real interest rate to proxy* $\overline{rr}$, *our estimate of* π^* *cannot differ from the sample average of* π *(=7.4) only when use HP filter.*

Controlling inflation became a major focus of monetary policy even in countries where central banks have some

[10] Both level and first difference of the nominal and real exchange rate were tested as explanatory variables and as instruments (see table 4).

reasonable degree of autonomy over their domestic monetary policy. Brazil does not represent an exception. Moreover, the estimate of the long term equilibrium inflation rate (7.36%) can show how big inflation in Brazil is in comparison with other countries.

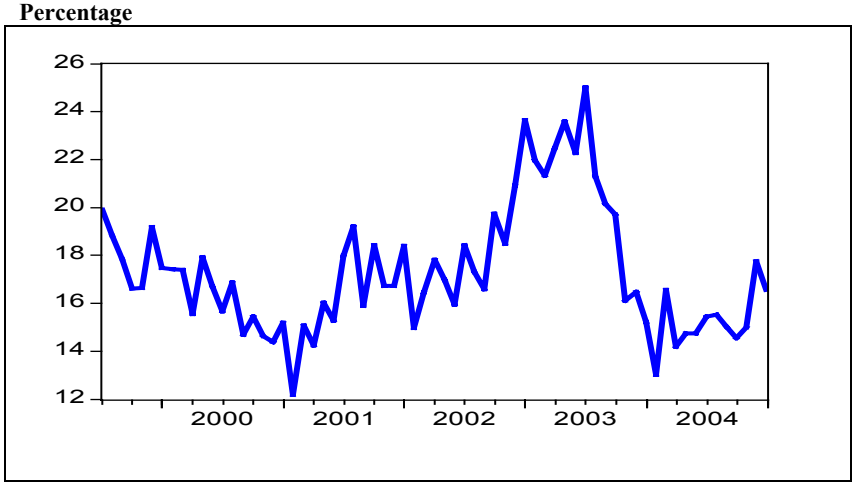
The key result is the estimate of the coefficient on the inflation, β, and the result depends on quite a lot the way output gap was calculated (either Hodrick-Prescott filter or Linear Trend). By computing output gap using linear trend the coefficients are greater than the ones estimated using HP filter[11]. At first sight, there is no reasonable explanation about this difference. Taking the second specification, when $\beta = 2.33$, a rise in expected annual inflation of the one percent induces the Brazilian Central Bank to raise interest rates by 133 basis points. Because β is much greater than one, the prediction than the Central Bank of Brazil raises the interest rates in response to inflationary pressures is statistically significant. Once more the estimate of the coefficient on the output gap is negative and no statistically significant at 5 per cent and again the energy crisis can be the explanation for the apparently wrong sign. During the rationing of electricity the annual interest rate moved from about 14 to 22 per cent (see figure 3). Then, during recessive period, and meanwhile the inflation rate raised under supply shock condition, the interest rate showed upwards movements. Finally, the estimates of the coefficient on real exchange rate depreciation were found no statistically significant. It was also allowed consider alternatives to the baseline specification including foreign interest rate (US federal fund rates) and foreign inflation rates (US inflation measured from wholesale price index) in order to assess whether the Brazilian Central Bank takes US monetary policy as external constraint. However, they are not statistically significant.

The table 4 presents different empirical findings. It was run specifications with interest rate in both level and first difference for two reasons: first, the unit root tests were not

[11] Some difference can be found in the Korean case (Eichengreem, 2004).

robust enough to irrefutably accept the null hypothesis[12]; and, second, the central bank might be focused on the level of the interest rate ratter than on its variation. Figure 3 illustrates that the level of the interest rate can be mean reversible and then specifications in first difference would be inappropriate. Next one can see nominal depreciation instead of real depreciation. According to the table 4 that shows alternative way of calculating output gap and currency depreciation the coefficient β averages 3.93, what is definitely high when compared with other international experiences.

Figure 3: Interest Rate in Brazil –Over-Selic (1999:07-2005:01) Annual Percentage



Source: Central Bank of Brazil

However, differently from the baseline specification in the table 3, now the fluctuations in the exchange rate matter when policymakers are operationalzing monetary policy. Nominal depreciation matters for expected inflation because nominal exchange rate was included in the information set and then Brazilian Central Bank does not disregard nominal variations, only when country risk is included in the information set, although it might be disregarding real variations. Specifications without including country risk in the information set accepted nominal depreciation as statistically

[12] All variables were tested for unit roots using ADF and Phillips-Perron tests.

significant only when HP filter was used to estimate output gap. Real exchange rate depreciation was not found significant whether or not country risk was treated as instrument. It can be explained by the intensive changes in the commodities prices and also by balance of payments adjustment issues. Likely during this time the Central Bank has shortsightedness in its insights about the changes in the purchase power parity. The estimated variants produce positive coefficient on the excess of actual output over capacity output only when linear trend was used to calculate the output gap. Again, the coefficients of the inflation are greater when output gap is computed by linear trend than those obtained when the gap is computed by HP filter.

Differently the results Eichengreen (2004) found for the Korean case, and because the first lag of the real currency appreciation is also included in the information set used to forecast inflation, the interpretation of this coefficient is that the Central Bank of the Brazil does not care about the movement of the real exchange rate. The real exchange rate does not matter for the conduct of monetary policy in Brazil when both inflation and monetary policy credibility remains a big problem.

Therefore, the conclusion that one can draw is that the nominal exchange rate matters for the conduct of monetary policy in Brazil, but real depreciations do not, when country risk is included in the information set and, moreover, when nominal exchange rate is included it reduces the coefficient of the inflation slightly.

Summing up, the question is whether or not movements in the exchange rate are actually important for the objectives of the Brazilian Central Bank. This article found two different and important results even apparently contradictory. Real depreciations are not as important in the reaction functions of the interest rate as the nominal ones and there are two important mechanisms that can be the explanation of the remarkable result.

Table 4. GMM Estimates: Reaction Functions of the Central Bank of Brazil

β (*Inflation*)	γ (*Output Gap*)	ρ (*Lagged Dependent Variable*)	α (*Constant*)	ξ (*Depr.*)	R^2	DW	Gap computed by
Dependent Variable: 1st. Diff Interest Rate			*Real Depreciation*				
3.23** (0.6)	-0.7** (0.08)	-0.57** (0.021)	-0.12** (0.03)	0.022 (0.03)	29%	1.95	HP Filter
3.43** (0.7)	-0.8** (0.3)	-0.56** (0.017)	-0.13** (0.01)		28%	1.95	HP Filter
4.70** (0.3)	0.25** (0.02)	-0.56** (0.03)	-0.09** (0.05)	0.023 (0.028)	15%	1.89	Linear Trend
4.40** (0.3)	0.27** (0.018)	-0.43** (0.028)	-0.15** (0.04)		16%	2.02	Linear Trend
Dependent Variable: 1st. Diff Interest Rate			*Nominal Depreciation*				
3.03** (0.6)	-0.112 (0.121)	-0.56** (0.039)	-0.71** (0.05)	0.512** (0.127)	28%	1.86	HP Filter
3.67** (072)	-0.77** (0.07)	-0.556** (0.01)	-0.11** (0.01)		28%	1.97	HP Filter
4.54** (0.5)	0.212** (0.03)	-0.73** (0.003)	-0.54** (0.07)	0.83** (0.07)	15%	1.72	Linear Trend
4.3** (0.33)	0.42** (0.03)	-0.365** (0.026)	-0.19** (0.04)		15%	1.97	Linear Trend
Dependent Variable: Interest Rate (in level)			*Real Depreciation*				
3.91** (0589)	-0.28** (0.027)	0.264** (0.024)	2.043** (0.06)	0.197 (0.51)	65%	1.86	HP Filter
3.78** (0.51)	-0.30** (0.02)	2.46** (0.02)	2.10** (0.05)		66%	1.89	HP Filter
4.03** (0.61)	0.63** (0.52)	0.745** (0.03)	0.68** (0.096)	-0.43 (0.46)	59%	2.7	Linear Trend
4.99** (0.57)	0.13** (0.005)	0.702** (0.026)	0.789** (0.07)		58%	2.38	Linear Trend
Dependent Variable: Interest Rate (in level)			*Nominal Depreciation*				
3.79** (0.63)	-0.29** (0.02)	-0.385** (0.134)	2.07** (0.059)	0.38** (0.13)	65%	1.85	HP Filter
3.91** (0.55)	-0.31** (0.02)	0.24** (0.019)	2.12** (0.05)		66%	1.89	HP Filter
4.17** (0.61)	0.07 (0.05)	0.725** (0.10)	0.73** (0.11)	-0.99** (0.11)	59%	2.7	Linear Trend
4.75** (0.59)	0.14** (0.04)	0.71** (0.026)	0.788** (0.07)		58%	2.30	Linear Trend

*Notes: t-values in parentheses. * significant at 1%, ** significant at 5%, and ** significant at 10%. The J-statistic reported is the minimized value of the objective function. Test of Overidentifying Restriction J=11.25 chi-squared (47) with p-value = 0.96. The J-statistic is used to carry out hypothesis tests from GMM estimation (see Newey and West, 1987). A simple application of the J-statistic is to test the validity of overidentifying restrictions when one has more instruments than parameters to estimate. Here we have instrument set to estimate four parameters and so there are three overidentifying restrictions. Under the null hypothesis that the overidentifying restrictions are satisfied, the J-statistic times the number of regression observations is asymptotically x^2 with degrees of freedom equal to the number of overidentifying restrictions. It was implemented dummy variables for Presidential Election (2002) and all were also significant at 5%. Both nominal and real exchange rate depreciation are lagged one month. The instruments are a constant and lags 1-6, 9 and 12 of the overnight interest rate (Over-Selic), industrial production index, either nominal or real exchange rate depreciation, country risk (EMBI+) and inflation CPI. The sample was adjusted in 12-month less than the ending point of the available data set. Estimates are obtained by GMM with correction for MA (12)*

autocorrelation. Optimal weighing matrix obtained from first step 2SLS parameter estimates. Convergence achieved after 80 weight matrices and, 81 total coefficient iterations.

On one hand, there is a direct channel of transmission passing by country risk and affecting nominal movements in the exchange rate and the central bank does not disregard it. One the other hand, there are direct and indirect effects of the relative prices such as commodities price shocks and low pass through (see the relationship between the wholesale price and consumer price indexes in figure 1) that makes central bank shortsighted to evaluate the equilibrium real exchange rate.

This last feature is not surprising according to the recent Brazilian experience. The real exchange rate showed unequivocal downward movement and the domestic currency depreciated about 22 per cent since the flexible regime (using WPI –wholesale price index- as deflator). However, using the other deflator (CPI – Consumer Price Index), it does not sustain. Domestic currency would have appreciated about 23 per cent over that period of time (1999-2005). The difference between those two deflators (wholesale and consumer price index) can come from another mechanism beyond the exchange rate dynamics and it might be tightly associated with the responses of the central bank in the context of "Calvo shock" by increasing interest rate and, therefore, depressing the components of aggregate demand, such as investment and consumption. Then, the lower the aggregate consumption is the lower the pass through from the wholesale price to the consumer price[13]. It seems like "Prebisch shock" as labeled by Eichengreen (2002:18): "Now there are two offsetting effects on inflation: while higher import prices will be passed through into inflation, weaker aggregate demand will be deflationary".

One can now compare the results with other ones found for other Central Banks around the world. Table 5 provides estimates of the coefficient on the inflation in different country and they vary from 0.98 (England) to 2.04 (Japan). Prior estimates of the Brazilian coefficient vary from 2.09 (using market's inflation expectation) to 3.54 (using Central Bank's inflation expectations). Differently the Minella et all (2003) this work followed Clarida, Galí and Gertler (1997)' procedures

[13] We also have the commodities price shock and administrated prices to be taken into account in other occasion.

and obtained estimates from 2.33 (using HP filter) to 4.35 (using Linear Trend). Adding the rate of exchange rate depreciation reduces the magnitude of the other coefficient slightly.

Table 5: Reaction Functions of the Central Banks

Country	Sample	β (*Inflation*)	γ (*Output Gap*)	ρ (*Lagged Dependent Variable*)	α (*Constant*)	References
Germany	1979:3-1993:12	1.31** (0.09)	0.25** (0.04)	0.91** (0.01)	3.14** (0.28)	CGG (1997)[e]
Japan	1979:4-1994:12	2.04** (0.19)	0.08** (0.03)	0.93** (0.01)	1.21** (0.44)	CGG (1997)
United States	1979:10-1994:12	1.79** (0.18)	0.07** (0.06)	0.92** (0.03)	0.26** (0.85)	CGG (1997)
England	1976:6-1990:10	0.98** (0.09)	0.19** (0.04)	0.92** (0.01)	5.76** (0.69)	CGG (1997)
France	1983:5-1989:12	1.13** (0.07)	0.88** (0.10)	0.95** (0.01)	5.75** (0.28)	CGG (1997)
Italy	1981:6-1989:12	0.90** (0.04)	0.22** (0.08)	0.95** (0.01)	7.14** (0.37)	CGG (1997)
Brazil[a]	1999:7-2002:12	3.54** (1.51)	-0.36* (0.21)	0.82** (0.09)	3.06* (1.59)	Minella et all (2003)
Brazil[b]	2001:1-2002:12	2.09** (0.53)	-0.10 (0.15)	0.67** (0.12)	5.38** (2.07)	Minella et all (2003)
Korea[c]	1998:1-2003:5	0.77** (0.28)	1.10** (0.14)	0.95** (0.004)	1.08 (0.88)	Eichengreen (2004)
Korea[d]	1998:1-2003:5	1.38** (0.22)	0.41** (0.04)	0.129** (0.09)	-0.71 (0.69)	Eichengreen (2004)

*Notes: P-value in parentheses. ** and * significant at 5% and 1%, respectively.*
a/ Using Central Bank's inflation expectations.
b/ Using Market's inflation expectations.
c/ GMM Estimates using Hodrick-Prescott filter.
d/ GMM estimates using linear trend.
e/ CGG stands for Clarida, Galí and Gertler (1997)

4. Final Remarks

This article presented evidence analyzing the hypothesis of the fear of floating and one could see that the Brazilian Central Bank does not suffer from the fear of floating. Lack of credibility associated with both difficulties in forecasting inflation and in reaching the target of the inflation can be the main factor to explain the inability of fixing, that is, the difficulty of managing the exchange rate. It is remarkable how the empirical findings are sensitive to alternative ways of estimating the output gap and also sensitive to addition of some variables in the information set.

This article sheds light on the idea that in context of inflation forecast problem a central bank has shortsightedness in its insights about long term equilibrium real exchange rate. On one hand, in a short-term perspective, central bank can be shortsighted in using its main monetary instrument to control the real exchange rate volatility. In our empirical results the reaction functions do not response to rate exchange shocks, but they do response to nominal depreciations what can be understood as the fact that the financial instability matters ratter than the real long term exchange rate misalignments. In other words, in a long-term perspective, central bank receives different signs to deal with the equilibrium exchange rate.

Finally, there is fair evidence that the Brazilian Central Bank reacts more strongly to inflationary pressures than the other central banks around the world. This could be explained by credibility issues and in a near future would be highly advisable to react less radically that it has been done so far. It is easily understood that a central bank in an emerging market economy takes long time to build credibility in its commitment with low inflation and, as the Brazilian inflation targeting can count a history of success, the credibility would allow changes in the reaction function. Last words: the reaction function has been strong enough to improve credibility and the change in the reaction should be considered in the order to uphold the accomplishment.

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