INFLUENCE OF REPUTATION AND CREDIBILITY FOR THE INFLATION BIAS AND LIQUIDITY MANAGEMENT: THEORETICAL MODEL AND EMPIRICAL EVIDENCE FOR BRAZIL

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Abstract

Based on the seminal works of Kydland and Prescott (1977) and Barro and Gordon (1983a, 1983b), and on the model presented in Walsh (2010), the paper develops a model which shows that, when the monetary authority acts committed with the goal of price stability, the gain of credibility reduces the effort of the monetary authority in the conduct of monetary policy. The model contributes to the literature, since it demonstrates that the credibility plays a crucial role not only for the task of anchoring inflation expectations, but also to reduce the inflation bias and the effort of the monetary authority and, thus, the variations of the monetary base. In order to provide empirical evidence for the theoretical model, the paper presents an analysis, for an important emerging economy (Brazil), using ordinary least squares, generalized method of moments, a system of equations by generalized method of moments and vector autoregressive. The findings suggest that the reputation of the monetary authority is key to the improvement of credibility, and the gain of credibility reduces the effort of the monetary authority in the conduct of monetary policy, reducing the variations of the monetary base.

Resumo

Com base nos trabalhos seminais de Kydland e Prescott (1977) e Barro e Gordon (1983a, 1983b), e no modelo apresentado em Walsh (2010), o trabalho desenvolve um modelo que mostra que, quando a autoridade monetária age comprometida com a objetivo de estabilidade de preços, o ganho de credibilidade reduz o esforço da autoridade monetária na condução da política monetária. O modelo contribui para a literatura, uma vez que demonstra que a credibilidade desempenha um papel crucial não só para a tarefa de ancorar as expectativas de inflação, mas também para reduzir a tendência de inflação eo esforço da autoridade monetária e, assim, as variações do monetário base. A fim de fornecer evidências empíricas para o modelo teórico, o artigo apresenta uma análise, para uma economia emergente importante (Brasil), utilizando mínimos quadrados ordinários e generalizados método dos momentos, um sistema de equações pelo método generalizado de momentos e vetores auto-regressivos. As descobertas sugerem que a reputação da autoridade monetária é fundamental para a melhoria da credibilidade, e o ganho de credibilidade reduz o esforço da autoridade monetária na condução da política monetária, reduzindo as variações da base monetária.

Introduction

In mid-1980's, due to the rational expectations revolution and the "rules rather than discretion" debate (Muth, 1961; Lucas, 1972a, 1972b, 1973; Sargent and Wallace, 1975, 1981; Kydland and Prescott, 1977; Barro and Gordon, 1983a, 1983b), a clear change in the paradigm of conducting monetary policy was perceived: price stability becomes the main objective of the monetary authority.

In the seminal article of Kydland and Prescott (1977), credibility and monetary authority's commitment are treated as central themes when analyzed the problems of time inconsistency and inflationary bias. In turn, through the works of Barro and Gordon (1983a, 1983b), the importance of reputation was added in order to deal with the time inconsistency problem in monetary policy.[1] The economic literature that developed influenced by these studies has handled the problem of persistent inflation as a consequence of loss of reputation of the monetary authority, which failed to maintain their commitment to society.

Macroeconomic stability depends on the current behavior of the monetary authority, but also depends on public expectations regarding the future behavior of the monetary authority. The works of Kydland and Prescott (1977) and Barro and Gordon (1983a, 1983b) call attention to the important role that expectations play in the economy, because the impact of monetary policy depends on the expectations formed by economic agents to the current time as well as to the future. Therefore, as expectations represent an important transmission channel of monetary policy, the task is to show that credibility and reputation are fundamental aspects to the solution of the problems of inflationary bias and time inconsistency.

The “rules rather than discretion” debate served as a theoretical framework for the development of studies about reputation and credibility of the monetary authority. Credibility is, itself, the degree of confidence that economic agents have in relation to the ability and determination of the monetary authority to maintain a commitment to a determined goal. Reputation is related to the belief of the economic agents about the preferences of the monetary authority. According to Drazen (2000, p. 168), “*Reputation often refers to generally held beliefs about an individual’s (or a group’s) character or characteristics*”.

The works of Goodfriend and King (1997), King (2000), Romer (2000), Taylor (1993, 2000), Goodfriend (2004) and Woodford (2003), point that monetary policies will be more effective and credibility will be improved, if the monetary authority strengthen its reputation and follows a strategy concerned to price stability. In summary, for the success of price stability, credibility and reputation are important characteristics in the conduct of monetary policy.

In the 1990s, several countries have adopted regimes of flexible targeting rules (such as inflation targeting) aiming at reducing inflation and keeping it under control. The main goal of such regimes is to create an environment of low and stable inflation and serve as a nominal anchor, making inflation expectations converge to the inflation target. Thus, reputation and credibility have key roles in this regime, given the importance of expectations as a monetary policy transmission channel.

To the extent that the monetary authority successively reaches the inflation target and credibility increases, it is expected that the conduct of monetary policy occurs in a smoother manner – with the inflation target playing an increasing role of anchor for inflation expectations. With the strengthening of the nominal anchor (observed through the convergence of inflation expectations to the inflation target), expectations exert more influence over the behavior of observed inflation and, as a consequence, the efforts of the

[1] The work of Persson and Tabellini (1990) provides a good research about the time inconsistency problem. Cukierman (1992) also offers an extensive discussion of theoretical issues about the analysis of inflation in models where time inconsistency may occur.

monetary authority to achieve the inflation target are reduced. According to de Mendonça and de Guimarães e Souza (2009, p. 1233): "*It is expected that a monetary authority that has reputation and conducts the monetary policy in a credible manner will be capable of achieving its objectives implying a lower social loss (considering unemployment and output). Thus, it is assumed that a high credibility implies a low cost in the control of inflation (represented by an increase in the interest rate*)". On the other hand, a low credibility will lead to a greater effort on the part of the monetary authority to control inflation and therefore a tighter monetary policy, with changes in the monetary base more extensive and with higher amplitude.

Emerging countries, such as Brazil, have adopted inflation targeting as a way of keeping inflation low and stable and to protect the gains achieved with price stability. However, gaining reputation and credibility is an important step to be done by the central banks of those countries, so that to control inflation less effort is needed.

In this sense, the goal of this work is twofold: 1) based on the arguments presented by Kydland and Prescott (1977) and Barro and Gordon (1983a, 1983b), and on the model presented in Walsh (2010), it is developed a theoretical model which shows that, when the monetary authority acts committed with the goal of price stability, the gain of credibility not only acts producing a better result in terms of inflation, but also reduces the effort of the monetary authority in the conduct of monetary policy, and; 2) based on an important emerging economy (Brazil), the article provides empirical evidence that the reputation of the monetary authority is key to the improvement of credibility, and the gain of credibility reduces the effort of the monetary authority in the conduct of monetary policy, and therefore reduces the variations of the monetary base.

The article is organized as follows: the second section presents the theoretical model developed on the basis of Kydland and Prescott (1977), Barro and Gordon (1983a, 1983b) and Walsh (2010). The model demonstrates – as done in Walsh (2010) – that a discretionary policy of the monetary authority produces an inflation rate, expected by economic agents, greater than when the monetary authority does not behave with discretion. Moreover, the model examines different behaviors of the central bank and compares the results in terms of reduction of the inflationary bias. The model contributes to the literature, since it demonstrates that under a flexible targeting regime, the 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 for the theoretical model, based on the Brazilian economy, using ordinary least squares (OLS), the generalized method of moments (GMM) and a system of equations by generalized method of moments (System GMM). Besides, for a dynamic analysis, the methodology of vector autoregressive (VAR) is used and the analysis is made through impulse response functions. The fourth section presents the conclusions of the work.

2. Theoretical model

As considered by Romer (2001) and Walsh (2010), the model assumes that the key determinant of inflation is money supply growth. This can be thought of in terms of the quantity theory of money, and in terms of a demand function for money. In this sense, to understand the causes of high inflation, it is necessary to understand the determinants of money demand and money supply growth. In countries that do not use money creation as a source of government revenue, the strongest candidate is the output-inflation trade-off. Thus, monetary disarray and, consequently, a high and unstable inflation are a result of the use of discretionary monetary policies that seek to exploit the output-inflation trade-off. As stated by

Romer (2001, p. 478), "*Any theory of how an output-inflation tradeoff can lead to inflation must confront the fact that there is no tradeoff in the long run*".

Although, at present, the main instrument of monetary policy to control inflation is the interest rate, the daily control of liquidity hides aspects related to agents' expectations about the behavior of the central bank. In this sense, changes in the money supply to keep the money market in equilibrium and thus preserve the predetermined interest rate are determined by the behavior of money demand, which includes the perception of agents in relation to the characteristics of the monetary authority. Therefore, the daily management of liquidity is done considering the demand for money, which, in turn, responds to changes in inflation expectations. Regarding the relation between money demand and the expected rate of inflation, Barro and Gordon (1983a, p. 602) suggest the following: "*We found also that some disturbances would generate divergent reactions of monetary growth and inflation. The differences involve the behavior of real money demanded, which responds to changes in output (i.e., in the unemployment rate) and to shifts in the expected rate of inflation*".

Thus, brief considerations must be made about the demand for money (in particular, about the speculative reason, which takes into account the expectations of agents related to the behavior of the basic interest rate of the economy) in order to understand: (i) the daily effort of the central bank to control liquidity and, (ii) how reputation and credibility affect the demand for money, the behavior of endogenous money supply and therefore the effort of the monetary authority in terms of daily management of liquidity.

Under inflation targeting, the classic instrument of monetary policy to control inflation is the basic interest rate of the economy. In turn, the daily monetary policy, conducted through the control of liquidity, has the intention to ensure the short-term interest rate announced.

Due to the fact that the short-term interest rate result from the interaction between money supply – defined by the actions of the central bank – and money demand, then setting the interest rate as operational target, means losing control over the money supply in the presence of shifts in money demand. The central bank cannot control, simultaneously, the basic interest rate and the level of bank reserves. If the central bank aims to achieve a particular goal of short-term interest rate, he must relinquish control over the level of reserves, which in this case acts as adjustment variable. Thus, the money supply becomes endogenous, and money market equilibrium occurs whenever the interest rate established as operational target is achieved.

In turn, whereas the agents form expectations about the future conduct of monetary policy, then the behavior of money demand is associated with the monetary authority's ability to keep inflation consistent with the target (i.e., reputation) as well as the ability of the monetary authority to influence inflation expectations of the agents (i.e., credibility).

Thus, the higher the credibility and the stronger the reputation of the monetary authority to be committed to the inflation targeting regime, then the need for abrupt increases in the basic interest rate is reduced. The work of de Mendonça and de Guimarães e Souza (2009) presents empirical evidence that confirms the hypothesis that higher credibility implies lower variations in the interest rate for controlling inflation. In this sense, the smaller the uncertainty of agents about the future behavior of prices and hence interest rates, the lower the need for holding money.

Considering that agents have, in general, two assets to choose in order to invest their funds, money and bonds, then, when agents have expectations that the interest rate will rise on the horizon for a decision, they will prefer holding money rather than to apply in bonds, because in the future, with higher interest rates, the prices of bonds will be lower. This reason for demanding money is traditionally known as speculative reason. The speculative demand is related to expectations about the future behavior of interest rates. Thus, when agents expect

higher interest rates in the future – and, therefore, bonds presenting even lower prices – they raise the demand for money. In turn, when they expect modest increases in interest rates in the future, the speculative demand for money is reduced.

Hence, when the credibility is increased and reputation is strengthened, the more stable is the demand for money. Consequently, the changes necessary in the money supply made by the monetary authority to maintain the short-term interest rate at a level previously announced will be smaller, and therefore lower will be the effort of the monetary authority in terms of monetary policy conduct and control of the short-term interest rate.

Thus, it is important to stress that, in the demand for money are included the agents' expectations about the behavior of the monetary authority in terms of commitment to maintaining an environment of low and stable prices. Therefore, if the inflation bias is high, money demand will be also high. Moreover, with low credibility and poor reputation, the greater the uncertainties in the economy and therefore the greater the variations in the demand for money. In this case, to control the interest rate and thus maintain the equilibrium in the money market, the greater the effort of the monetary authority through the daily management of liquidity, which will result in large variations in the money supply.

2.1 Monetary policy objectives

In order to determine the central bank's policy choice, it is important to specify its preferences. In Barro and Gordon (1983b), the central bank's objective is to maximize the expected value of

$$U = \lambda(y - y_n) - \frac{1}{2}\pi^2 \quad (1)$$

where y is output, y_n is the economy's natural rate of output, and π is the inflation rate. It is considered that more output is preferred to less output with constant marginal utility, so output enters linearly, while inflation is assumed to generate increasing marginal disutility and so enters quadratically. The parameter λ is the relative weight that the monetary authority places on output gap relative to inflation stabilization.[2]

Another standard formulation for the central bank's preferences is a loss function that depends on output and inflation, but the loss function is quadratic in both output and inflation, and takes the form

$$L_{bc} = \frac{1}{2}\lambda(y_t - y_n - k)^2 + \frac{1}{2}\pi^2 \quad (2)$$

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 zero but output around $(y_n + k)$[3].

The specification of the economy follows the analysis of Barro and Gordon (1983a, 1983b). Thus, aggregate output is given by a Lucas-type aggregate supply function of the form

$$y = y_n + \alpha(\pi - \pi^e) + e \quad (3)$$

where π^e is expected inflation and *e* is a random term corresponding to a supply shock.

[2] For more details about the motivations for this type of function, see Cukierman (1992).

[3] According to Walsh (2010), there are several interpretations for the assumption that k > 0, for more details see Walsh (2010, p. 272).

In turn, inflation is determined by monetary policy (which is given by the growth rate of the money supply, assumed to be the central bank's policy instrument),

$$\pi = \Delta m + v \tag{4}$$

where Δm is the growth rate of the money supply (the first difference of the log nominal money supply) and v is a velocity disturbance. It is assumed that e and v are uncorrelated.

The private sector's expectations are assumed to be determined prior to the central bank's choice of a growth rate for the nominal money supply. Thus, in setting Δm, the central bank will take π^e as given. It is also assumed that the central bank can observe e (but not v) prior to setting Δm. According to Walsh (2010), this assumption generates a role for stabilization policy.

The model presents the following sequence of events: first, the private sector sets its inflation expectations; then the supply shock e is realized; due to the fact that expectations have already been determined, they do not respond to the realization of e. However, the monetary authority can respond and, therefore, the policy instrument (Δm) is set after the central bank has observed the supply shock (e). The velocity shock (v) is then realized, and actual inflation and output are determined.[4]

Considering that the central bank acts before observing the disturbance v, thus, its objective will be to maximize the expected value of its objective function, where the central bank's expectation is defined over the distribution of v. Thus, substituting equation (3) and equation (4) into the central bank's objective function yields

$$U = \lambda[\alpha(\Delta m + v - \pi^e) + e] - \frac{1}{2}(\Delta m + v)^2$$

The first-order condition for the optimal choice of Δm, conditional on e and taking π^e as given, is

$$\alpha\lambda - \Delta m = 0,$$

or

$$\Delta m = \alpha\lambda > 0 \tag{5}$$

In this sense, given this policy and based on equation (4), actual inflation will equal $\pi = \alpha\lambda + v$. Due to the fact that private agents are rational, i.e., because private agents are assumed to understand the incentives facing the central bank, they use (5) in forming their inflation expectations. With private agents forming expectations prior to observing the velocity shock v, (4) and (5) imply

$$\pi^e = E[\Delta m] = \alpha\lambda \tag{6}$$

Thus, average inflation is fully anticipated.

In turn, substituting equations (3) and (4) in the loss function given by equation (2), the following function is obtained

$$L_{bc} = \frac{1}{2}\lambda[\alpha(\Delta m + v - \pi^e) + e - k]^2 + \frac{1}{2}(\Delta m + v)^2$$

[4] For further details and explanations with regard to the assumptions used, see Walsh (2010, p. 274-275).

Considering that Δm is chosen after observing the supply shock e, but before observing the velocity shock v, so, to minimize the expected value of the loss function (which disregards the value of v), the first-order condition for the optimal choice of Δm, conditional on e and taking π^e as given, is

$$\alpha\lambda[\alpha(\Delta m - \pi^e) + e - k] + \Delta m = 0$$

$$\alpha^2\lambda\Delta m - \alpha^2\lambda\pi^e + \alpha\lambda(e - k) + \Delta m = 0$$

$$\Delta m(\alpha^2\lambda + 1) = \alpha^2\lambda\pi^e + \alpha\lambda(k - e)$$

$$\Delta m = \frac{\alpha^2\lambda\pi^e + \alpha\lambda(k - e)}{(1 + \alpha^2\lambda)} \tag{7}$$

With expectations formed prior to observing the aggregate supply shock, e, and considering that $E[e] = 0$, thus,

$$\pi^e = E[\Delta m] = \frac{\alpha^2\lambda\pi^e + \alpha\lambda k}{(1 + \alpha^2\lambda)}$$

and solving for π^e yields,

$$(1 + \alpha^2\lambda)\pi^e - \alpha^2\lambda\pi^e = \alpha\lambda k$$

$$\pi^e = \alpha\lambda k > 0$$

Substituting this result into (7) gives

$$\Delta m = \frac{\alpha^2\lambda(\alpha\lambda k) + \alpha\lambda k + \alpha\lambda e}{(1 + \alpha^2\lambda)} = \alpha\lambda k - \left(\frac{\alpha\lambda}{(1 + \alpha^2\lambda)}\right)e \tag{7'}$$

and using this result in equation (4), gives an expression for the equilibrium rate of inflation:

$$\pi^d = \Delta m + v = \alpha\lambda k - \left(\frac{\alpha\lambda}{(1 + \alpha^2\lambda)}\right)e + v \tag{8}$$

where, the superscript d stands for discretion and, π^d refers to the average rate of inflation under a discretionary policy of the monetary authority. Since $E[e] = E[v] = 0$, thus, the average rate of inflation when the monetary authority acts with discretion is equal to $\alpha\lambda k$, which is, therefore, higher than the average rate of inflation given by equation (6). Based on equation (8), the size of the inflation bias is increasing in the distortion (k), the effect of a money surprise on output (α) and the weight the central bank places on its output objective (λ).

2.2 The case for a flexible targeting rule

Based on Walsh (2010, p. 310), following a flexible targeting rule, the central bank's loss function to be minimized is,

$$L_{bc} = \frac{1}{2}\lambda E_t(y_t - y_n - k)^2 + \frac{1}{2}E_t(\pi - \pi^s)^2 + \frac{1}{2}hE_t(\pi_t - \pi^T)^2 \quad (9)$$

where, π^s denotes the socially optimal inflation rate (which may differ from zero) and the last term represents the penalty related to deviations from the target inflation rate π^T. The parameter *h* measures the weight placed on deviations from the target inflation rate.

The rest of the model consists of an aggregate supply function, given by equation (3), and an equation that gives the link between the policy instrument (the growth rate of the money supply) and inflation, given by equation (4),

$$y_t = y_n + \alpha(\pi_t - \pi^e) + e_t \quad (3)$$

$$\pi_t = \Delta m_t + v_t \quad (4)$$

It is assumed that the public's expectations are formed prior to observing either *e* and v, but the central bank can observe *e* (but not v) before setting Δm.

Before deriving the policy followed by the central bank, Walsh (2010) notes that the socially optimal commitment policy is given by

$$\Delta m_t^S = \pi^s - \left(\frac{\alpha\lambda}{1 + \alpha^2\lambda}\right)e_t \quad (10)$$

The equation (10) is obtained through equation (7') and considering that the average rate of inflation – which is $\alpha\lambda k$ when the monetary authority acts with discretion – will converge to the socially optimal inflation rate (π^s).

At this point, it is considered a policy under discretion. Substituting equations (3) and (4) into equation (9) gives the following loss function to be minimized,

$$L_{bc} = \frac{1}{2}\lambda E[\alpha(\Delta m + v - \pi^e) + e - k]^2 + \frac{1}{2}E(\Delta m + v - \pi^s)^2 + \frac{1}{2}hE(\Delta m + v - \pi^T)^2$$

The first-order condition for the optimal choice of Δm, taking expectations as given, is

$$\alpha^2\lambda(\Delta m - \pi^e) + \alpha\lambda(e - k) + (\Delta m - \pi^s) + h(\Delta m - \pi^T) = 0$$

Solving for Δm yields

$$\alpha^2\lambda\Delta m - \alpha^2\lambda\pi^e + \alpha\lambda e - \alpha\lambda k + \Delta m - \pi^s + h\Delta m - h\pi^T = 0$$

$$\Delta m(\alpha^2\lambda + 1 + h) - \alpha^2\lambda\pi^e + \alpha\lambda e - \alpha\lambda k - \pi^s - h\pi^T = 0$$

$$\Delta m(1 + h + \alpha^2\lambda) = \alpha^2\lambda\pi^e - \alpha\lambda e + \alpha\lambda k + \pi^s + h\pi^T$$

$$\Delta m = \frac{\alpha^2\lambda\pi^e + \alpha\lambda k - \alpha\lambda e + \pi^s + h\pi^T}{1 + h + \alpha^2\lambda} \quad (11)$$

Assuming rational expectations, i.e., that $\pi^e = \Delta m^e$, and considering that private agents form its expectations knowing the value of *e*, thus, the value of $\alpha\lambda e$ equals zero. Therefore,

$$\Delta m^{e} = \frac{\alpha^2\lambda\Delta m^{e} + \alpha\lambda k + \pi^{s} + h\pi^{T}}{1 + h + \alpha^2\lambda} \tag{12}$$

$$\Delta m^{e}(1 + h + \alpha^2\lambda) - \alpha^2\lambda\Delta m^{e} = \alpha\lambda k + \pi^{s} + h\pi^{T}$$

$$\Delta m^{e}(1 + h) = \alpha\lambda k + \pi^{s} + h\pi^{T}$$

$$\Delta m^{e} = \frac{\alpha\lambda k + \pi^{s} + h\pi^{T}}{1 + h}$$

Substituting this result into equation (11) on π^{e}, gives

$$\Delta m = \frac{\alpha^2\lambda\dfrac{(\alpha\lambda k + \pi^{s} + h\pi^{T})}{1 + h} + \alpha\lambda k - \alpha\lambda e + \pi^{s} + h\pi^{T}}{1 + h + \alpha^2\lambda}$$

$$\Delta m = \frac{\alpha^2\lambda\dfrac{(\alpha\lambda k + \pi^{s} + h\pi^{T})}{1 + h} + \alpha\lambda k + \pi^{s} + h\pi^{T}}{1 + h + \alpha^2\lambda} - \frac{\alpha\lambda e}{1 + h + \alpha^2\lambda}$$

$$\Delta m = \frac{\dfrac{\alpha^2\lambda(\alpha\lambda k + \pi^{s} + h\pi^{T}) + (1 + h)(\alpha\lambda k + \pi^{s} + h\pi^{T})}{1 + h}}{1 + h + \alpha^2\lambda} - \frac{\alpha\lambda e}{1 + h + \alpha^2\lambda}$$

$$\Delta m = \frac{\dfrac{(1 + h + \alpha^2\lambda)(\alpha\lambda k + \pi^{s} + h\pi^{T})}{1 + h}}{1 + h + \alpha^2\lambda} - \frac{\alpha\lambda e}{1 + h + \alpha^2\lambda}$$

$$\Delta m = \frac{\alpha\lambda k + \pi^{s} + h\pi^{T}}{1 + h} - \frac{\alpha\lambda e}{1 + h + \alpha^2\lambda}$$

Summing and subtracting $h\pi^{s}$ in the numerator of the first fraction, gives the time-consistent money growth rate (Δm^{T}):

$$\Delta m^{T} = \frac{\alpha\lambda k + \pi^{s} + h\pi^{T} + h\pi^{s} - h\pi^{s}}{1 + h} - \frac{\alpha\lambda e}{1 + h + \alpha^2\lambda}$$

$$\Delta m^{T} = \frac{\alpha\lambda k + \pi^{s}(1 + h) + h(\pi^{T} - \pi^{s})}{1 + h} - \frac{\alpha\lambda e}{1 + h + \alpha^2\lambda}$$

$$\Delta m^{T} = \pi^{s} + \frac{\alpha\lambda k}{1 + h} + \frac{h(\pi^{T} - \pi^{s})}{1 + h} - \frac{\alpha\lambda e}{1 + h + \alpha^2\lambda}$$

If the target inflation rate is equal to the socially optimal inflation rate ($\pi^T = \pi^s$), it follows that,

$$\Delta m^T = \pi^s + \frac{\alpha\lambda k}{1+h} - \frac{\alpha\lambda e}{1+h+\alpha^2\lambda} \quad (13)$$

Setting $h = 0$ yields the time-consistent discretionary solution without targeting (Δm^{NT}),

$$\Delta m^{NT} = \pi^s + \alpha\lambda k - \frac{\alpha\lambda e}{1+\alpha^2\lambda} \quad (14)$$

with the inflation bias equal to $\alpha\lambda k$.

Thus, according to the results of (13) and (14), it is possible to conclude, similar to Walsh (2010), that the monetary policy under a regime of flexible inflation targeting reduces the inflation bias from $\alpha\lambda k$ to $\frac{\alpha\lambda k}{1+h}$.

2.3 Credible inflation target

This section contributes to the literature by demonstrating that a credible inflation target reduces the inflation bias and, therefore, the monetary authority's effort in terms of monetary policy.

Assuming that, under a regime of flexible inflation targeting, expected inflation converges to the inflation target ($\pi^e = \pi^T$), i.e., the inflation target is credible and serves as a nominal anchor for the process of expectations formation of the private agents, thus equation (12) turns into

$$\Delta m^T = \frac{\alpha^2\lambda\pi^T + \alpha\lambda k - \alpha\lambda e + \pi^s + h\pi^T}{1+h+\alpha^2\lambda}$$

$$\Delta m^T = \frac{\alpha^2\lambda\pi^T + \pi^s + h\pi^T}{1+h+\alpha^2\lambda} + \frac{\alpha\lambda k - \alpha\lambda e}{1+h+\alpha^2\lambda}$$

In turn, if the target inflation rate is equal to the socially optimal inflation rate ($\pi^T = \pi^s$), thus,

$$\Delta m^T = \frac{\alpha^2\lambda\pi^s + \pi^s + h\pi^s}{1+h+\alpha^2\lambda} + \frac{\alpha\lambda k - \alpha\lambda e}{1+h+\alpha^2\lambda}$$

$$\Delta m^T = \frac{\alpha^2\lambda\pi^s + \pi^s + h\pi^s}{1+h+\alpha^2\lambda} + \frac{\alpha\lambda k}{1+h+\alpha^2\lambda} - \frac{\alpha\lambda e}{1+h+\alpha^2\lambda}$$

$$\Delta m^T = \frac{\pi^s(\alpha^2\lambda+1+h)}{1+h+\alpha^2\lambda} + \frac{\alpha\lambda k}{1+h+\alpha^2\lambda} - \frac{\alpha\lambda e}{1+h+\alpha^2\lambda}$$

$$\Delta m^T = \pi^s + \frac{\alpha\lambda k}{1+h+\alpha^2\lambda} - \frac{\alpha\lambda e}{1+h+\alpha^2\lambda} \quad (15)$$

Since $\alpha^2\lambda > 0$, the result for Δm^T is lower than that obtained by Walsh (2010), given by (13).

Setting $h = 0$, i.e., without inflation target, the result is

$$\Delta m^{NT} = \pi^s + \frac{\alpha\lambda k}{1+\alpha^2\lambda} - \frac{\alpha\lambda e}{1+\alpha^2\lambda} \quad (16)$$

With the inflation bias equal to $\frac{\alpha\lambda k}{1+\alpha^2\lambda}$, which is also lower than that found by Walsh (2010), given by (14).

In summary,

(1) Result for a discretionary policy of the central bank

(a) without credibility for the announced inflation target

$$\Delta m^{NT} = \pi^s + \alpha\lambda k - \frac{\alpha\lambda e}{1+h+\alpha^2\lambda}$$

(b) with credibility for the announced inflation target

$$\Delta m^{NT}_{credib} = \pi^s + \frac{\alpha\lambda k}{1+\alpha^2\lambda} - \frac{\alpha\lambda e}{1+\alpha^2\lambda}$$

(2) Result for a policy under inflation targeting

(a) without inflation targeting credibility

$$\Delta m^{T} = \pi^s + \frac{\alpha\lambda k}{1+h} - \frac{\alpha\lambda e}{1+h+\alpha^2\lambda}$$

(b) with inflation targeting credibility

$$\Delta m^{T}_{credib} = \pi^s + \frac{\alpha\lambda k}{1+h+\alpha^2\lambda} - \frac{\alpha\lambda e}{1+h+\alpha^2\lambda}$$

3. Empirical evidence for the Brazilian economy

The Brazilian economy represents an interesting case study regarding the importance of reputation and credibility for the conduct of monetary policy, because: since June 1999, Brazil adopts the regime of inflation targeting; the Brazilian economy is the sixth largest economy in the world, and; Brazil is one of the most important developing countries, along with Russia, India and China (BRIC group). Besides, there is empirical evidence in the literature suggesting that the gain in credibility earned by the regime of inflation targeting, in

Brazil, contributed to the reduction of uncertainties and improved macroeconomic performance.[5]

Therefore, in order to contribute with the empirical literature and give robustness to the results reported by the theoretical model, this section seeks evidence to support the following argument: a higher reputation of the monetary authority leads to greater credibility of the regime of inflation targeting. In turn, the higher the credibility, the easier it is to anchor inflation expectations to the target, reducing, in this sense, the monetary authority's efforts to control inflation.

3.1 Methodology and data

The period of analysis runs from December 2001 to October 2011[6]. The (monthly) series used in this study are:

- **inflation targeting credibility** (*credib*): Based on the argument presented by Agénor and Taylor (1992) and Svensson (1993, 2000) that series of inflation expectations could be used in the creation of credibility indices, and based on the work of Cecchetti and Krause (2002) which presented a credibility index for the central bank, the work of de Mendonça (2007) developed a credibility index which considers the inflation expectations, the inflation target and the tolerance intervals. The credibility index has a value equal to 1 when the annual expected inflation ($E(\pi)$) is equal to the target inflation 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_t^*) established for each year and assumes a value equal to 0 when the expected inflation exceeds one of these limits.

  Considering the series of Inflation expectations formed for the next twelve months (IPCA) made available by the Central Bank of Brazil and the annual inflation targets determined by National Monetary Council, the credibility index (*credib*) used in the present work was built based on the methodology of de Mendonça (2007):

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

- **Monetary authority reputation** (*reput*): according to Blinder (2000), the reputation of the monetary authority is built on the basis of the results achieved by monetary policy for several years. Thus, the monetary authority that seeks to build a reputation of being an institution that is responsible and committed with price stability should occupy itself in reaching the goal of inflation for many years. In turn, the monetary authority with this kind of reputation and committed to price stability can control inflation through minor variations in the money supply, because the public will believe that the monetary authority will succeed in the task of keeping prices stable. The index of reputation of the monetary authority is measured using a variant of the methodology developed by de Mendonça and de Guimarães e Souza (2009). The structure of the index of reputation is similar to that applied for the index of credibility. The main difference is that the deviations are

[5] See, for instance, de Mendonça and Simão Filho (2007), de Mendonça (2009), de Mendonça and de Guimarães e Souza (2009) and Montes and Bastos (2011).

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

calculated considering the observed inflation[7] and not the expected inflation. Nonetheless, in the present work, the index of reputation uses the index developed by de Mendonça and de Guimarães e Souza (2009), however, weighted by the output gap. The reason for this is due to the fact that if the monetary authority is practicing a policy which seeks to push output temporarily above its normal level then, even with inflation within the tolerance bands, its reputation must be penalized, because this will indicate an attempt to exploit the trade-off between inflation and output in the short run. Hence,

$$Reput = \begin{cases} 1 & if \quad \pi^*_{t\,Min} \leq \pi_{t\,OBS} \leq \pi^*_{t\,Max} \\ 1 - \frac{1}{0.2 - \pi^*_{t\,Max}} . [\pi_{t\,OBS} - \pi^*_{t\,Max}] & if \quad \pi^*_{t\,Max} < \pi_{t\,OBS} < 0.2 \\ 1 - \frac{1}{-\pi^*_{t\,Min}} . [\pi_{t\,OBS} - \pi^*_{t\,Min}] & if \quad 0\% < \pi_{t\,OBS} < \pi^*_{t\,Min} \\ 0 & if \quad \pi_{t\,OBS} \geq 0.2 \; ou \; \pi_{t\,OBS} \leq 0 \end{cases} \text{x} \begin{cases} \frac{Y_n}{Y} & if \; \frac{Y_n}{Y} < 1 \\ 1 & if \; \frac{Y_n}{Y} > 1 \end{cases}$$

where, $\pi_{t\,OBS}$ is the observed inflation rate, $\pi^*_{t\,Min}$ is the lower bound of the tolerance band, $\pi^*_{t\,Max}$ is the upper bound of the tolerance band, y is the real output and y_n is the long-term real GDP trend (obtained through the Hodrick-Prescott filter).

- **Variation of monetary base** (*var_base*): in the literature on "rules rather than discretion" (as for example, in the works of Kydland and Prescott (1977) and Barro and Gordon (1983a, 1983b)) the variable used for measuring the instrument of monetary policy is the change in money supply. Here, the growth of the monetary base[8] will reflect the behavior of the monetary authority in the pursuit of its goals and will serve also as a proxy of the monetary authority's efforts in the conduct of monetary policy.

- **Output gap** (*gap*): the output gap[9] is an important variable in the study since it is present both in the objective function (equation 1) and the loss function (equation 2) of the monetary authority. The relevance of this variable concerns the incentive that the monetary authority has to make an output superior to the economy's potential output, which is the central issue of a discretionary policy. Thus, when the monetary authority try to push the output above its normal level, i.e., explore the trade-off between output and inflation in the short-term, the result is the economy showing higher inflation in the future and the output in a situation compatible with the potential output, which generates, as a consequence, loss of credibility.

- **Public debt/GDP ratio** (*debt*): this series is available from the Central Bank of Brazil and is for total consolidated net public-sector debt as a percentage of GDP. The series of Public debt/GDP ratio acts as a *proxy* for government fiscal performance. In this sense, an increase in this ratio means that the government is engaging in loose fiscal behavior, which puts pressure on the expected inflation. This variable is used in this work as an

[7] The series of inflation is measured by the Broad Consumer Price Index in the last 12 months – IPCA (which is the official CPI in Brazil under inflation targeting). The series is available at the website of the Central Bank of Brazil.

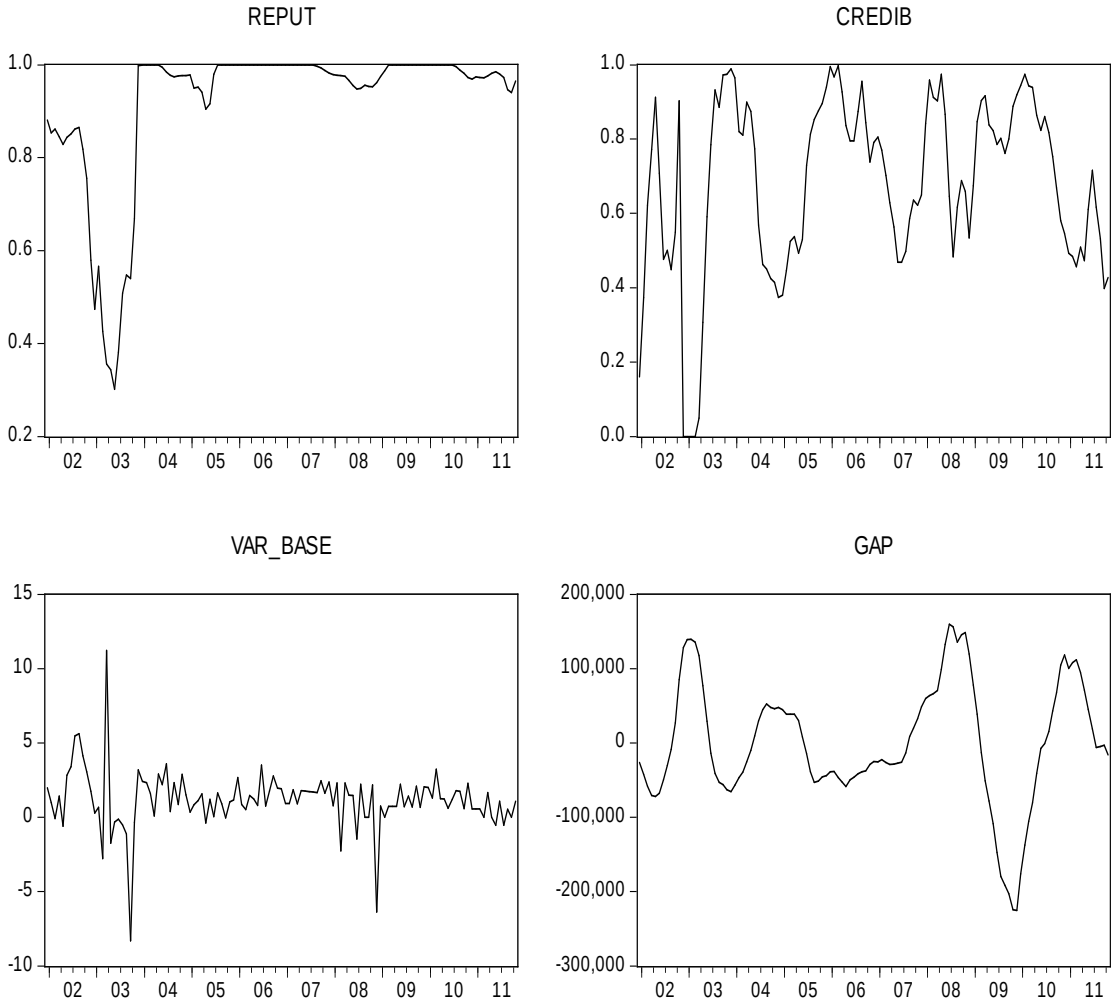
[8] The series used is the "Monetary base (working day balance average) - c.m.u. (thousand)", available at the website of the Central Bank of Brazil.

[9] The output gap is obtained by the difference between the natural logarithm of GDP and the natural logarithm of its long-term trend. The series of GDP is the "GDP accumulated in the last 12 months - valuated by the centered IGP-DI in the month (R$ million)", available at the website of the Central Bank of Brazil, and its long-term trend is obtained through the Hodrick-Prescott filter.

instrumental variable in the estimates through GMM and system GMM, and as an exogenous variable in the study of impulse-response using a var.

Based on the data of the Brazilian economy, the figure 1 below provides the first evidence for the arguments that a greater reputation of the monetary authority leads to greater credibility of the regime of inflation targeting, and, also, that the greater the credibility of the regime, the lower the monetary authority's effort, because the variation of monetary base decreased. Furthermore, it is also possible to observe that there is evidence that the change in the monetary base is influenced by output fluctuations.

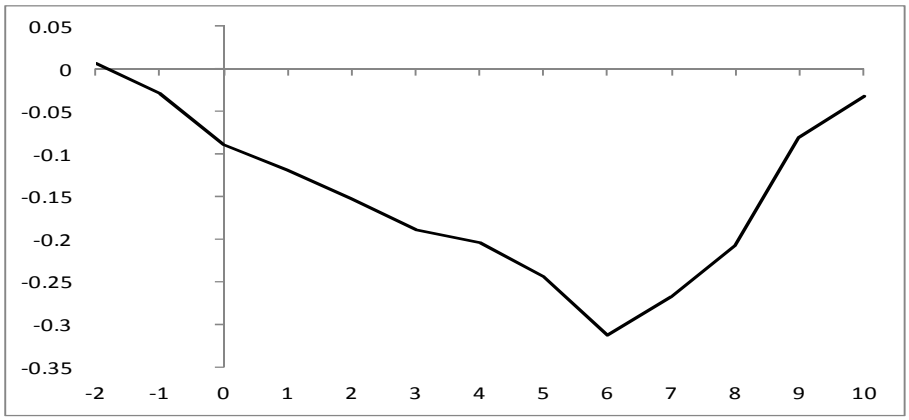
Figure 1 – Growth of the monetary base, credibility, reputation and output gap



Source: author's elaboration

Based on the results of the theoretical model, it is possible to argue that a greater credibility of the regime of inflation targeting is crucial to reduce the variations of money supply (or monetary base) (Δm). In this sense, through the series of inflation targeting credibility (credib) and variation of monetary base (var_base), the present study sought to provide preliminary evidence: a study of dynamic correlation between these two variables was done. Figure 2 shows the dynamic correlation between var_$base_t$ and $credib_{t+j}$ for different months (j)

Figure 2 – Dynamic correlation between *var_base*$_t$ and *credib*$_{t+j}$



Source: authors' elaboration.

It can be observed that the correlations are negative and non-negligible in both lags and leads. The general index of correlation between *base* and *credib* is -0,089. Therefore, through the analysis of dynamic correlation presented, there is a first evidence that greater credibility leads to less variation of monetary base.

3.2 Estimates

To verify that inflation targeting credibility is influenced by the reputation of the monetary authority, an equation for the index of credibility is established below (equation 1). The equation considers that credibility is also influenced by output fluctuations resulting from the exploration of the trade-off between output and inflation by the monetary authority. Hence, the output gap is included in equation 1:

Equation 1: $credib_t = \gamma_0 + \gamma_1 reput_t + \gamma_2 gap_{t-3} + \varepsilon_t$

where, $\gamma_0 > 0;\ \gamma_1 > 0; \gamma_2 < 0$, and, ε is an error term.

An increase in the reputation of the monetary authority leads to an increase in the credibility of the regime of inflation targeting. On the other hand, an increase in the output gap (gap) leads to a reduction in the credibility index, since economic agents believe that this increase is due to a discretionary policy of the monetary authority.Based on the assumption that the variation in the monetary base is influenced by the credibility of the regime of inflation targeting, an equation for this relation (equation 2) is given below:

Equation 2: $var\_base_t = \beta_0 + \beta_1 credib_t + \beta_2 gap_{t-3} + \mu_t$

where, $\beta_0 > 0; \beta_1 < 0;\ \beta_2 < 0,$ and, μ is an error term.

It is expected, therefore, that an increase in credibility leads to a reduction in the variation of monetary base, as presented by the theoretical model. An increase in output gap (*gap*) leads to a reduction in the variation of monetary base, because, an increase in output gap will result in pressure on inflation, and thus the monetary authority will respond by reducing the monetary base in order to increase the interest rate.

3.1.1 Analysis using OLS, GMM and System GMM

A first condition to be analyzed before applying the econometric analysis is to check if series are stationary. Therefore, the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) was applied (Table A.1 at the appendix). The advantage of this test results from the powerless of conventional tests, as these tend to not reject the null hypothesis too often (Franses and Haldrup, 1994; Cati et al., 1999). The results show that all series are I(0).

The empirical analysis makes use of ordinary least squares (OLS)[10] 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". The weighting matrix in the equation was chosen to enable the GMM estimates to be robust, considering the possible presence of heteroskedasticity and autocorrelation of unknown form.[11] The estimations were performed using the software E-Views 7.0.

Moreover, a way of testing the validity of the equations and coefficients achieved through OLS and GMM is the estimation through system of equations. For treating possible problems of endogeneity, the use of system of equations which applies GMM is adequate for estimating non-biased coefficients.[12] Table 1 presents all the estimates.

System:

$$credib_t = \theta_0 + \theta_1 reput_t + \theta_2 gap_{t-3} + \epsilon_t$$

$$var\_base_t = \varphi_0 + \varphi_1 credib_t + \varphi_2 gap_{t-3} + \tau_t$$

Regarding OLS estimates, Table 1 shows that the F-statistic of both equations (1) and (2) indicate that the regressions are significant; besides, the outcomes of the Ramsey RESET test indicate that the estimations do not present problems of model specification. In terms of GMM and system GMM estimations, the results of the J-test indicate that all models are correctly specified.

In turn, in relation to the estimated coefficients, the signals of the coefficients of the explanatory variables in the equations (1) and (2), as well as in the System, are those expected and are statistically significant, except the constant and the coefficient of reputation in the equation 1 by OLS, which do not have significance. Another important observation refers to the use of the system GMM as a way to test the validity of the results found for the equations (1) and (2), which were estimated individually. In table 1, the results show that the coefficients of the equations (1) and (2) are similar to those achieved by the system GMM, which gives robustness to the econometric analysis. It is important to note that the estimation

[10] The reported t-statistics in the OLS estimates of Equation 1 are based on the estimator of Newey and West (1987), which is consistent in the presence of both heteroskedasticity and autocorrelation of unknown form. Regarding the OLS estimates, diagnostic tests were performed and are presented at table 1.

[11] GMM estimates applied the following instrumental variables: Equation 1 – $credib_{-1}$, $credib_{-2}$, $credib_{-3}$, $credib_{-4}$, $credib_{-5}$, $credib_{-6}$, $reput_{-1}$, $reput_{-2}$, $reput_{-3}$, $reput_{-4}$, $reput_{-5}$, $reput_{-6}$, $reput_{-7}$, gap_{-4}, gap_{-5}, gap_{-6}, gap_{-7}, gap_{-8}, debt, $debt_{-1}$, $debt_{-2}$, $debt_{-3}$, $debt_{-4}$, $debt_{-5}$, $debt_{-6}$ and a constant; Equation 2 – var_base_{-1}, var_base_{-2}, var_base_{-3}, $credib_{-1}$, $credib_{-2}$, $credib_{-3}$, $credib_{-4}$, $credib_{-5}$, $credib_{-6}$, $credib_{-7}$, gap_{-4}, gap_{-5}, gap_{-6} and a constant. Regarding the GMM technique, Cragg (1983) pointed out that overidentification analysis has an important role in the selection of instrumental variables to improve the efficiency of the estimators. Hence, a standard J-test was performed with the objective of testing this property for the validity of the overidentifying restrictions (Hansen, 1982).

[12] The System GMM applies the same instrumental variables of the GMM.

through the system considerably increased the accuracy of the coefficients in the models (the standard errors are smaller).

Table 1 – OLS, GMM and System-GMM estimates

	Equation 1			Equation 2	
	Dependent Variable: credib			Dependent Variable: var_base	
	OLS	GMM		OLS	GMM
constant	0.378	0.446*	constant	2.798*	2.778*
	(0.373)	(0.118)		(0.602)	(0.523)
	[1.012]	[3.781]		[4.640]	[5.309]
reput	0.338	0.281**	credib	-2.328*	-2.257*
	(0.386)	(0.133)		(0.836)	(0.721)
	[0.877]	[2.108]		[-2.781]	[-3.129]
gap(-3)	-2.486*	-3.077*	gap(-3)	-23.947*	-26.377*
	(1.012)	(0.593)		(5.862)	(3.758)
	[-2.455]	[-5.182]		[-4.084]	[-7.017]
R2	0.260	0.280	R2	0.135	0.124
Adjusted R2	0.247	0.267	Adjusted R2	0.119	0.108
F-statistic	19.875		F-statistic	8.835	
Prob (F-statistic)	0.000		Prob (F-statistic)	0.000	
Ramsey (1); *p-value*	0.204		Ramsey (1); *p-value*	0.207	
Ramsey (2); *p-value*	0.358		Ramsey (2); *p-value*	0.423	
Serial Correlation LM Test(1); *p-value*	0.000		Serial Correlation LM Test(1); *p-value*	0.204	
Serial Correlation LM Test(2); *p-value*	0.000		Serial Correlation LM Test(2); *p-value*	0.446	
Heteroskedasticity (ARCH) (1)	0.000		Heteroskedasticity (ARCH) (1)	0.483	
Heteroskedasticity (ARCH) (2)	0.000		Heteroskedasticity (ARCH) (2)	0.737	
Normatlity (Jarque-Bera); probability	0.754		Normatlity (Jarque-Bera); probability	0.000	
J-Statistic		16.534	J-Statistic		9.309
Prob (J-statistic)		0.867	Prob (J-statistic)		0.749
Instrument rank		27			16

	GMM System		
	Equation 1		Equation 2
	Dependent Variable: credib		Dependent Variable: var_base
constant	0.454*	constant	3.392*
	(0.062)		(0.217)
	[7.283]		[15.618]
reput	0.264*	credib	-3.181*
	(0.069)		(0.287)
	[3.796]		[-11.063]
gap(-3)	-3.116*	gap(-3)	-27.177*
	(0.217)		(1.714)
	[-15.618]		[-15.851]
R2	0.282		0.116
Adjusted R2	0.269		0.099
J-Statistic		0.169	
Prob (J-statistic)		0.987	

Source : author's estimates

Marginal Significance Levels: * denotes 0.01, ** denotes 0.05. Standard erros in parentheses ant *t* -satatistics in square brackets.

In accordance to the literature about reputation and credibility, and, also, in accordance with the results of the theoretical model, it is possible to observe in the estimates

of equation 1, through OLS, GMM and System GMM, that the positive signal found for the coefficient of reputation (*reput*) makes it clear that an increase in this variable leads to an increase in the credibility (*credib*) of the regime of inflation targeting. Thus, insofar as the monetary authority strengthens its reputation, which enhances the credibility of the regime of inflation targeting, as a result, the effort of the monetary authority in the conduct of monetary policy is reduced (equation 2). The negative signs of the coefficients of the output gap (*gap*) of the equations (1) and (2) can be explained as follows: an increase in the output gap (gap) leads to a reduction in the credibility index, since economic agents believe that this increase is due to a discretionary policy of the monetary authority, resulting, as a consequence, in the formation of higher inflation expectations. In turn, an increase in output gap will result in inflationary pressures, and thus, leading the monetary authority to respond by reducing the monetary base in order to increase the interest rate, i.e., one might think that a larger output gap leads the monetary authority to be more rigid in terms of reaching the inflation target.

3.1.2 VAR analysis

In a general way the dynamic analysis of vector autoregressive is made through methods such as impulse response functions because it permits evaluation of the impulse on key variables caused by shocks (or innovations) provoked by residual variables over time (Sims, 1980). As pointed out by Lutkenpohl (1991), the conventional method applies "orthogonality assumption" and thus the result may depend on the ordering of variables in the VAR. The works of Koop et al. (1996) and Pesaran and Shin (1998) developed the idea of the generalized impulse response function as a manner of eliminating the problem of the ordering of variables in the VAR. The main argument is that the generalized impulse responses are invariant to any re-ordering of the variables in the VAR.

Aiming at evaluating the transmission mechanism, the set of variables used in the VAR analysis is represented by *var_base*, *credib*, *reput* and *gap*.[13]

The choice of the VAR lag order was determined using the Schwarz (SC) and Hannan-Quinn (HQ) information criteria. It is observed that both models (with and without constant) indicate that the VAR lag order is 2 and that the best-fit model is without constant (Table A.2 at the Appendix). Figure A.1 at the Appendix shows the stability of the VAR.

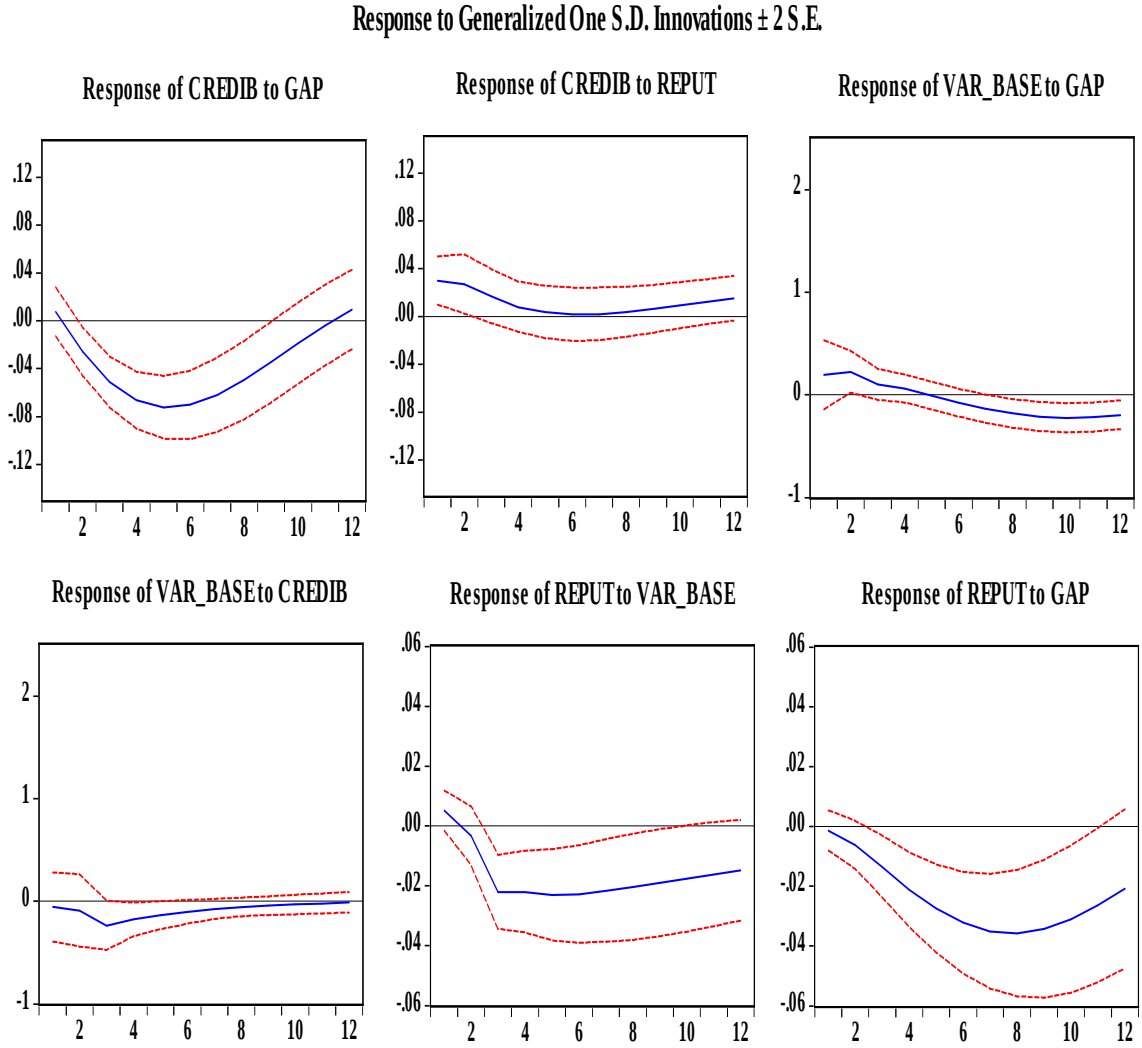
Figure 3 shows the results of the generalized impulse response functions for a time horizon of 12 months. The results suggest that an unexpected positive shock on *credib* provokes an increase in *var_base* that remains for a period of approximately 8 months. Hence, the gain of credibility is an important aspect for reducing monetary policy efforts. Concerning the relationship between credibility and reputation, it is observed that an unexpected positive shock on *reput* provokes an increase in *credib*. These results are in agreement with the previous analysis of the estimations in Table 1.

In terms of the influence of the output gap, it is observed that the impact of a shock that provokes an increase in *gap* implies a decrease in both *reput* and *credib*, this is explained by the fact that economic agents may believe that the monetary authority has incentives to explore the output-inflation trade-off in the short run. On the other hand, an unexpected positive shock on *gap* provokes, after the third month approximately, a decrease in *var_base*, this is because since a larger output gap puts pressure on inflation, thus, a committed monetary policy should act by reducing positive changes of monetary base in order to reach the inflation target.

[13] The VAR includes two exogenous variables: the debt/GDP ratio (*debt*) and a dummy variable for the subprime crisis, which assumes value 1 to the period from 2008.1 to 2009.6, and zero otherwise.

It is also possible to note that, since high money growth is one of the main causes of high inflation (Romer, 2001), thus, the evidence suggest that an unexpected positive shock on *var_base* provokes a decrease in *reput*.

Figure 3 – Impulse Response



Source: author's elaboration

Conclusion

In general, the present paper reveals, theoretically and empirically, that the reputation of the monetary authority and the credibility of the monetary regime represent important elements for the conduct of monetary policy in an important inflation targeting emerging country, such as Brazil.

In particular, the present study makes the following advances to the literature that deals with both the "rules rather than discretion" debate and the consequences of adopting a regime of inflation targeting for the conduct of monetary policy in emerging economies:

- In the theoretical field: based on the arguments presented by Kydland and Prescott (1977) and Barro and Gordon (1983a and 1983b) concerning the importance of credibility and reputation for the conduct of monetary policy and economic outcomes, and based on the model presented by Walsh (2010) which demonstrates the inflation bias when the

monetary authority operates on a discretionary basis, the present study developed a model that extends the one developed by Walsh (2010). The model incorporates the case of a central bank that operates committed with the regime of inflation targeting, and, at the same time, the inflation target presents credibility. When compared with the results of the model presented by Walsh (2010), the model, here proposed, provides a solution compatible with an inflation bias even lower and less efforts of the monetary authority in the conduct of monetary policy.

- In the empirical field: (1) based on the reputation index proposed by de Mendonça and de Guimarães e Souza (2009), it was proposed another index which considers output fluctuations and, thus, the attempts of the monetary authority to push output above its normal level, i.e., this new index penalizes the monetary authority that operates on a discretionary basis in order to explore the trade-off; (2) the study demonstrates that the gain of reputation improves credibility (which is a known result, found, for example, by de Mendonça and de Guimarães e Souza (2009) for the Brazilian economy), but also that attempts to exploit the output-inflation trade-off (measured by the output gap) reduces credibility; (3) the analysis found that the gains in terms of credibility reduces the efforts of the monetary authority in the conduct of monetary policy, reducing the variations of the monetary base, and; (4) aiming at giving robustness for the theoretical model and for the results found by OLS and GMM estimates, and aiming at checking the transmission mechanism, a system of equations by generalized method of moments (system GMM) and a VAR analysis were used, the findings suggest that reputation affects credibility and, credibility affects the effort of the monetary authority in terms of monetary policy.

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Appendix

Table A.1
Unit roots test: KPSS

Series	KPSS				
	Lags	I/T	Test	Critical Values 1%	Critical Values 5%
var_base	4	I	0.161	0.739	0.463
credib	8	I/T	0.096	0.216	0.146
reput	8	I/T	0.133	0.216	0.146
gap	8	I	0.037	0.739	0.463

Source : author's estimates.
Note: the final choice of lag was made based on Bartlett e Kernel criterion.

Table A.2
SC e HQ criteria for VAR

With constant			No constant		
Lags	SC	HQ	Lags	SC	HQ
0	-1.982	-2.157	0	-0.776	-0.892
1	-7.220	-7.626	1	-6.989	-7.337
2	-8.150*	-8.788*	2	-8.255*	-8.835*
3	-7.824	-8.694	3	-7.938	-8.751
4	-7.571	-8.673	4	-7.683	-8.728
5	-7.272	-8.606	5	-7.363	-8.640
6	-7.064	-8.631	6	-7.143	-8.652

Source : author's estimates.
Note: SC - Schwarz criteria. HQ — Hannan-Quinn criteria.
* Denotes lag order selected by the criterion.

Figura A.1