

A Modified Taylor Rule for Brazilian Economy: convention and conservatism in 11 years of inflation targeting (2000-2010)*

André de Melo Modenesi*
Rui Lyrío Modenesi*
Norberto Montani Martins*

Resumo: Pretende-se avaliar a condução da política monetária pelo Banco Central do Brasil (BCB) após a adoção das metas de inflação (2000-2010) por meio da estimação de uma regra de Taylor modificada. O termo modificada se refere à importante inovação em relação aos trabalhos existentes: a inclusão da taxa de juros externa (Libor) como variável explicativa na equação original. O artigo reforça e estende os resultados de Modenesi (2011), oferecendo evidências de que o BCB reage à taxa de juros externa ao fixar a taxa Selic. Os resultados corroboram a tese de que há uma convenção pró-conservadorismo, materializada na adoção de uma regra de Taylor com três características distintivas: elevado grau de suavização nos movimentos dos juros; elevado juro de equilíbrio *doméstico puro*; alto diferencial entre as taxas de juros doméstica e externa. Estas duas últimas características explicam em larga medida a sobreapreciação do real, elemento fundamental da estratégia de estabilização de preços. É mostrado que a queda recente na Selic reflete, largamente, a queda anormal das taxas de juros externas (após a crise do *subprime*) – contrariando-se a crença de que o juro de equilíbrio caiu devido a melhora nos fundamentos macro.

Palavras-chave: Política Monetária, Regra de Taylor, Metas de Inflação, Selic, Convenção.

Classificação JEL: E43, E58

Abstract: With the purpose of evaluating Brazilian Central Bank's (BCB) conduct of monetary policy after the adoption of inflation targeting (IT), we propose a modified version of Taylor rule for the Brazilian economy in the period 2000-2010. The term modified refers to an important innovation with regard to the reviewed literature: the inclusion of a variable for international

* We are grateful to Fabio S. Erber (*in memoriam*), Viviane Luporini, and Fernando Cardim. Any errors or omissions are our own.

* Associate professor at Institute of Economics of Federal University of Rio de Janeiro (IE/UFRJ) and researcher of the National Council for Scientific and Technological Development (CNPq). E-mail: amodenesi@gmail.com

* Former associate professor at Department of Economics of Fluminense Federal University (UFF). Retired economist of Brazilian Development Bank (BNDES). E-mail: rlmodenesi@gmail.com

* Research assistant of Money and Financial Systems Study Group and of Economic Conjuncture Research Group (IE/UFRJ). Master candidate in Economics at IE/UFRJ and scholar of The International Celso Furtado Center for Development Policies. E-mail: norberto.montani@gmail.com

interest rate (measured by Libor) in the original equation. This study reinforces and expands results achieved by Modenesi (2011) and also provides as a novelty the evidence that BCB reacts to foreign interest rates when setting its basic rate. BCB has reduced autonomy: Selic is endogenous not only to domestic conditions (inflation and output gaps), but also to foreign interest rate. Evidence is provided in favor of the thesis that BCB policy is ruled by a pro-conservative convention substantiated in the adoption of a Taylor rule containing three distinctive features: 1) high degree of interest rate smoothness; 2) high pure domestic equilibrium interest rate; and 3) high interest rate differential. Items 2) and 3) largely explain the overvaluation of real, a key element of price stabilization. Results also contest the idea that Brazilian equilibrium interest rate has recently experienced a sharp fall. The reduction of Selic reflects mostly the recent abnormal decline of foreign interest rates.

Keywords: Monetary Policy; Taylor rule; Inflation Targeting; Selic; Convention.

Indicação de área SEP: 5. Dinheiro, finanças internacionais e crescimento – **5.1. Economia monetária e financeira – Sessões Ordinárias.**

A Modified Taylor Rule for Brazilian Economy: convention and conservatism in 11 years of inflation targeting (2000-2010)

1 – Introduction

Seventeen years after the achievement of price stability with the Real Plan (RP), we have not seen a satisfactory reduction in real interest rates in Brazil. In fact, as is well known, the country is on the top of the ranking of world's rates. Initially, the maintenance of the basic interest rate (Selic) at high levels was justified by the Central Bank of Brazil (BCB) as a means of offsetting current account deficit (4,3% of GDP in 1998) and, eventually, of preserving international reserves. The loose fiscal policy of the first President Cardoso's term was also cited as a cause of the rigidity of monetary policy.

The abandonment of exchange rate anchor in 1999, the improvement in external accounts and the change in the instance of fiscal policy – with a primary surplus of around 3,5% of GDP – were not enough to *substantially* reduce the Selic. In fact, the real Selic non-negligibly fell in the period 2000 to 2010, with its average approaching 10% p.y.¹ However, this is still a very high level. The real basic interest rate practiced by developing countries, for example, was on average about 2.7% p.y. over the same period. That is, the interest rate in Brazil has been almost four times the rate of the emerging countries. Therefore, one may affirm that the BCB has been extremely conservative in setting Selic. Among many readings of this phenomenon, we highlight the one asserting that there is a *convention* justifying the high levels of interest rates and the overvaluation of Real.

This paper aims at assessing the conduct of monetary policy after the introduction of a flexible exchange rate regime and the adoption of inflation targeting (IT). More specifically, our main objective is to estimate a reaction function of BCB from 2000 to 2010. Doing so, we provide empirical evidence that can be seen as favoring the existence of the so called *pro-conservative* convention ruling BCB policy. It is worth to note that our approach is essentially empirical aiming not at treating the theme theoretically. There are four sections besides this introduction. In the next, we undertake a brief review of the concept of convention, mainly based on Keynes's contribution. In section 3, literature on the Taylor rule is reviewed. In section 4 formation of Selic rate is modeled by estimating a BCB's reaction function based on a *modified* version of Taylor rule. The term modified refers to an important innovation with respect to reviewed literature: the inclusion of a measure of international interest rate in the original equation. Based on estimated results, an evaluation is made of the conduction of Brazil's monetary policy, after the adoption of IT. In

¹ It is also important to observe what happened to the volatility of the interest rate, which has gone down, because now the exchange rate absorbs some of the shocks. But in Keynes's theory, a stable interest rate is important to preclude bearish speculative demands for money (the people that demand money because they expect interest rates to rise and so securities prices to go down).

section five, we argue that empirical evidence seems to corroborate the pro conservative convention. Section six brings our conclusions.

2 – Convention: a brief review

2.1 – Keynes' contribution

The concept of convention plays an essential role in Keynes's theory given his understanding that in a capitalistic society² some relevant political, social and economic variables are uncertain. According to Davidson (2002), Keynes in particular assumes implicitly that an *entrepreneurial economy* is characterized by a *nonegordic* stochastic process.³ In it, “decision makers ‘know’ that they cannot reliably predict the future on the basis of any statistical analysis of past market data” (Davidson, 2002, p. 52). Agents' behavior is based on expectations that they form “creating” the inexistent information they need to take their decisions. Particularly, there is not sufficient knowledge to determine the mathematical expectation of the yield of an *investment*.⁴ Convention is fundamental in this context: it is one of the devices employed to circumvent such difficulties. One can argue that Keynes himself did not formulate a definition of convention. Rather, he presented concepts of convention or examples of conventional behavior (Dequech, 2011; Davis, 1997; 2005). Nevertheless, some authors consider such formulations as “definitions” of convention. Following Orléan (1986), Dupuy (1989) understand that Keynes formulated two “definitions” of convention.

The first one is used in chapter 12 of *The General Theory* to explain how evaluation of existing “investments” is made in the stock exchange as reflected in the price of shares:

[i]n practice we have tacitly agreed, as a rule, to fall back on what is, in truth, a *convention*. The essence of this convention – though it does not, of course, work out quite so simply – lies in assuming that the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect a change. This does not mean that we really believe that the existing state of affairs will continue indefinitely (Keynes, 1936, p. 152; emphasis in original).

Keynes (ibid., p. 148) has earlier justified this concept of convention as a consequence of the weak confidence in forecasts about the future because they are based on “facts about which our knowledge is vague and scanty” and “for this reason the facts of the existing situation enter, in a sense disproportionately, into the formation of our long-term expectations”. Keynes has later

² For Keynes (1936, p. 162), in it “human decisions affecting the future whether personal or political or economic cannot depend on strict mathematical expectation, since the basis for making such calculations does not exist”. Hicks (1977, p. vii) put it more literarily: “[agents] do not know what is going to happen and know that they do not know what is going to happen. As in history!” This is a nonergodic concept of uncertainty although Hicks did not know this when elaborated it. What he revealed to Davidson (2002, p. 52) in a 1983 letter: “You have now *rationalized* my suspicious, and have shown me that I missed a chance of labeling my own point of view as *nonergodic*” (emphasis in original).

³ “Keynes implicitly rejected the classical ergodic axiom... With the later development of the theory of ergodic stochastic process analysis, it is possible now to interpret Keynes's uncertainty concept in terms of this stochastic process” (Davidson 2002, p. 52). See also Carvalho (1992, ch. 3 and 4) and Dequech (2003, 2011).

⁴ Keynes uses the term “investment” to designate not only the purchase (or own production) of capital asset, but also the purchase of financial asset, as of a share in the stock market (e. g., 1936, pp. 157-158).

emphasized that, having to act without knowing what the future is likely to be, agents need to assume some hypothesis about the future which is, in fact, a convention: “[w]e tend, therefore, to substitute for the knowledge that is unattainable certain conventions, the chief of which is to assume, contrary to all likelihood, that the future will resemble the past” (Keynes, 1973, p. 124).

The propensity to follow the majority or average opinion is what Orléan (1986) and Dupuy (1989) consider Keynes’s second “definition” of convention: “[t]he psychology of a society of individuals each of whom is endeavoring to copy the others leads to what we may strictly term a *conventional judgement*” (Keynes, 1937a, p. 214; emphasis in original). This concept of convention or example of conventional behavior is firstly mentioned in the *General Theory*⁵ to describe the logic of financial speculation metaphorically illustrated by the beauty contest “in which the competitors have to pick out the six prettiest faces from a hundred photographs, the prize being awarded to the competitor whose choice most corresponds to the average preferences of the competitors as a whole” (1936, p. 156). In such situations which do not provide common references to the agents, as prevails in the financial markets, Keynes (1937a, p. 214) prescribes that the only rational behavior is to follow the others: “[k]nowing that our own individual judgment is worthless, we endeavor to fall back on the judgment of the rest of the world which is perhaps better informed. That is, we endeavor to conform to the behavior of the majority or the average”. In sum, “imitation” (Dupuy, 1989) or “informational mimetism” (Orléan, 1986; 1999) is Keynes’s second “definition” of convention.

Dequech (2011, p. 482) proposes that Keynes has just formulated an “implicit concept” which, nevertheless, incorporates the essential features of a general concept of convention: social sharing, conformity with the conformity of others and arbitrariness. The first one means that a convention is an *institution* or “a socially shared pattern of thought (and possibly of behavior)” (Dequech, 2009, p. 73). The second implies that people follow a convention for, partially at least, others (are expected to) follow it. Arbitrariness denotes that a pattern which is not perceived as evidently inferior to the one being followed may replace it. Keynes (1936) maintains that, in the case of a decision to buy capital goods, arbitrariness is mainly due to uncertainty, that is, the precarious basis of knowledge for estimating its prospective yield. Concerning the decision to buy a share, precariousness is accentuated by the fact that its conventional valuation “is established as an outcome of the mass psychology of a large number of ignorant individuals” (ibid., p. 154). Thus, “[it]is liable to change violently as a result of a sudden fluctuation of opinion due to factors which do not really make much difference to prospective yield; since there will be no strong roots of conviction to hold it steady” (ibid, p. 154).

⁵ For Davis (1997, p. 150), “Keynes’s post-*General Theory* writings do not add significantly to our understanding of Keynes’s thinking on the subject [convention]”.

In chapter 15 of *The General Theory* (“The Psychological and Business Incentives to Liquidity”), Keynes focuses on the phenomenological aspects of the rate of interest. He firstly affirms that the rate of interest is a psychological phenomenon but, at the end, he concludes: “[i]t might be more accurate, perhaps, to say that the rate of interest is a highly conventional, rather than a psychological, phenomenon” (ibid., p. 203). Conclusion based on the following reasoning. A monetary policy which public opinion judges as having an experimental nature or is easily subject to change may not achieve the aimed level of the rate of interest. But, it “may prove easily successful if it appeals to public opinion as being reasonable and practicable and in the public interest, rooted in strong conviction, and promoted by an authority unlikely to be superseded” (ibid., p. 203). Summing up, the rate of interest is greatly conventional “for its actual value is largely governed by the prevailing view as to what its value is expected to be” (ibid, p. 203).

Another relevant question to face is whether a convention has a short or a long life. As mentioned above, Keynes’s financial convention is precarious and liable to drastic changes. However, although arbitrary, it is not *always* fragile and, eventually, short-lived. There is also the possibility of it being long-lived. In the case of the rate of interest Keynes has firstly asserted that “[a]ny level of interest which is accepted with sufficient conviction as *likely* to be durable *will* be durable” (ibid., p. 203; emphasis in original). Proposition which has been reinforced by the following statement:

(...) it [the rate of interest] may fluctuate for decades about a level which is chronically too high for full employment; – particularly if it is the prevailing opinion that the rate of interest is self-adjusting, so that the level established by convention is thought to be rooted in objective grounds much stronger than convention (...) (ibid., p. 204).

But, as we have already remarked, Keynes calls attention to the possible short-duration of a convention emphasizing the usual link between the precariousness of the basis of knowledge on which it is built and its short life. A few lines after the text last quoted he also asseverates that “the convention is not rooted in secure knowledge” (ibid., p. 204). This warning is taken for granted in a very relevant statement about monetary policy – that precariousness may favor monetary authority in its aim of reducing the long term rate of interest in order to achieve full employment:

(...) precisely because the convention is not rooted in secure knowledge, it will not be always unduly resistant to a modest measure of persistence and consistency of purpose by the monetary authority. Public opinion can be fairly rapidly accustomed to a modest fall in the rate of interest and the conventional expectation of the future may be modified accordingly; thus preparing the way for a further movement (...) (ibid, p. 204).

For Keynes, an interesting example of this expected result was given by what happened in Great Britain when she left the gold standard. According to him, “major movements were effected by a

series of discontinuous jumps, as the liquidity function of the public, having become accustomed to each successive reduction, became ready to respond to some incentive in the news or in the policy of the authorities” (ibid, p. 204).

Finally, it is worth mentioning that as proposed by Davis’s (1997, p. 155), Keynes “did not go very far in *The General Theory* towards explaining the various different ways in which conventions operated and changed” and, more specifically speaking, he believes that Keynes “would have at last attempted to say more about how confidence affects stability or instability of convention governing investment”.

2.2 – The case of Brazil: the problem of high interest rates and the overvaluation of real

The concept of convention may be useful in explaining the long lasting high levels of Selic rate, as proposed by Bresser and Nakano (2002), Nakano (2006), Erber (2008a; 2011), Chernavsky (2007, 2008) and Corrêa (2011).⁶ Since 1995, Brazilian inflation has been under control (it averages 7.5% p.y. from 1995 to 2010) and in 1999 current account deficit was offset and after 2000 government started generating a primary surplus (that peaked almost 4% of GDP in 2005). Nevertheless, these highly positive results were not sufficient to determine a *substantial* reduction of the basic interest rate. That is, the economic fundamentals seem not to be the reason why the Selic rate remains at a still very high level. There must be other reasons to help understanding this awkward fact, and the concept of convention may help to find them.

Bresser-Pereira and Nakano (2002) originally sought inspiration in the concept of convention to explain the maintenance of Selic rate at excessively high levels. They suggest that a convention was established according to which “after the lasting maintenance of interest rate in very high levels it is natural that a fear of reducing it arises, and so this level becomes a convention. Now, this is a perverse convention, and needs being overcome” (p. 169, our translation).

According to Nakano (2006), inflation was then under control, there was no demand pressure – unemployment was high, industrial production was falling and fiscal primary surplus was 5% of GDP. The international conjuncture was also highly favorable: the world economy was growing, international liquidity conditions were propitious, Brazil’s sovereign risk was at its lowest historical level and current account surplus reached US\$ 13 billions. In sum, economic fundamentals and external conditions were exceptionally suitable for a sharper decrease of Selic. However, BCB didn’t take advantage of this conjuncture. For Nakano (ibid.), the too slow process of Selic rate reduction started in 2005 would only be justified by BCB’s acceptance of the convention that i) there was a considerably high floor for the Selic nominal rate of around 14% p.y.; and ii) monetary policy should be based on a Taylor rule, aligned with the New Consensus on Monetary Policy, in

⁶ For the debate on the so called “problem of interest rate” in Brazil, see Modenesi and Modenesi (2012).

order to smooth interest rate movements (more details on section 3). Nakano concludes his analysis hopelessly: “None of this makes much sense in the present conjuncture” (2006, p. A-12, our translation).

It seems that in Nakano’s argument is implicit the idea that, having put inflation under control through the imposition of high levels of interest rates, economic agents, BCB among them, came to share a convention that lower interest rate levels (in line with the rates of low-inflationary economies) would jeopardize the economically and socially costly process of price stabilization initiated with the Real Plan in 1995. In effect, the memory of the undesirable consequences of inflation – above all one that has been close to hyperinflation for a long lapse of time – arose a socially shared feeling that a fast lowering of interest rates would represent the threat of the return of the old times, which nobody would like to go through ever again. So, given that uncertainty makes it foolish to believe that one can forecast the true consequences of a decision to accelerate the fall of interest rates, agents eventually agreed on the convention that keeping them at high levels was the best course of action for Brazilian economy.

Summing up in Keynesian terms, this is a typical case in which, believing their knowledge to be insufficient to form true expectations, agents establish the convention “contrary to all likelihood, that the future will resemble the past” (Keynes, 1973, p. 124). We agree with Correa (2010)⁷ that this convention has the three main features of a general concept of convention as proposed by Dequech (2009, 2011), that is to say: social sharing, since the understanding that Selic must remain at high levels is clearly a socially shared pattern of thought; conformity with the conformity of others, which implies that each agent is in favor of high levels of Selic, partially at least, because others also are; and arbitrariness: given the lack of knowledge or uncertainty about the consequences of a faster process of Selic reduction, agents prefer the slow course despite of the fact that “there is no parallel in the history of mankind of countries that have practiced, during such a long period, interest rates so high as in Brazil” (Nakano, 2005, p. 10; our translation).

Nowadays, a growing number of economists are recognizing the arbitrariness of the high levels of the interest rates, among them some that were policy-makers when the Selic was subject to a major overshooting, with the launching of Real Plan in 1995. A good example is Bacha (2010, p. 1; our translation) who wrote:

The interest rate in Brazil is 5,5% per year being, thus, with an extremely high probability, out of the distribution that generates the real interest rates in the other countries of the world. Since 1999, the macroeconomic triad – primary surplus, flexible exchange and inflation targeting – allows reducing

⁷ For Correa (2010) it is not trivial to sustain the thesis that a convention determines the Selic. Notwithstanding, she eventually identifies in the Selic formation process the three essential features of a convention. She aims at demonstrating the conventional character of the Selic formation under IT, not explaining why its levels are high.

real interest rates. But this movement has been insufficient to put them in the pattern of the other countries.

Erber (2008a, 2008b, 2011) resorts to an innovative approach when he states that such an excessively tight monetary policy can only be understood through the prism of political economy. The question is not merely macroeconomic but the result of a coalition of interests revolving around the maintenance of interest rate at high levels. In his own words:

(...) a coalition of interests was formed, structured by the public debt and the high interests earned on such debt. Such coalition operates under a tacit agreement that the Brazilian state has to pay high interests. In other words, there is a convention firmly grounded on powerful interests about the payment of interest rates. (...) what counts is the convention that interests are due (2008a, p. 34).

He also remarks that the overvaluation of real is another pillar of the coalition of interests favoring BCB conservatism: “[t]he exchange rate appreciation is the Siamese-sister of high interest rates”. As Erber (2011, p. 16) emphasizes, the long lasting appreciation of Real has significantly benefited importers of goods and services, consumers and enterprises; and the two sisters act in the benefit of “companies that are able to access external credit and all who want to send resources abroad, either for investment (especially commodity producers) as interest, profits and dividends”. For him, this convention favors not only the agents of the financial markets, the “rentiers” and financial institutions, with high earnings derived from high interest rate payments, but also the BCB itself, which collects as a benefit the reputation of being able to achieve his targets. As he says:

There is, thus, an ample and powerful constellation of interests structured along the time around the combination of high interest rates-overvalued currency, which established the convention that these elements are essential for the country’s development.... This coalition of interests has powerful instruments to consolidate and diffuse its convention of development. The most explicit is in the hands of the financial system, as was demonstrated by the crisis of the second semester of 2002, which so effectively tamed the expectations of the incoming government. But there are other instruments, more subtle, as the financing of political campaigns, the relations with the members of the Congress, the “bureaucratic-entrepreneurial rings” (...) and the relations with the media which diffuse the convention of stability. The Central Bank is a necessary member of this coalition (...), without this implying, necessarily, a “capture” of BC by the financial system in the sense of “public choice”. For the establishment of the coalition and of the convention that serves as its social representation, it is enough that BC and the private sector members together derive benefits from this policy – in this case, the prestige of achieving the targets and the profits derived from the high level of interests and the from the overvalued currency (Erber, 2011, pp. 43-4; our translation).

Also for Chernavsky (2007, 2008), the orthodox theory has revealed incapable of explaining the exceptionally high levels of the real Selic. He affirms that under IT regime, mainly in the case of Brazil, the interest rate does not reflect the economic fundamentals but a convention among the relevant agents about the levels proper for their expectations to get close to the target, and for keeping inflation controlled.

Finally, as pointed out by Stiglitz (2008), monetary policymaking has historically been subject to “fads and fashions”. In Keynesian terms, we may properly say that anti-inflationary policy has been marked by different conventions according to which a specific monetary regime is seen as the best one and offers a simple way – the use of a single instrument – of controlling inflation.

In fact, monetary regimes’ history has three paradigmatic moments. The gold standard was the conventional policy of the late 19th and early 20th centuries. In the 1970’s and early 1980’s, the conventional policy was the use of monetary aggregates targets – prescribed by Friedmanian monetarism. After the 1990’s, IT (and the belief that interest rate is the *unique instrument* apt to curb inflation) has been the conventional regime prescribed by the New Consensus on Monetary Policy. None of them is rooted in solid theoretical grounds or robust empirical evidence. Nevertheless all of them were, at their time, a socially shared truth, considered to be *the* correct way of conducting monetary policy. In Stiglitz’s view:

[t]he World’s central bankers are a close-knit club, given to fads and fashions. In the early 1980’s, they fell under the spell of monetarism, a simplistic economic theory promoted by Milton Friedman. After monetarism was discredited – at great cost to those countries that succumbed to it – the quest began for a new mantra. The answer came in the form of “inflation targeting,” which says that whenever price growth exceeds a target level, interest rates should be raised. This crude recipe is based on little economic theory or empirical evidence; there is no reason to expect that regardless of the source of inflation, the best response is to increase interest rates. One hopes that most countries will have the good sense not to implement inflation targeting; my sympathies go to the unfortunate citizens of those that do. Among the list of those who have officially adopted inflation targeting (is) Brazil (Stiglitz, 2008).

3 – The Taylor Rule: a Brief Review

The Taylor rule, a keystone of the the New Consensus on Monetary Policy (NCMP), holds that the central banks should determine interest rate aiming at an (explicit or implicit) inflation target, and keeping GDP growth near its potential. NCMP represents the new conventional way of understanding the macroeconomic phenomena and thus offers the new conventional way of dealing with macroeconomic issues (e.g. inflation and unemployment) (Blinder, 1981; 1997; Taylor, 2000; Allsopp e Vines, 2000; Romer, 2000). It emerges from the growing popularity of IT regime and the resulting acceptance that, even where this regime is not adopted, the main instrument of monetary

policy is the interest rate, and no longer the monetary aggregates of some decades ago, as proposed by Friedmanian monetarism.

Taylor (1993) suggests that the conduction of monetary policy should be modeled by a feedback rule that (positively) relates the overnight rate to output gap and to the deviation of inflation from its target. He proposes that the Federal Reserve determines the Fed Funds rate in accordance with the following reaction function:

$$i_t = \alpha_1 + \alpha_2(\pi_{t-1} - \pi^*) + \alpha_3 y_t, \quad \alpha_1 = \pi_{t-1} + \bar{i} \quad (1)$$

In which: i_t , is Federal Funds rate; \bar{i} , is long-run equilibrium real interest rate; π_{t-1} , is inflation rate (past year); π^* , is inflation target; and y_t , is percent deviation of GDP from its trend. Considering that the real GDP trend in the USA (between the first quarter of 1984 and the third quarter of 1992) was of 2.2%, with an inflation target of 2%, the author holds that equation (1) should show the following parameters:

$$i_t = \pi_{t-1} + 2 + 0.5(\pi_{t-1} - 2) + 0.5 y_t \quad (2)$$

According to equation (2), the FED Funds rate raises when: i) inflation increases above the (2% per year) target; and/or ii) the GDP rises above its trend (target). If both rates – of inflation and of GDP growth – are equal to their respective targets, the interest rate is maintained (by construction) at 4% per annum (or 2% in real terms). A rise in inflation generates a (positive) response more than proportionate to interest: higher inflation is reflected in an amplified real interest rate. Taylor points out that the coefficients of equation (2) were chosen by him in informal judgment, and does not hide his surprise in finding that it represents fairly well the interest rate trajectory from 1987 to 1992.

Although the Taylor rule describes very well the behavior or the interest rate in the USA, it doesn't incorporate what orthodoxy stresses as a stylized fact – which we may properly call a convention – of contemporary monetary policy conduction: central banks tend to calibrate basic interest in a smooth and continuous way. Monetary authorities are, in fact, usually contrary to interest rate shocks: inflation and/or GDP deviations from their targets don't usually lead to drastic and immediate reaction from monetary authorities, who prefer correcting them gradually (Goodfriend, 1987; Mankiw & Miron, 1991; Rudebusch, 1995; Thorton, 2004).

According to orthodox theory, some of main reasons for the high degree of interest rate serial correlation are: i) the fear that abrupt movements of interest may lead to crises in the financial markets (Goodfriend, 1991); ii) and the uncertainty regarding the effects of interest rate variations (Sack, 1997). In the first case, the central banks would act gradually in order to avoid a financial crisis resulting from an interest rate shock. In the second case, due to imperfect knowledge of the monetary policy transmission mechanism, the central banks would base their decisions in a sequential trial-and-error process that would smooth down interest rate movements. Clarida, Galí

and Gertler (1999) incorporate this convention and propose a major modification of Taylor's rule (1993), with the introduction of a smoothing term (or an autoregressive component) that may capture the relation between the interest rate and its past values. Thus, the (current) interest rate equals its lagged value, plus a Taylor component, as represented in equations (3) and (4):

$$i_t = \alpha_1 i_{t-1} + (1 - \alpha_1) i_t^* \quad (3)$$

$$i_t^* = \alpha_2 + \alpha_3 (\pi_{t+1}^E - \pi^*) + \alpha_4 y_{t+1}^E \quad (4)$$

$$\alpha_1 \in (0,1), \alpha_2 = \pi^* + \bar{i}, \alpha_3 > 1, \alpha_4 > 0$$

Replacing (3) by (4), we have:

$$i_t = \alpha_1 i_{t-1} + (1 - \alpha_1) [\alpha_2 + \alpha_3 (\pi_{t+1}^E - \pi^*) + \alpha_4 y_{t+1}^E] \quad (5)$$

Parameter α_1 represents the degree of *smoothing* of interest rate changes. The higher its value, the greater the inertia (or serial correlation) of the interest rate. One should note that equation (5) is a more general formulation than what Taylor originally proposed: if $\alpha_1 = 0$, equation (5) is reduced to equation (1). In this case, interest rate is adjusted immediately: there is no smoothing. In opposition, if $\alpha_1 \rightarrow 1$, the interest rate comes near a first-order autoregressive process. As we will show in section 4, BCB's reaction function is similar to this case. If $\alpha_3 < 1$ or $\alpha_4 < 0$, equation (5) is said to be destabilizing as regards both inflation and the GDP (Clarida, Galí and Gertler, 2000). In the first case, the central bank let real interest rate decline as inflation rises. In the second case, monetary policy is procyclical: a greater growth of the GDP (as regards its potential) is accompanied by a drop in interest.

Equation (5) represents a forwardlooking-type rule as opposed to Taylor's (1993), which is backwardlooking. According to (5), interest rate rises as a response to a rise of inflation expectation (π_{t+1}^E) and of the expected output gap (y_{t+1}^E). This formulation is more explicit in incorporating the conception that the existence of lags in the conduction of monetary policy (Friedman, 1948) requires a prospective behavior by the central bank. It is indeed a more general formulation, allowing monetary authorities to base their expectations on a wider set of information, and not just on the lagged values of the studied variable. However, this is not a substantial difference, as the lack of a reliable antecedent indicator for inflation, its lagged values may be a good proxy for future inflation.

Clarida, Galí and Gertler (1999) apply equation (5) to the American economy in the years 1960 to 1996. Table 1 shows the values of the parameters estimated for two sub-samples, the pre-Volcker era (between the first quarter of 1960 to the second quarter of 1979) and the Volcker-Greenspan era (between the third quarter of 1979 to the fourth quarter of 1996).

Table 1 – FED’s Reaction Function: 1960: T1 to 1996: T4

Period	AR (1) (α_1)	Inflation (α_3)	GDP (α_4)
Pre-Volcker	0.68 (0.05)	0.83 (0.07)	0.27 (0.08)
Volcker- Greenspan	0.79 (0.04)	2.15 (0.40)	0.93 (0.42)

Standard error in parentheses. Source: Clarida, Galí and Gertler (1999)

Clarida, Galí and Gertler (2000) conclude that in the era before Paul Volcker, monetary policy was strongly accommodating. On average, the real interest rate declined as the inflation expectations rose ($\alpha_3 = 0.83$). In the Volcker and Alan Greenspan era, in contrast with the preceding period, the FED adopted a clearly pro-active attitude. On average, the real interest rate rose together with the inflation expectations ($\alpha_3 = 2.15$).

The aforementioned articles are main references in a vast bibliography that is not of specific interest for this paper. The volume organized by Taylor (1999) is a good collection of the vast literature (mostly orthodox) on the subject. Haight (2008) presents a Post Keynesian critic of what he correctly identify as being the essence of the Taylor rule – the proposition that interest rates should be always raised (reduced) proportionally more than a given rise (fall) in inflation rate. For a review on the critical literature on the Taylor (and the NCPM), see Rochon (2006).

Especially after the adoption of IT, estimates of Taylor rule were made for the Brazilian economy, amongst which we must note the works by Figueiredo and Ferreira (2002), Minella *et al.* (2002), Favero and Giavazzi (2002), Mendonça (2007), Gonçalves and Fenolio (2007) and Modenesi (2011).⁸

In brief, Brazilian literature provides strong evidence that BCB interest rate policies follow a Taylor rule. Since the adoption of IT in mid-1999, BCB has been acting proactively in regard to inflation. There is strong evidence that a rise in inflation generates a more than proportional response from Selic: the coefficient of inflation deviation *vis-à-vis* its target varies from 1.1 (Figueiredo and Ferreira, 2002) to 1.94 (Favero and Giavazzi, 2002). However, there is only weak evidence showing that BCB reacts counter-cyclically to the output gap, as was to be expected. Only few works include this variable in their regressions. For instance, Minella *et al.* (2002) find that the output gap is not significant or does not have the expected sign. Gonçalves and Fenolio (2007) and Modenesi (2011), in their turn, show that BCB reacts to output gap: although the corresponding coefficient has the expected sign it is not strongly statistically significant. There is also evidence that the equilibrium interest rate is quite high and that BCB has been practicing a high level of

⁸ Before adoption of IT, Andrade and Divino (2001) use a sample that goes from 08/1994 to 03/1999; Salgado, Garcia and Medeiros (2005) deal with the 07/1994-12/2000 period. Muinhos (2004) estimates a Taylor rule amplified by the inclusion of the exchange rate – proposed by Ball (2000) – in a paper aimed at evaluating the Brazilian economy’s pass through after the January 1999 devaluation. On the importance of the exchange rate to emerging economies that practice IT, see Mishkin (2000).

interest rate smoothing. However, the reviewed literature presents one major empirical problem: the great majority of the papers uses extremely small samples, going from only 28 to 71 observations.⁹ This definitely jeopardizes the results robustness.

4 – A Modified Taylor Rule in 11 years of Inflation Targeting (2000-2010)

4.1 – Data base, functional form, and unit root test

The adoption of IT in June 21, 1999, represents an important structural break, resulting in deep changes in the conduction of monetary policy, which until then was based on an exchange rate targeting regime (Modenesi, 2005: chap. 4 and 5). For this reason, we have decided to exclude the first six months of IT adoption from the sample, which therefore comprehends the period from January 2000 to December 2010. There were 132 monthly observations, a number much higher than those of the aforementioned works. Thus, our estimates are considerably robust.

With the purpose of evaluating BCB behavior during the adoption of IT, a backward looking *modified* Taylor rule was estimated for the Brazilian economy. The term modified refers to an important innovation with respect to reviewed literature: the inclusion of a measure of international interest rate in the original equation, resulting in model (I):

$$i_t = \alpha_1 i_{t-1} + (1 - \alpha_1) \left[\alpha_2 + \alpha_3 \overbrace{(IPCA_{t-1} - \pi_{t-1}^*)}^{Dipca} + \alpha_4 \overbrace{(Ind_{t-1} - Ind_{t-1}^*)}^{Dind} + \alpha_5 libor_t \right] \quad (I)$$

In which: i_t , is Selic rate (in month t); $IPCA_{t-1}$, is inflation (in the last 12 months before month t); π_{t-1}^* , is inflation target (last 12 months before month t); Ind_{t-1} , is industrial output growth rate (last 12 months before month t), used as proxy for GDP; Ind_{t-1}^* , is potential industrial output growth rate (last 12 months before month t); and $libor_t$, is London interbank rate (in month t). All variables in logarithmic form.¹⁰

The estimates of model (I) presented serial correlation in the residuals, as usually happens. This problem was overcome with the introduction of a second lag of the dependent variable, resulting in model (II):

$$i_t = \alpha_1 i_{t-1} + \alpha_2 i_{t-2} + (1 - \alpha_1 - \alpha_2) \left[\alpha_3 + \alpha_4 \overbrace{(IPCA_{t-1} - \pi_{t-1}^*)}^{Dipca} + \alpha_5 \overbrace{(Ind_{t-1} - Ind_{t-1}^*)}^{Dind} + \alpha_6 libor_t \right] \quad (II)$$

It should be noted that the usual interpretation of the constant term, which according to equation (5) represents the equilibrium interest rate (Item 3.2), does not apply here. In our model the

⁹ Although Mendonça (2007) works with 71 observations he includes the year of 1999, a period of transition between two different monetary regimes, what also makes his results less robust. As an exception, Modenesi (2011) works with 96 observations not including the year of 1999.

¹⁰ Where $\ln(y_t) = \ln(y_t + 100)$. Note that the estimated coefficients represent the variable-elasticity of Selic. The Selic rate is set by BCB. The index for industrial production and IPCA are given by IBGE. The potential industrial output growth rate is given by the HP filter. The Libor is the short-term interest rate of United Kingdom and is provided by Ipeadata.

equilibrium interest rate is broken down into two components: i) what we may call the *pure domestic* equilibrium interest rate (α_3) in equation (II); that should be added to ii) an *external* component, given by (a fraction of) the international interest rate ($\alpha_3 \text{libor}_t$). This innovation reflects the fact that in an open small economy, like Brazil, domestic interest rate are not set independently of the external rate (accordingly with the so called interest rate parity rule).

Table 2 shows the results of Augmented Dickey-Fuller (ADF), DF-GLS and KPSS tests.¹¹ Given the well-known low power of unit root tests (Elder and Kennedy, 2001), we report the results of three different tests to give more robustness to the analysis. In face of the provided set of evidence we will take all series as stationary (alike all literature reviewed above)¹².

Table 2 – Unit Root Tests

Variable	ADF (Statistic t)	ADF-GLS (Statistic t)	KPSS (LM Statistic)
<i>Selic</i>	-2.430142	-2.026433*	0.992916*
<i>Dipca</i>	-3.259937*	-3.202539*	0.323417
<i>Dind</i>	-2.952180*	-2.319252*	0.045902
<i>libor</i>	-1.221146	-0.267400	0.687763**

*Reject H_0 at 5% level of significance. **Reject H_0 at 5% but not at % level. See Hamilton (1994).
Source: authors elaboration

4.2 – Results

Table 3 shows the main results of the three variants of model (II). They are different only as regards to the lags of the output gap (*Dind*): the first line shows its present value; the second line, its lagged value; and the last line, the second lag.

Table 3 – Estimates of BCB's Reaction Function (AR(2)): 2000-2010

Model	AR (1) (α_1)	AR (2) (α_2)	Constant (α_3)	Dipca (α_4)	Dind (α_5)	Libor (α_6)	Adju. R ²
II.1: <i>Dind</i>	1.741124* (0.057716)	-0.774549* (0.053556)	-4.30635*** (2.346044)	0.786957* (0.280995)	0.234580 (0.181230)	0.933836** (0.425894)	0.994631
II.2: <i>Dind</i> (-1)	1.727800* (0.058157)	-0.759561* (0.054423)	-4.30006*** (2.440262)	0.795660* (0.291371)	0.315758† (0.217320)	0.843171*** (0.455975)	0.994696
II.3: <i>Dind</i> (-2)	1.710648* (0.059751)	-0.743240* (0.056317)	-4.31925*** (2.370368)	0.798397* (0.282513)	0.336203† (0.214742)	0.824242** (0.443743)	0.994723

Standard error in parentheses. * Significant at 1%. ** Significant at 5%. *** Significant at 10%. † Significant at 15%.

Source: Authors elaboration

Amongst the three variants in this model, (II.2) has the best statistical properties. Particularly, the Breusch-Godfrey test for serial correlation of residuals (LM) is more favorable to model (II.2) than to (II.3) (Table 4). Therefore, for the purpose of analysis model (II.2) was chosen and will be referred to simply as “the model”. It represents very fairly the behavior of BCB. This high

¹¹ All tests have been made using the test equation with an intercept and without a trend. As Elder and Kennedy (2001) have suggested, this option results from the observation of the graphics of the series, which does not present a clear trend.

¹² At a first sight the results are not very conclusive. Notwithstanding, for all variables, at least one of the performed tests indicates stationarity. Taking into account the usual low power of these tests we can accept that all series are stationary.

adherence results from a high adjusted R^2 (0.99), as can also be verified in the reviewed articles (between 0.92 and 0.98).

Table 4 – Breusch-Godfrey Test for Serial Correlation (LM): Model II Class

Model	Lags	F Statistics	Probability	Obs. R^2	Probability
I.1: <i>Dind</i>	2	1.684850	0.196671	1.755539	0.185182
II.2: <i>Dind</i> (-1)	2	2.039466	0.155757	2.119101	0.145472
II.3: <i>Dind</i> (-2)	2	3.601762	0.060025	3.696937	0.054512

Source: Authors elaboration

As the model was estimated for a sample and an equation considerably different from the reviewed works, the results are also different. The main difference regards the degree of inertia of interest rate changes, which is extremely high. As seen in (item 3.2), interest rate inertia is measured by the weight of the parameters of the autoregressive component(s). In the estimated model, the sum of the coefficients of the two autoregressive terms approaches 1 ($\alpha_1 + \alpha_2 = 0.97$), meaning a very high degree of interest rate autocorrelation. In the reviewed works, the weight of the autoregressive component(s) is lower, varying between 0.72 and 0.92.

A high degree of interest smoothing means reduced sensibility to the state of domestic economy. In other words, in determining Selic, BCB barely takes into account the inflation (*Dipca*) and output (*Dind*) gaps. Intuitively, this shows that, even in the face of a significant drop in inflation and/or a drastic slowing down of the economy, BCB acts very gradually, reducing interest much too slowly and by much too little.

The insensitiveness of BCB is more serious regarding the output gap. As in the reviewed articles, BCB seems not to pay much attention to output gap: its coefficient is statistically significant only at 15% percent level of significance and has very low magnitude ($\alpha_5 = 0.316$). The sensitiveness of BCB to inflation gap ($\alpha_5 = 0.796$) is highly statistically significant (at 1%). Similar results were also found by Modenesi (2011). The novelty presented here is the evidence that BCB reacts to foreign interest rate when fixing Selic rate. *Libor* coefficient has a relatively high magnitude ($\alpha_6 = 0.843$) and is statistically significant at 10% level of significance.

Finally, as long as the estimated model refers to variables in logarithm, the constant obtained above is meaningless. Howsoever, through a simple algebraic manipulation we can obtain what we call *pure domestic* equilibrium interest rate. As in all reviewed articles, the constant is positive and high ($\alpha_3 = 10.07$), showing a very high level of what we define as the *pure domestic* equilibrium interest rate. As mentioned above, the usual interpretation of the constant term does not directly apply here: this level is lower than in the reviewed articles because we have controlled for foreign interest rates (see Section 5 for the intuition behind). The high magnitude of the constant term is a fundamental brand of conservatism that marks monetary policy in Brazil.

5 – The Pro-Conservatism Convention in Monetary Policy

Evidence presented in section 4 seems to corroborate the thesis according to which there is a pro conservative convention in the formation of Selic rate. Empirical results allow us to conclude that monetary policy is marked by an excess of conservatism. Evidence was provided showing that BCB sets the Selic rate based in a Taylor rule, aligned with the NCMP. Besides that BCB's reaction function has three distinctive features: 1) a high weight of autoregressive components; 2) a high level of the *pure domestic* equilibrium interest rate. This term is added to the *external* component, meaning that BCB sets Selic rate aiming at maintaining 3) a very high differential between domestic and foreign interest rates.

As proposed by Nakano (2006), BCB strictly follows a Taylor rule, a key element of the pro conservative convention favoring high interest rates in Brazil (Item 2.2). The use of a Taylor rule “ties the hands” of BCB and implies that it does not target another variable than inflation. Additionally, interest rate is considered the unique instrument that should be used to maintain price stability. Consequently, the complexity of inflation dynamics is put aside: inflation is conventionally considered to be a demand phenomenon – always and everywhere as proposed by Friedman (1968). Besides that, BCB's reaction function parameters are quite singular. For instance, they differ significantly from the ones estimated for the US by Clarida, Galí and Gertler (1999).

The first distinctive parameter implies that BCB has stretched much too far the orthodox convention that interest movement should be gradual. It has practiced smoothing to an extremely high degree, as measured by the high weight of the estimated autoregressive components. The weight of autoregressive components in BCB's reaction function ($\alpha_1 + \alpha_2 = 0.97$) is considerably higher than the weight of the autoregressive component in the FED's reaction function, whether in the pre-Volcker era ($\alpha_1 = 0.68$) or in the Volcker-Greenspan period ($\alpha_1 = 0.79$). As mentioned (items 3.2 and 4.2), the counterpart of the high weight of the autoregressive component is the little importance BCB gives to the state of domestic economy. In the Brazilian case, monetary authority is insensitive notably to the behavior of inflation and to the level of activity ($1 - \alpha_1 - \alpha_2 = 0.03$); unlike the FED, who pays more attention to the economic situation ($1 - \alpha_1 = 0.21$) when it makes any decision.

To say that the BCB conducts monetary policy based on the orthodox convention that interest rate movements should be smooth is nothing new. The agency openly defends this position and the BCB's conservatism is of public domain. Its past chairman remarked, for instance, that: “[the] most prudent attitude seems indeed to adjust the variables more gradually than would be the case if there was complete certainty regarding the economy and the parameters” and, as a consequence, “gradualism will minimize the chance of monetary policy undergoing sudden reversion” (Meireles *Apud* Ribeiro, 2008). What *does* surprise is the BCB's degree of conservatism. The results

submitted show us a Central Bank that is extremely loath to make any movement – however small – in interest. BCB virtually does not take the state of domestic economy into account. In short, changes in interest only happen in an excessively gradual rate (accordingly to Nakano, 2006).

The high inertia of Selic can also be seen in Table 5, which shows absolute variations in Selic rate by magnitude. Indeed, BCB was highly reluctant to alter Selic by more than 0.5 p.p. each time. From January 2000 to December 2010, the Committee met 118 times (ordinarily and extraordinarily). Most of the times BCB kept Selic unchanged. Variations of up to 0.5 p.p. represent 79% of the total of changes. The rate was raised more than 1.0 p.p. in less than 7% of the Committee's meetings. No changes were higher than 3.0 p.p., and changes of 3.0 p.p. of magnitude happened in only 2% of the meetings. (Note that as Selic averaged 15.7% p.y. a change of 0.5 p.p. is irrelevant).

Table 5 – Selic Variations by Magnitude: 2000-2010

Absolute Magnitude (p.p.)	Absolute Frequency	Relative Frequency	Cumulative Relative Frequency
0.00	48	40.7	40.7
0.25	13	11.0	51.7
0.50	32	27.1	78.8
0.75	9	7.6	86.4
1.00	8	6.8	93.2
1.50	4	3.4	96.6
2.00	1	0.8	97.5
2.50	1	0.8	98.3
3.00	2	1.7	100.0
Total	118	100.0	-

Source: Authors elaboration from data of BCB.

However, inertia is not sufficient to explain the conservatism in monetary policy. In fact, inertia is symmetric: a rise in inflation or in the output gap also does not cause an abrupt and significant hike in the basic rate.

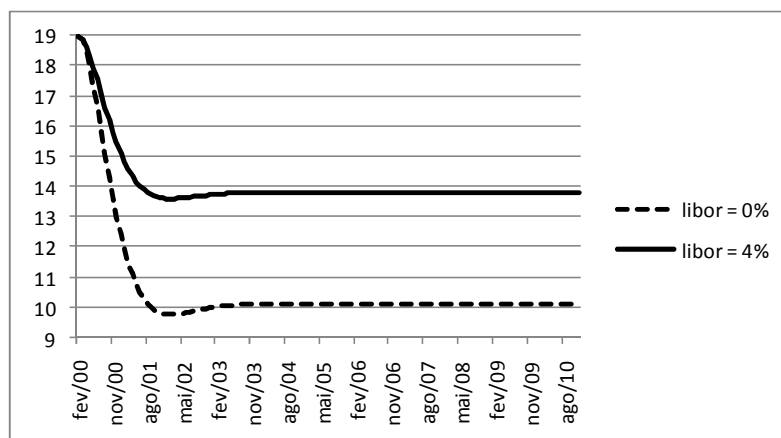
The second distinctive parameter of the estimated reaction function, tells us that BCB is not only averse to change Selic. The main element of his conservatism is the high level of what we call *pure domestic* equilibrium interest rate. The estimated constant term (α_3) is 10.07% p.y., a very high value. It means that if the inflation target is systematically attained ($Dipca = 0$) and output systematically equals its potential ($Dind = 0$)¹³, Selic would converge to 10.1% plus the *external* component, given by a fraction of the actual level of *libor*, *ceteris paribus* (Graph 1).¹⁴ For instance, to achieve the (average) level of interest rates used in developing countries during the analyzed period, around 6.0% p.y., it would be needed a permanent and drastic deflation of 9,5%, *ceteris paribus* (i.e., $Dipca = -9.5\%$, for all t , given the actual behavior of $Dind$ and *libor*). Alternatively, it

¹³ From here, *Selic*, *Dind*, *Dipca* and *libor* refer to the level and not to the logarithmic form.

¹⁴ The simulations presented here assume the constancy of all relevant parameters of BCB's reaction function (model II.2). They do not constitute a model for forecasting the Selic.

would be necessary a huge and perennial output gap of 25%, *ceteris paribus* (i.e., $Dind = -25.0\%$, for all t , given the actual behavior of $Dipca$ and $libor$).

Graph 1 – Simulations of Selic for $Dipca = Dind = 0$



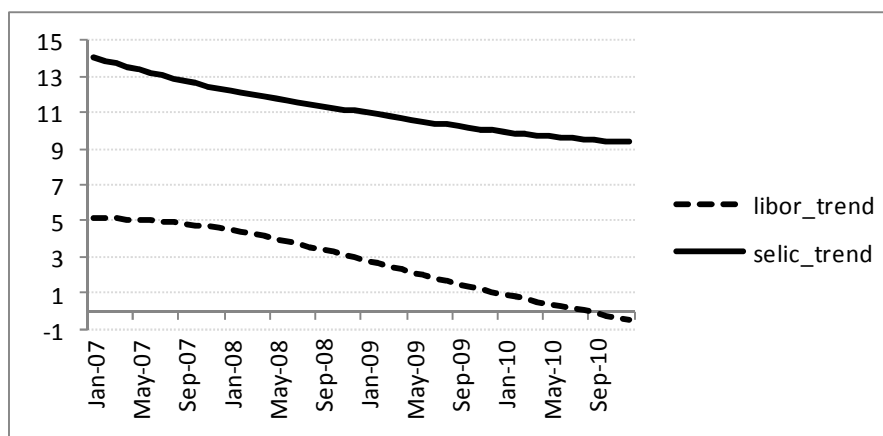
Source: Authors elaboration.

Finally, when setting Selic rate, BCB aims at keeping a interest rate differential (or spread) around 10 p.p. with respect to international interest rate (measured by Libor), which is the third distinguished characteristic of BCB reaction function. The high level of *pure domestic* equilibrium rate – and the relevance attributed to the *external* component by BCB when setting Selic – can also be illustrated by others simulations. If we suppose that both inflation and output gaps and also Libor equal zero ($Dipca = Dind = libor = 0$, for all t), Selic converges to 10.1%, *ceteris paribus* (dashed line in Graph 1). Alternatively, if both inflation and output gaps equals zero and if *libor* equals 4.0% ($Dipca = Dind = 0$ and $libor = 4\%$, for all t), Selic converges to 13.8%, *ceteris paribus* (solid line).

It is worth to note that our results contradict the current widespread idea that the Brazilian equilibrium interest rate has recently experienced a sharp decline (especially after 2008). According to our model, the reduction of Selic reflects the *abnormal* decline of foreign interest rates – following the subprime crisis. The *pure domestic* equilibrium interest rate remains stable and very high. The *external* component varies systematically according to BOE's decisions. Remind that amongst the non autoregressive terms, the *libor*-elasticity of *Selic* is the greater. This means that BCB reacts more intensively to changes in foreign interest rates than to changes in output and in inflation gaps. Indeed, we can see in Graph 2 that the recent reduction of Selic rate could be largely attributed to the decline in foreign interest rates – keeping the spread between them roughly constant. Consequently, one can expect that when the international interest rate converges to their *normal* levels, Selic would accordingly be raised by BCB, *ceteris paribus*.¹⁵

¹⁵ We are not saying that if foreign interest rates returns to their normal levels Selic will eventually converge to its average. There are some evidences that BCB has changed its policy under President Dilma's term, begun in 2011. For instance, BCB is using other instruments besides Selic specially the control of credit conditions. At the same time policy mix seems to be also changed. Fiscal policy has been tightened in order to open space for a more flexible

Graph 2 – Trends of Selic and Libor (Hodrick-Prescott filter): Jan/2007-12/2010



Source: Authors elaboration.

As a matter of fact, the maintenance of a high differential between domestic and foreign interest rates has been used by BCB as the main instrument of price stabilization since the adoption of IT. This has two main implications: stimulates large inflow of foreign capital, which finances the balance of payments, and is one of the main causes of the overvaluation of real (Bresser-Pereira, 2010a; 2010b). As pointed out by Erber (2011) the overvaluation of real is the other side of coin of the high level of Selic rate (item 2.2) and a crucial element of the pro-conservative convention of BCB. Indeed, overvaluation of real has been a key element in price stabilization. As Arestis, Ferrari-Filho and Paula (2011), Araújo and Modenesi (2010), and Modenesi and Araújo (2011) among others have shown, the exchange rate has been the main channel of transmission of monetary policy.

6 – Conclusion

This article reinforces and expands the results shown by Modenesi (2011), with the novelty that evidence was provided showing that BCB reacts to foreign interest rates when setting Selic. This means that BCB has reduced autonomy when setting its rate. In this sense, Selic is not only endogenous to domestic conditions (inflation and output gaps) but also to foreign interest rate (measured by Libor).

Summing up, our results can be seen as favoring the thesis according to which BCB policy is ruled by a pro conservative convention materialized in the adoption of a Taylor rule which has three distinctive features: 1) high degree of interest rate smoothness; 2) high *pure domestic* equilibrium interest rate; and 3) high interest rate differential. Items (2) and (3) largely explain the overvaluation of real, a key element of price stabilization in Brazil during the analyzed period.

monetary policy. The prevailing of this new policy mix will imply changes in the parameters of BCB's reaction function.

Our results also seem to contradict the current widespread idea that Brazilian equilibrium interest rate has recently experienced a sharp decline. Accordingly, the reduction of Selic may be largely considered as reflecting the *abnormal* decline of foreign interest rates – resulting from the subprime crisis. In other words, the view that the fall in Selic results from an improvement in the fundamentals of Brazilian economy can be fallacious, according to our model. BCB reacts more intensively to changes in foreign interest rates than to changes in output and in inflation gaps. The recent reduction of Selic rate is largely attributed to the decline in foreign interest rates – keeping the interest rate differential roughly constant. In a few words, BCB has not changed its behavior and one can say that it is still setting Selic based on the so called pro conservative convention.

Finally it must be said that the body of evidence shown, though robust, can be improved. Therefore, a note of caution is warranted concerning the conclusions presented: in the face of the importance of the consequences involved, further studies are still called for.

7 – References

- ALLSOPP, C. e VINES, D (2000), “The assessment: Macroeconomic policy”. *Oxford Review of Economic Policy*, vol. 16 (4), pp. 1-32.
- ANDRADE, J. P., DIVINO, J. A. C.A. (2001), “Optimal rules for monetary policy in Brasil”. Instituto de Pesquisa Econômica Aplicada, *Texto para Discussão*, 806.
- ARAÚJO, E., e MODENESI, A. M. (2010). “Custos e Benefícios do Controle Inflacionário no Brasil (2000-2008): uma análise empírica do mecanismo de transmissão da política monetária com base em um modelo VAR”. *XXVIII Encontro Nacional de Economia* (ANPEC). Salvador, dezembro.
- ARESTIS, P., FERRARI-FILHO, F. & PAULA, L. F. (2011) "Inflation targeting in Brazil," *International Review of Applied Economics*, vol. 25(2), pages 127-148. Taylor and Francis Journals.
- BACHA, E. L. (2010). Além da tríade: há como reduzir os juros? [Beyond the triad: is a way of reducing interest rates?]. Rio de Janeiro: Instituto de Estudos de Política Econômica/Casa das Garças.
- BALL, L. (2000), “Policy rules and external shocks”. *NBER Working Paper series*, 7910.
- BLINDER A.S. (1981), “Monetarism is obsolete”. *Challenge*, Sep-Oct, pp. 35-43.
- _____. (1997), “A Core of macroeconomic beliefs”. *Challenge*, Jul-Au, pp. 36-44.
- BRESSER-PEREIRA, L. C. (2010a) A tendência à sobreapreciação da taxa de câmbio no Brasil. In *Crise Global e o Brasil*, Rio de Janeiro: Editora FGV, 2010. pp: 127-151.
- _____. (2010b) *Doença holandesa e indústria* (org.) Rio de Janeiro: Editora FGV.

- BRESSER-PEREIRA, L. C. e NAKANO, Y. (2002). "Uma Estratégia de Desenvolvimento com Estabilidade". *Revista de Economia Política*, v. 22, n. 3, pp. 146-180, jul./set.
- CARVALHO, F.J.C. (1992) "Mr. Keynes and the Post Keynesians" in Edward Elgar (ed.), *Principles of Macroeconomics for a Monetary Production Economy*. Cheltenham: Edward Elgar.
- CHERNAVSKY, E. (2007). *Sobre a construção da política econômica: uma discussão dos determinantes da taxa real de juros no Brasil*. Dissertação de mestrado. S. Paulo: Universidade de São Paulo/IPE.
- _____. (2008). Taxa natural e convenções: uma discussão dos determinantes da taxa real de juros no Brasil. In: XIII Encontro de Economia Política. João Pessoa.
- CLARIDA, R.; GALÍ, J. & GERTLER, M. (1999). "The Science of Monetary Policy: A New Keynesian Perspective," *CEPR Discussion Papers* 2139, C.E.P.R. Discussion Papers.
- _____. (2000). "Monetary Policy Rules And Macroeconomic Stability: Evidence And Some Theory," *The Quarterly Journal of Economics*, MIT Press, vol. 115(1), pages 147-180, February.
- DAVIDSON, P. (2002). *Financial Markets, Money and the Real World*. Cheltenham: Edward Elgar.
- DAVIS, J. B. (1994). *Keynes's Philosophical Development*. Cambridge: Cambridge University Press.
- _____. (2005). "Keynes on History and Convention," in G. Harcourt and P. Riach (eds.), *A "Second Edition" of the General Theory*, vol. 2., pp. 149-162. London: Routledge.
- DEQUECH, D. (2003) "Conventional and Unconventional Behavior under Uncertainty." *Journal of Post Keynesian Economics*, 26, no. 1, pp. 145-68.
- _____. (2009). "Institutions, social norms, and decision-theoretical norms". *Journal of Economic Behavior* v. 72, pp. 70-78. Available in www.elsevier.com/locate/jeb.
- _____. (2011). "Financial conventions in Keynes's theory: the stock exchange," *Journal of Post Keynesian Economics*, vol. 33, n.3, spring, pp. 469-90.
- DUPUY, J. P. (1989). "Convention and Common Knowledge." *Revue Économique*, vol. 40, n. 2, mars, pp. 361-399.
- ELDER, J. & KENNEDY, P. E. (2001) "Testing for Unit Roots: What Should Students Be Taught?" *Journal of Economic Education*, Helen Dwight Reid Foundation, vol. 32(2), pages 137-146.
- ERBER, F. (2008a), "Development projects and growth under finance domination – the case of Brazil during the Lula years (2003-2007)". *Revue Tiers Monde*, 194 (no prelo).
- _____. (2008b). "The Evolution of Development Conventions". *XII ISS Conference*. Instituto de Economia, Universidade Federal do Rio de Janeiro, Julho.

- _____. (2011). “As convenções de desenvolvimento no Brasil: um ensaio de economia política”. *Revista de Economia Política*, vol. 31(1), Jan-Mar, pp. 31-55.
- FAVERO, C.A., e GIAVAZZI, F. (2002), “Why are Brazil’s Interest rates so High?” Università Bocconi, Innocenzo Gasparini Institute for Economic Research, *Working Paper*, 224.
- FIGUEIREDO, F.M.R. e FERREIRA, T.P. (2002), “Os Preços Administrados e a Inflação no Brasil”. Banco Central do Brasil, *Trabalhos para Discussão*, 59.
- FRIEDMAN, M. (1948), “A Monetary and Fiscal Framework for Economic Stability”. *The American Economic Review*, v. XXXVIII (3), p. 245-264.
- _____. (1968), “The role of Monetary Policy”. *The American Economic Review*, v. LVIII (1), p. 1-17.
- GONÇALVES, C.E.S, e FENOLIO, F.R. (2007), “Ciclos eleitorais e política monetária: evidências para o Brasil”. *Pesquisa e Planejamento Econômico*, vol. 37 (3), pp. 465-87.
- GOODFRIEND, M. (1987). “Interest Rate Smoothing and Price Level Trend-Stationary”. *Journal of Monetary Economics*, 19, pp. 335-348.
- GOODFRIEND, M. (1991). “Interest Rate and the Conduct of Monetary Policy”. *Carnegie-Rochester Conference Series on Public Policy*, 34, pp.7-30.
- HAIGHT, A.D. “A Keynesian angle for the Taylor rule: mortgage rates, monthly payment illusion, and the scarecrow effect of inflation”. *Journal of Post Keynesian Economics*, vol. 30 (2), winter, pp. 259-77.
- HAMILTON, J.D. (1994). *Time Series Analysis*. Princeton: Princeton University Press.
- HAYECK, F. (1967). “Notes on the Evolution of Systems of Rules of Conduct.” In F. Hayeck (ed.), *Studies in Philosophy, Politics and Economics*. Chicago: University of Chicago Press, pp. 66-81.
- HICKS, J. R. (1977), *Economic Perspectives*. Oxford: Oxford University Press.
- KEYNES, J.M. (1936), *The General Theory of Employment, Interest and Money*. London: Macmillan.
- _____. (1937a), “The general theory of employment”. *The Quarterly Journal of Economics*, vol. 51 (2), pp.209-223.
- _____. (1937b), “Alternatives theories of the rate of interest”. *The Economic Journal*, vol. 47 (186), pp. 241-52.
- _____. (1937c) “The ‘ex-ante’ theory of the rate of interest”. *The Economic Journal*, vol. 47 (188), pp. 663-9
- _____. (1973). “Some Economic Consequences of a Declining Population.” In D. Moggridge (ed.), *The Collected Writings of John Maynard Keynes*, vol. XIV. London: Macmillan, 1973, pp. 124-133.

- MANKIW N. G. e MIRON J. A. (1991). "Should the FED Smooth Interest Rates? The case of Seasonal Monetary Policy". *Carnegie- Rochester Conference Series on Public Policy*, 34, pp. 41-70.
- MINELLA, A., FREITAS, P.S., GOLDFAJN, I. e MUINHOS, M.K. (2002), "*Inflation targeting in Brazil: Lessons and challenges*". Banco Central do Brasil, *Trabalhos para Discussão*, 53.
- MENDONÇA, H.F. (2007). "Metas de inflação e taxa de juros no Brasil: uma análise do efeito dos preços livres e administrados". *Revista de Economia Política*, 27, pp. 431-451.
- MISHKIN, F. (2000), "Inflation targeting in emerging markets countries". *NBER Working Paper Series*, 7618.
- MODENESI, A.M. (2005), *Regimes Monetários: Teoria e a Experiência do Real*. Barueri: Manole.
- _____. (2011), "Conservadorismo e Rigidez na Política Monetária: uma estimativa da função de reação do BCB (2000-2007)". *Revista de Economia Política*, V. 31(3), pp. 415-434.
- MODENESI, A. M. & ARAUJO, E. (2011) "Costs and benefits of inflation control in Brazil (2000-2008): An empirical analysis of the monetary policy transmission mechanism based on a VAR model," *8th International Conference 'Development in Economic Theory and Policy.'* Bilbao, June 29th to July 1st.
- MODENESI, A. M. & MODENESI, R.L. (2012), "Quinze Anos de Rigidez Monetária no Brasil: uma agenda de pesquisa". *Revista de Economia Política* [to be published].
- MUINHOS, M.K. (2004), "Inflation targeting in an open financially integrated emerging economy: The case of Brazil". *Estudos Econômicos*, vol. 34 (2), 269-96.
- NAKANO, Y. (2005) "O regime monetário, a dívida pública e a alta taxa de juros". *Conjuntura Econômica*. Rio de Janeiro: Fundação Getulio Vargas, v.59. n.11, Nov.
- _____. (2006), "Antes que os populistas tomem conta". *Jornal Valor Econômico*, 17/01/06, p. A-10.
- O'DONNELL, R. (1989) *Keynes: Philosophy, Economics and Politics*. London: Macmillan.
- ORLÉAN, A. (1986), "Mimetism et anticipations rationnelles: une perspective keynésienne," *Recherche Économique de Louvain*, 1, mars.
- _____. (1989) "Pour une approche cognitive des conventions économiques," *Revue économique*, v. 40, n°2, pp. 241-272.
- _____. (1999), *Le pouvoir de la Finance* [The power of Finance]. Paris: Odile Jacob.
- POSSAS, M. L. (1993) "Racionalidade e Regularidades: Rumo a uma Integração Micro-Macrodinâmica," *Economia e Sociedade* (UNICAMP), vol. S/N, fac. 2, pp.59-80. Campinas: Unicamp.
- RIBEIRO, A. (2008), "Ziguezague na política monetária". *Valor Econômico*, 25/02/2008, p. 2.

- ROCHON, L.P. (2006). "The more things change... inflation targeting and central bank policy". *Journal of Post Keynesian Economics*, Summer, vol. 28 (4), 551-58.
- ROMER, D. (2000), "Keynesian macroeconomics without the LM curve". *Journal of Economic Perspectives*, vol. 14 (2), pp. 149-69.
- RUDEBUSCH, G. D. (1995). "Federal Reserve Interest Rate Targeting, Rational Expectations and Term Structure". *Journal of Monetary Economics*, 35, pp. 245-274.
- SACK, B. P. (1997) "*Does the Fed Act Gradually? A VAR Analysis*" (November 1997). Mimeo. Available at SSRN: <http://ssrn.com/abstract=49248>.
- SAID, S.E., e DICKEY, D.A (1984). "Testing for Unit Roots in Autoregressive Moving Average Models of Unknown Order". *Biometrika*, 71, 599-607.
- SALGADO, M. J. S, GARCIA, M. G. P, e MEDEIROS, M. C. (2005). "Monetary Policy During Brazil's Real Plan: Estimating the Central Bank's Reaction Function". *Revista de Economia Política*. pp. 61-79.
- STIGLITZ, J. (2008), "The Failure of Inflation Target". Available in: <http://project-syndicate.org/commentary/stiglitz99/English>. Access in 02.01.2012.
- TAYLOR, J.B. (1993), "Discretion versus policy rules in practice", *Carnegie-Rochester Conference Series on Public Policy*, 39, pp. 195-214.
- _____. (Ed.) (1999), *Monetary Policy Rules*. Chicago: Chicago University Press.
- (2000), "Teaching modern macroeconomics at the principles level". *American Economic Review*, vol. 90 (2), pp. 90-94.
- THORTON, D. L. (2004). "The FED and Short-Term Rates: Is it Open Market Operations, Open Mouth Operations or Interest Rate Smoothing?" *Journal of Banking & Finance* 28, pp. 475-498.
- VERNENGO, M. (2006), "Money and inflation" in P. ARESITIS e M. SAWYER (Ed.), *A Handbook of monetary Economics*. Cheltenham, UK: Edward Elgar.