The importance of credibility for the conduct of monetary policy and inflation control
Theoretical model and empirical analysis for Brazil under inflation targeting

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Abstract

This paper raises the following hypotheses: to the extent that the monetary authority successively reaches the inflation target and credibility increases, expectations will have more influence on inflation and, thus, the efforts of the monetary authority to reach the inflation target will decrease. Hence, the goal of this work is twofold: 1) a theoretical model is developed to show that when the monetary authority is committed to the goal of price stability, the gain of credibility not only acts by producing a better result in terms of inflation, but also it reduces the volatility of the basic interest rate, and; 2) based on the Brazilian economy, the article provides empirical evidence that the gain of credibility is crucial to reduce the volatility of the basic interest as well as the inflation rate. The findings suggest that credibility plays a key role for the conduct of monetary policy and inflation control.

Keywords: inflation targeting, credibility, interest rate, inflation

JEL classification: E43, E52, E58

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1. Introduction

The seminal article of Kydland and Prescott (1977) served as theoretical framework for the development of studies about credibility of the monetary authority. Studies point that monetary policies will be more effective and the credibility will be improved, if the monetary authority strengthens its reputation and follows a strategy concerned to price stability (King, 2000; Romer, 2000; Taylor, 2000; Montes and Bastos, 2014).

In the 1990s, several countries have adopted inflation targeting in order to reduce inflation and keep it under control. The main goal of this regime is to create an environment of low and stable inflation and serve as a nominal anchor in the task of guiding inflation expectations to the inflation target. Thus, since expectations represent an important transmission channel, credibility plays a key role in this regime.

To the extent that the monetary authority successively reaches the inflation target and credibility increases, it is expected that the management of monetary policy will occur in a smooth way. Therefore, the hypothesis tested in the present study is that to the extent that the regime is strengthened, expectations will have more influence on inflation and, as a consequence, the efforts of the monetary authority to reach the inflation target will decrease. Therefore, a low credibility will lead to a greater effort on the part of the monetary authority to control inflation and thus tighter monetary policies will be required, leading to more volatility in the basic interest rate.

The lack of credibility is considered a serious problem faced by developing countries, particularly by those who have chosen the inflation targeting regime. This is because monetary austerity will be needed to control inflation, especially in times of inflationary pressure, which will bring adverse consequences for the economy as a whole. Brazil has adopted inflation targeting in order to protect the gains achieved with price stability. However, in the early periods after the implementation of the regime, the monetary authority had to act forcefully to control inflation, probably due to the still low credibility of the regime and the poor reputation of the policymakers.

Based on the above mentioned arguments, the goal of this work is twofold: 1) taking as reference the arguments presented by Kydland and Prescott (1977), a theoretical model is developed to show that when the monetary authority is committed to the goal of price stability, the gain of credibility not only acts by producing a better result in terms of inflation, but also it reduces the volatility of the basic interest rate and thus the effort of the monetary authority in the conduct of monetary policy, and; 2) based on the Brazilian economy, the article aims at providing empirical evidence that the gain of credibility is crucial to reduce the volatility of the basic interest as well as the inflation rate.

The article is organized as follows: the second section presents the theoretical model. The model contributes to the literature, since it demonstrates that credibility plays a crucial role not only for the task of making inflation expectations converge to the inflation target, but also to reduce the effort of the monetary authority in terms of monetary policy. The third section presents an empirical analysis, using ordinary least squares (OLS) and the generalized method of moments (GMM). Besides, a dynamic analysis through vector autoregressive (VAR) is done and impulse response functions are presented. The fourth section presents the conclusions of the work.

2. Theoretical model

Under inflation targeting, the main instrument of monetary policy to control inflation is the short-term interest rate. In a context of inflation targeting, the monetary authority reacts to deviations of inflation from the target through changes in the basic interest rate.

Taking as reference the arguments presented by Kydland and Prescott (1977), a theoretical model is developed to show that when the monetary authority is committed to the goal of price stability, the gain of credibility not only acts by producing a better result in terms of inflation, but also it reduces the variations in the basic interest rate and thus the effort of the monetary authority in the conduct of monetary policy.

2.1 Monetary policy objectives

In order to determine the central bank's policy choice, it is important to specify its preferences. A standard formulation for the central bank's preferences is a quadratic loss function that depends on output and inflation, and takes the form:

$$L = \frac{1}{2}\{(\pi - \pi^*)^2 + \rho[y - (y_n + k)]^2\} \quad (1)$$

Where y is output, y_n is the economy's natural rate of output, π is the inflation rate and ρ is the relative weight that the monetary authority places on output gap relative to inflation stabilization. The key aspect of this loss function is the parameter k. The assumption is that the central bank desires to stabilize both output and inflation, inflation around the inflation target (π^*) but output around ($y_n + k$).

2.2 The Economy

The specification of the economy is quite simple. Aggregate output is given by a Lucas-type aggregate supply function of the form:

$$y = y_n + \beta(\pi - E[\pi]) + \vartheta \quad (2)$$

where $E[\pi]$ is expected inflation and ϑ is a random term corresponding to a supply shock. As is well known, this specification (sometimes called the new Keynesian Phillips curve) can be derived from underlying microeconomic foundations with a stochastic price adjustment mechanism of the Calvo (1983) form.

In turn, there is a negative relation between inflation and nominal interest rate variation (equation (3)). The nominal interest rate is assumed to be the central bank's policy instrument. Equation (3) shows that when $\pi = \pi^*$ thus $\Delta i = 0$. μ represents a random term (white noise).

$$\pi = \pi^* - \Delta i + \mu \quad (3)$$

The expectations from the private sector are assumed to be determined prior to the central bank's choice of interest rate variation. Thus, in setting Δi, the central bank will take $E[\pi]$ as given. It is also assumed that the central bank can observe ϑ (but not μ) prior to setting Δi.

The model presents the following sequence of events: first, the private sector sets its inflation expectations; then the supply shock ϑ is realized; due to the fact that expectations have already been determined, they do not respond to the realization of ϑ. However, the monetary authority can respond, and, therefore, the policy instrument (Δi) is set after the central bank has observed the supply shock (ϑ). The random shock (μ) is then realized, and actual inflation and output are determined.

2.3 Equilibrium

It is considered that the central bank acts before observing the disturbance (μ), thus, its objective will be to minimize the expected value of its loss function, in which the central bank's expectation is defined over the distribution of μ. Thus, putting equations (2) and (3) in the loss function given by equation (1), the following function is obtained:

$$L = \frac{1}{2}\{(-\Delta i + \mu)^2 + \rho[\beta(\pi^* - \Delta i + \mu - E[\pi]) + \vartheta - k]^2\} \quad (4)$$

The central bank minimizes equation (4) in terms of Δi,

$$\min_{\Delta i} L = \frac{1}{2}\{(-\Delta i + \mu)^2 + \rho[\beta(\pi^* - \Delta i + \mu - E[\pi]) + \vartheta - k]^2\}$$

Considering that Δi is chosen after observing the supply shock ϑ, but before observing the random shock μ, so, to minimize the expected value of the loss function (which disregards the value of μ), the first-order condition for the optimal choice of Δi, conditional on ϑ and taking $E[\pi]$ as given, is,

$$\min_{\Delta i} L = \frac{\partial L\left\{\frac{1}{2}(-\Delta i + \mu)^2 + \frac{1}{2}\rho[\beta(\pi^* - \Delta i + \mu - E[\pi]) + \vartheta - k]^2\right\}}{\partial \Delta i_t} = 0$$

Solving for Δi, equation (5) is obtained:

$$\Delta i = -\frac{\beta^2\rho[E[\pi] - \pi^*] + \beta\rho(k - \vartheta)}{(1 + \beta^2\rho)} \quad (5)$$

2.4 The discretion case

With expectations formed prior to observing the aggregate supply shock (ϑ) and considering that $E[\vartheta] = 0$, thus,

$$E[\pi] = \pi^* - E[\Delta i]$$

and solving for $E[\pi]$ yields

$$E[\pi] = \pi^* + \frac{\beta^2\rho[E[\pi] - \pi^*] + \beta\rho(k)}{(1 + \beta^2\rho)}$$

$$(1 + \beta^2\rho)E[\pi] = (1 + \beta^2\rho)\pi^* + \beta^2\rho[E[\pi] - \pi^*] + \beta\rho(k)$$

$E[\pi] = \pi^* + \beta\rho k$, where, $E[\pi] = \pi^* + \beta\rho k > 0$ and, thus, $[E[\pi] - \pi^*] = \beta\rho k > 0$. Substituting this result into (5) gives,

$$\Delta i = \frac{-\beta^2\rho\beta\rho k - \beta\rho(k - \vartheta)}{1 + \beta^2\rho} = \frac{-\beta^2\rho\beta\rho k - \beta\rho k + \beta\rho\vartheta}{1 + \beta^2\rho} = \frac{-(\beta^2\rho + 1)\beta\rho k + \beta\rho\vartheta}{1 + \beta^2\rho}$$

$$\Delta i = -\beta\rho k + \frac{\beta\rho}{1+\beta^2\rho}\vartheta \quad (6)$$

and using this result in equation (3), gives an expression for the equilibrium rate of inflation, under discretionary policy:

$$\pi = \pi^* - \left(-\beta\rho k + \frac{\beta\rho}{1+\beta^2\rho}\vartheta\right) + \mu$$

$$\pi^d = \pi^* + \beta\rho k - \frac{\beta\rho}{1+\beta^2\rho}\vartheta + \mu \quad (7)$$

Where, the superscript *d* stands for discretion and, refers to the average rate of inflation under a discretionary policy of the monetary authority. Since $E[\vartheta] = E[\mu] = 0$, thus, the average rate of inflation when the monetary authority acts with discretion is $\pi^d = \pi^* + \beta\rho k$.

Based on equation (7), the results are similar to Walsh (2010), i.e., the size of the inflation bias is increasing in the distortion *k*, the effect of instrument policy surprise on output (β) and the weight the central bank places on its output objective (ρ).

2.5 The credibility case

Assuming that, the expectations are formed prior to observing the aggregate supply shock (ϑ), considering that $E[\vartheta] = 0$, and the inflation target is credible, i.e., $E[\pi] = \pi^*$, thus,

$$\Delta i = -\frac{\beta\rho k}{(1+\beta^2\rho)} + \frac{\beta\rho\vartheta}{(1+\beta^2\rho)} \quad (8)$$

and using this result in equation (3), gives an expression for the equilibrium rate of inflation:

$$\pi^c = \pi^* + \frac{\beta\rho k}{(1+\beta^2\rho)} - \frac{\beta\rho\vartheta}{(1+\beta^2\rho)} \quad (9)$$

Where, the superscript *c* stands for credibility and, refers to the average rate of inflation under a credibility policy of the monetary authority. Since $E[\vartheta] = E[\mu] = 0$, thus, the average rate of inflation when the monetary authority acts with credibility is $\pi^c = \pi^* + \frac{\beta\rho k}{(1+\beta^2\rho)}$. So we can conclude that $\pi^c < \pi^d$.

In the present paper, these ideas are explored in terms of efforts of the monetary authority in the conduct of monetary policy. Moreover, the results obtained by the model suggests that the ability of the monetary authority in guiding expectations, as measured by credibility, represents an important element in the management of interest rate and therefore for the conduct of monetary policy. Similar to results in the existing literature (e.g., Rogoff, 1985), the results obtained by equations (6) and (8) also point out that to the extent that the monetary authority increases the commitment to the inflation target, the effort of the monetary authority in terms of interest rate reduces and, thus, interest rate volatility also reduces.

In this sense, the following hypotheses are tested:

(i) When credibility increases, interest rate volatility decreases;
(ii) When credibility increases, the inflation rate decreases.

3. Empirical evidence

Since the early 1990s, inflation targeting has been adopted by several central banks as a strategy for the implementation of monetary policy. This regime has as its main feature the official announcement of ranges for inflation fluctuations and the explicit recognition that the main objective of monetary policy is to assure a low and stable inflation rate. Inflation targeting works as a guide for inflation expectations and it is associated with an increase in central bank transparency, which, in turn, increases accountability in the implementation of monetary policy and thus improves the central banks' credibility.

An important step in controlling inflation is to guide inflationary expectations, thus one main task of a central bank is to build credibility through the commitment to price stability.

Gonçalves and Salles (2008) reproduced Ball and Sheridan's (2005) analysis using data for 36 developing economies, 13 of which have implemented the inflation targeting framework. Their findings suggest that the choice of the inflation targeting regime proved beneficial for emerging economies. In particular, they found that the greater fall in inflation experienced by emerging market targeters can, to some extent, be attributed to the regime itself and not only to mean reversion. Moreover, the often heard claim that inflation targeting regimes hinder economic growth is clearly not sustained by the empirical evidence. In sum, the data so far suggests that the adoption of inflation targeting by emerging economies did contribute towards the attainment of superior outcomes in terms of economic performance.

According to de Mendonça and de Guimarães e Souza (2012), the effectiveness of this framework for inflation control fuels a controversial debate between policymakers and academics. As a consequence, two key questions are raised: (i) How successful is inflation targeting in reducing and stabilizing the inflation rate? (ii) Are effects caused by inflation targeting sufficiently homogeneous when both developing and industrialized countries are taken into consideration? Considering a sample of 180 countries for the period from 1990 to 2007, de Mendonça and de Guimarães e Souza (2012) analyzed whether the adoption of inflation targeting can reduce inflation and inflation volatility. The sample of 180 countries was split into two sets of countries (advanced and developing). The findings suggest that the adoption of inflation targeting represents a good strategy for developing economies and, in addition to reducing inflation volatility, can drive inflation down to internationally acceptable levels.

3.1 Empirical evidence for the Brazilian economy

Among emerging economies, Brazil represents an interesting case study because in 1999 the country adopted the regime of inflation targeting. Since then, the Central Bank of Brazil (CBB) conducts monetary policy in order to minimize deviations of inflation relative to the inflation target and fluctuations in the output gap, but also in order to guide the agent's expectations about inflation and future monetary policy.

This section seeks evidence for the hypotheses stated above. The period of analysis runs from December 2001 to June 2013.[2] The monthly series are:

- Inflation targeting credibility (CREDIB): The credibility index (CREDIB) is based on de Mendonça (2007). The credibility index has a value equal to 1 when the annual expected inflation ($E[\pi]$) is equal to the target (π^T) and decreases in a linear way while inflationary expectation deviates from the announced target. Therefore, the credibility index shows a value between 0 and 1 strictly if the expected inflation is situated between the maximum and minimum limits (π^*) established for each year and assumes a value equal to zero when the

[2] The justification for using this period is that the market expectations series available from the Central Bank of Brazil started in December 2001.

expected inflation exceeds one of these limits. The index uses the series of inflation expectations obtained from the Central Bank of Brazil (CBB), the inflation target defined by the monetary authority and the tolerance bands.[3] Hence,

$$credib = \begin{cases} 1 & if\ E[\pi] = \pi_t^T \\ 1 - \frac{1}{\pi_t^* - \pi_t^T}[E[\pi] - \pi_t^T] & if\ \pi_{tMIN}^* < E[\pi] < \pi_{tMAX}^* \\ 0 & if\ E(\pi) \geq \pi_{tMAX}^*\ or\ E[\pi] \leq\ \pi_{tMIN}^* \end{cases}$$

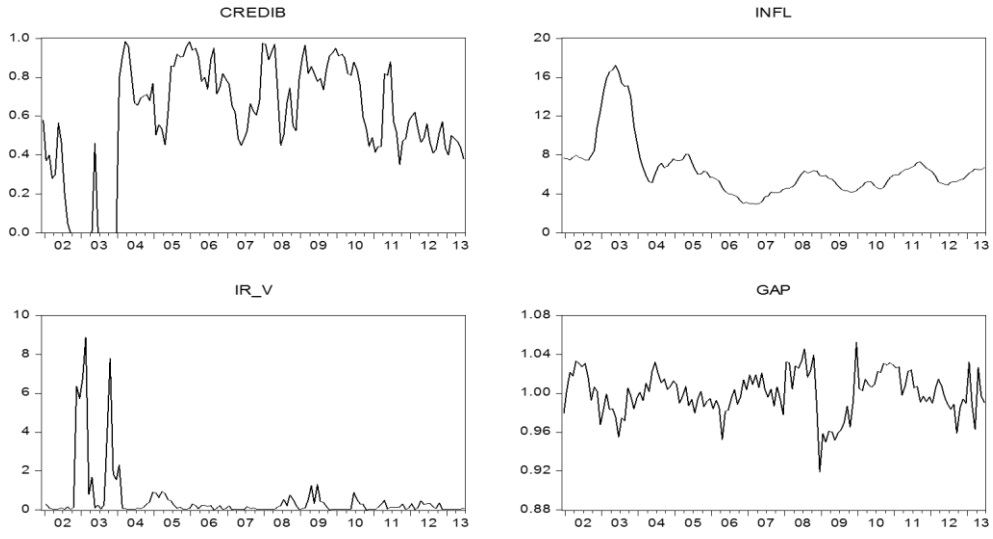
- Interest rate volatility (*IR_V*): The volatility of interest rate is obtained from a GARCH (1,1) model. The series of interest rate (*SELIC*) is available at CBB website. The basic interest rate is the main instrument of monetary policy under inflation targeting in Brazil.
- Inflation Rate (*INFL*): The inflation rate used is the series of Consumer Price Index (IPCA) which is the main objective of CBB.
- Output Gap (*GAP*): This series is constructed using the GDP at current prices seasonally adjusted by the method Census X12, deflated by the inflation rate (IPCA) and divided by its long-term trend obtained through the Hodrick-Prescott filter.

Table 1 shows descriptive statistics and figure 1 the behavior of macroeconomic variables.

Table 1- Descriptive Statistics

Statistic	*INFL*	*SELIC*	*IR_V*	*CREDIB*	*GAP*
Mean	6.56	14.02	0.54	0.6	1.00
Median	5.95	12.7	0.13	0.62	1.00
Maximum	17.24	26.32	8.88	0.98	1.05
Minimum	2.96	7.11	0.01	0.00	0.92

Figure 1 – Brazilian macroeconomic variables



[3] Although different indexes of credibility have been proposed – as summarized in the works of de Mendonça and de Guimarães e Souza (2009) and Nahon and Meurer (2009) – and therefore there is a variety of indexes of credibility capable of being used in empirical analyses, the present work does not seek to analyze the influence and power of each index on monetary policy in Brazil – although such research is important. Thus, the option for using the index proposed by de Mendonça (2007) is due to the following arguments: (i) the index is recognized by international literature, being this index used in several applied studies, (ii) simplicity of understanding and preparation, (iii) The index captures the changes and fluctuations in credibility in a way compatible with the regime of inflation targeting adopted in Brazil, i.e., the index uses predetermined tolerance bands, and not ad-hoc tolerance bands as proposed by other indices, and (iv) the index is rigorous enough and punishes appropriately deviations of inflation expectations in relation to the inflation target.

There is empirical evidence in the literature suggesting that the credibility earned by the regime of inflation targeting, in Brazil, has contributed to the reduction of uncertainties and has improved macroeconomic performance (de Mendonça and de Guimarães e Souza, 2009; Montes and Bastos, 2013). Figure 2 shows the relation between inflation and credibility for the Brazilian case. The correlation is -0.69. In turn, table 2 presents Granger[4] causality test. The result suggests that inflation causes credibility and, credibility causes inflation.

Figure 2 - Scatter plot of inflation and credibility

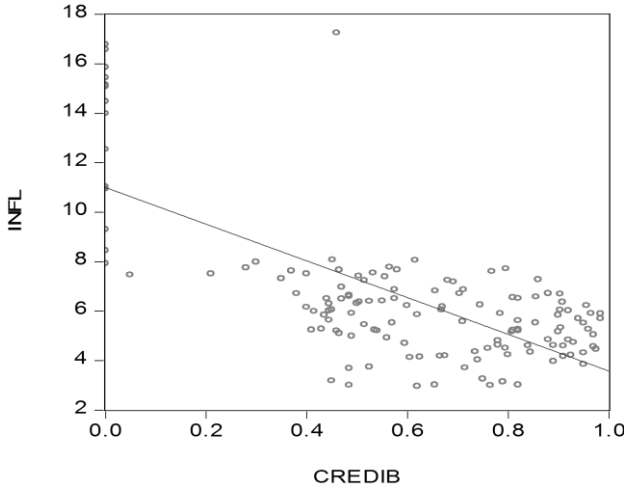
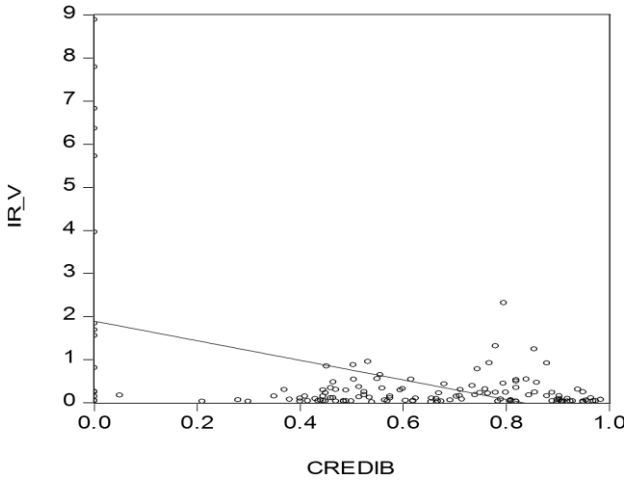


Table 2- Granger Causality Test

Granger Causality Tests	Obs	Prob.
Inflation does not Granger Cause Credibility	137	0.0098
Credibility does not Granger Cause Inflation		0.0957

In turn, figure 3 shows the relation between credibility and interest rate volatility for the Brazilian case. The correlation is -0.46. Table 3 presents Granger[5] causality test. The result suggests that credibility causes interest rate volatility and, interest rate volatility causes credibility.

Figure 3 - Scatter Plot Interest Rate Volatility and Credibility



[4] Lag choice is based on Schwarz criterion. Based on the criterion, the lag order is 2.
[5] Lag choice is based on Schwarz criterion. Based on the criterion, the lag order is 4.

Table 3 - Granger Causality Test Interest Rate Volatility and Credibility

Granger Causality Tests	Obs	Prob.
IR_V does not Granger Cause CREDIB	134	0.0000
CREDIB does not Granger Cause IR_V		0.0006

3.2 Estimates through OLS and GMM

Equation 1 seeks to verify whether Interest Rate Volatility is influenced by credibility. The equation considers the Inflation Rate - which is the main goal of the Central Bank of Brazil - and the influence of output fluctuations. Hence, the inflation rate and the output gap are included in equation 1.

Equation 1:

$$IR\_V_t = \gamma_0 + \gamma_1 IR\_V_{t-1} + \gamma_2 CREDIB_{t-1} + \gamma_3 GAP_{t-7} + \gamma_4 INFL_{t-8} + \varepsilon_t$$

where, $\gamma_1 > 0$; $\gamma_2 < 0$; $\gamma_3 > 0$; $\gamma_4 > 0$, and, ε is an error term.

It is expected that an increase in the credibility of the monetary authority will lead to a decrease in the interest rate volatility.

In turn, Equation 2 seeks to verify whether credibility affects the inflation rate. The equation also considers the effect of the output gap and the effect of the main instrument of monetary policy in Brazil (the basic interest rate - SELIC).

Equation 2:

$$INFL_t = \alpha_0 + \alpha_1 INFL_{t-1} + \alpha_2 CREDIB + \alpha_3 GAP_{t-3} + \alpha_4 SELIC_{t-3} + \tau_t$$

where, $\alpha_1 > 0$; $\alpha_2 < 0$; $\alpha_3 > 0$; $\alpha_4 < 0$, and, τ is an error term.

A first condition to be analyzed before applying the econometric analysis is to check if series are stationary (or have unit roots). Therefore, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS), Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were applied (Table A.1 in Appendix A).

The empirical analysis makes use of ordinary least squares[6] (OLS) and generalized method of moments (GMM). One reason for using GMM is that while OLS estimates have problems of serial autocorrelation, heteroskedasticity or non-linearity, which is typical in macroeconomic time series, this method provides consistent estimators for the regression (Hansen, 1982). As pointed out by Wooldridge (2001, p. 95), "to obtain a more efficient estimator than two-stage least squares (or ordinary least squares), one must have overriding restrictions". For a more efficient GMM estimator than OLS, overriding restrictions need to be considered (Wooldridge, 2001). Therefore, with the intention of testing the validity of the overriding restrictions, a standard J-test is performed (Hansen, 1982). In addition, the instrument variables need to be dated to the period t-1 or earlier as a way of predicting the contemporaneous variables which are unavailable at time t. As usual, the instrument variables used in the regressions are the lagged regressors. The estimations were performed using the software E-Views 7.0.

[6] The reported t-statistics in the OLS estimates of Equation 1 are based on the estimator of White (1980), which is consistent in the presence of conditional heteroskedasticity of unknown form. The reported t-statistics in the OLS estimates of Equation 2 are based on the estimator of Newey and West (1987), which is consistent in the presence of both heteroskedasticity and autocorrelation of unknown form.

Table 4 shows the estimates for equation 1. In terms of OLS estimates, the F-statistic of equation (1) indicates that the regression is significant; besides, the outcomes of the Ramsey RESET test indicate that the estimation do not present problem of model specification. In terms of GMM, the results of the J-test indicate that we cannot reject the hypothesis that the model is correct specified.

Regarding the estimated coefficients, the signals of the coefficients of the explanatory variables are those expected and are statistically significant, except the coefficient of inflation in the equation 1 through OLS, which do not have significance. It is possible to observe that the negative signal found for the coefficient of credibility makes it clear that a decrease in this variable leads to an increase in the volatility of the interest rate. Thus, insofar as the monetary authority strengthens the credibility, as a result, the effort of the monetary authority in the conduct of monetary policy is reduced.

Table 4 – OLS and GMM estimates

Dependent Variable: *IR_V*	Model OLS	Model GMM
c	-5.874*	-5.809*
	(3.191)	(3.446)
	[-1.840]	[-1.685]
$IR\_V_{(-1)}$	0.475*	0.469***
	(0.245)	(0.105)
	[1.933]	[4.450]
$CREDIB_{(-1)}$	-1.183**	-0.795**
	(0.491)	(0.312)
	[-2.408]	[-2.544]
$GAP_{(-7)}$	6.571*	6.232*
	(3.435)	(3.442)
	[1.912]	[1.810]
$INFL_{(-8)}$	0.048	0.047**
	(0.045)	(0.019)
	[1.048]	[2.333]
R-squared	0.48	0.48
Adj R-squared	0.46	0.46
Ramsey RESET (1)	2.41	
Prob. Ramsey RESET (1)	0.12	
ARCH(1) test	31.32	
Prob. ARCH(1) test	0	
ARCH(2) test	15.75	
Prob. ARCH(2) test	0	
LM(1) test	0.14	
Prob. LM(1) test	0.71	
LM(2) test	0.18	
Prob. LM(2) test	0.83	
Jarque-Bera	802.9	
Prob. Jarque-Bera	0	
F-staistic	28.88	
Prob F-staistic	0	
Observations	138	138
RANK		21
J-statistic		11.68
Prob. (J-STAT)		0.77

Authors' estimates. Marginal Significance Levels: * denotes 0.01, ** denotes 0.05 and ***denotes 0.10. Standard errors in parentheses and t-statistics in square brackets.

Table 5 shows the estimates for equation 2. In terms of OLS estimates, the F-statistic of equation (2) indicates that the regression is significant; besides, the outcomes of the Ramsey RESET test indicate that the estimation do not present problem of model specification. In terms of GMM, the results of the J-test indicate that we cannot reject the hypothesis that the model is correct specified.

Regarding the estimated coefficients, the signals of the coefficients of the explanatory variables are those expected and are statistically significant, except the coefficient of the basic interest rate (SELIC) in the equation 1 through OLS, which is only statistically significant at the 11% level. The negative signal found for the coefficient of credibility suggests that an increase in credibility leads to a decrease in inflation. Besides, the results also suggest that the basic interest rate (SELIC) affects negatively the inflation rate.

Table 5 – OLS and GMM estimates

Dependent Variable: *INFL*	Model OLS	Model GMM
c	-2.998**	-3.062**
	(1.513)	(1.282)
	[-1.981]	[-2.388]
$INFL_{(-1)}$	0.968*	0.975*
	(0.037)	(0.022)
	[25.623]	[44.299]
CREDIB	-0.665***	-0.527**
	(0.379)	(0.234)
	[-1.752]	[-2.244]
$GAP_{(-3)}$	3.911**	3.796*
	(1.503)	(1.257)
	[2.601]	[3.019]
$SELIC_{(-3)}$	-0.021	-0.017***
	(0.013)	(0.010)
	[-1.652]	[-1.772]
R-squared	0.97	0.97
Adj R-squared	0.97	0.97
Ramsey RESET (1)	0.26	
Prob. Ramsey RESET (1)	0.61	
ARCH(1) test	43.59	
Prob. ARCH(1) test	0	
ARCH(2) test	21.71	
Prob. ARCH(2) test	0	
LM(1) test	115.81	
Prob. LM(1) test	0	
LM(2) test	58.61	
Prob. LM(2) test	0	
Jarque-Bera	353.01	
Prob. Jarque-Bera	0	
F-staistic	1006.24	
Prob F-staistic	0.00	
Observations	138	138
RANK		20
J-statistic		10.43
Prob. (J-STAT)		0.79

Authors' estimates. Marginal Significance Levels: * denotes 0.01, ** denotes 0.05 and ***denotes 0.10. Standard errors in parentheses and t-statistics in square brackets.

3.3 VAR analysis

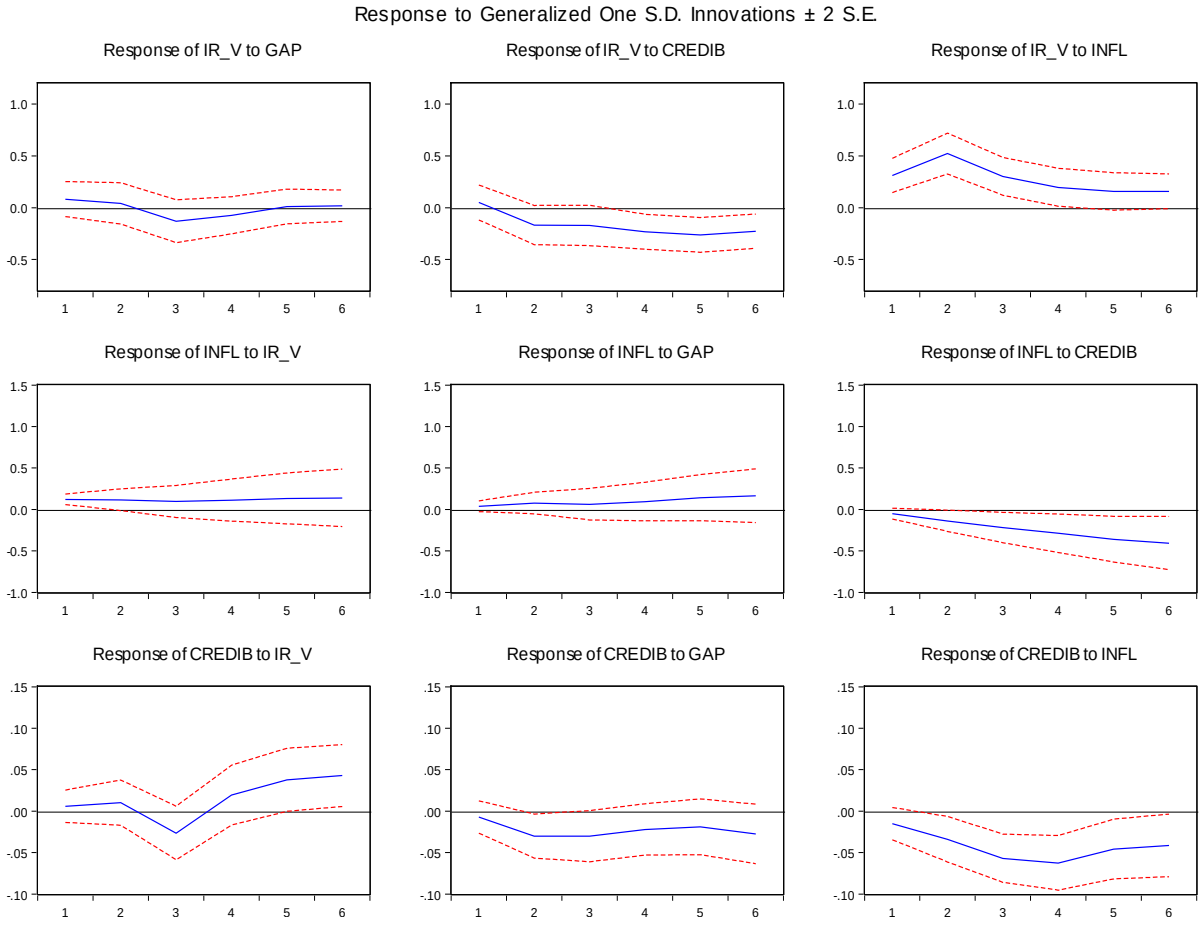
A VAR analysis, making use of impulse–response functions, is made. Aiming at eliminating the known problem in the results caused by the order of variables in the VAR, the generalized impulse response function is adopted (Koop et al., 1996; and Pesaran and Shin, 1998). The variables used in the analysis are: IR_V, CREDIB, INFL and GAP. The choice of the VAR lag order was determined using the Schwarz information criterion (SIC). It is observed that the VAR lag order is 3 (Table 6). Figure A.1 in Appendix A shows the stability of the VAR. Figure 4 below shows the results.

Table 6 – VAR lag order

Lag	SIC
0	3.111565
1	-1.458449
2	-1.778009
3	-1.789811*
4	-1.724196
5	-1.360331
6	-1.014272
7	-0.708956
8	-0.479036

Authors' elaboration

Figure 4 - Impulse Response Analysis



Authors' elaboration

It is observed that an unexpected positive shock on credibility causes a decrease in the volatility of the basic interest rate (IR_V). Hence, the gain of credibility is an important aspect for reducing monetary policy volatility. It is also observed that an unexpected positive shock on the inflation rate causes an increase in the volatility of the basic interest rate. Concerning the relation between credibility and inflation, it is observed that an unexpected positive shock on credibility causes a decrease in the inflation rate. These results are in agreement with the previous estimations in Tables 4 and 5.

Besides, an unexpected positive shock on the inflation rate provokes a decrease in credibility.

4. Conclusion

Due to the fact that credibility is often identified with strong aversion to inflation, incentive compatibility, or pre-commitment and it may be understood as the degree of confidence that economic agents have in relation to the commitment of the monetary authority to keep inflation low and stable, the present paper analyzed the impact of the credibility on the inflation rate and on the conduct of monetary policy through the basic interest rate (SELIC) in Brazil. Concerning inflation targeting regimes, when the target is credible and the monetary authority presents an increased capacity of affecting the expectations of the public, less effort is necessary to achieve the inflation target. In other words, grater credibility makes disinflation less costly and helps hold down inflation once it is low. In this sense, the present paper tests the hypothesis that credibility plays a key role in the economy.

The present study shows that credibility represents an important aspect for the conduct of monetary policy in an inflation targeting emerging economy, such as Brazil. The study contributes to the literature in the following ways:

- *In the theoretical field*: based on the arguments concerning the importance of credibility for the conduct of monetary policy, the paper developed a model that incorporates the case of a central bank committed to the regime of inflation targeting and thus to credibility. The model provides a solution compatible with an even lower inflation bias and with less efforts of the monetary authority in the conduct of monetary policy.
- *In the empirical field*: (1) the analysis found that the gains of credibility reduce the inflation bias and also the efforts of the monetary authority in the conduct of monetary policy and, as a consequence, the volatility of the interest rate.

In brief, the study presents an important practical implication in terms of monetary policy: a central bank, which acts committed with the regime of inflation targeting – and thus with the goal of price stability – needs less effort to conduct monetary policy, since uncertainties are reduced in the economy.

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Appendix A

Table A.1 – Unit Roots Test and Stationarity Test

	ADF Test						PP Test					
Séries	Lag		Test	1% Critical Value	5% Critical Value	10% Critical Value	Lag		Test	1% Critical Value	5% Critical Value	10% Critical Value
IR_V	7	b	-3.092	-4.030	-3.445	-3.147	5	c	-5.026	-2.582	-1.943	-1.615
INFL	13	a	-3.199	-3.483	-2.885	-2.579	8	c	-0.972	-2.582	-1.943	-1.615
CREDIB	0	a	-2.850	-3.478	-2.882	-2.578	3	a	-2.907	-3.478	-2.882	-2.578
GAP	3	a	-3.889	-3.479	-2.883	-2.578	5	a	-5.853	-3.478	-2.882	-2.578
SELIC	1	b	-5.036	-4.026	-3.443	-3.146	8	c	-1.193	-2.581	-1.943	-1.615

	KPSS Test					
Séries	Lag		Test	1% Critical Value	5% Critical Value	10% Critical Value
IR_V	5	b	0.117	0.216	0.146	0.119
INFL	9	b	0.187	0.216	0.146	0.119
CREDIB	9	b	0.243	0.216	0.146	0.119
GAP	8	a	0.036	0.739	0.463	0.347
SELIC	9	b	0.086	0.216	0.146	0.119

Figure A.1 – Auto Regressive Roots Graph