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Does Brazilian Monetary Policy Respond to Financial Stress?

A política monetária brasileira responde a estress financeiro?

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Deus adiante paz e guia
Encomendo-me a Deus e a virgem Maria minha mãe ...
Os doze apóstolos meus irmãos
Andarei nesse dia nessa noite
Com meu corpo cercado vigiado e protegido
Pelas as armas de São Jorge
São Jorge sentou praça na cavalaria
Eu estou feliz porque eu também sou da sua companhia
Eu estou vestido com as roupas e as armas de Jorge
Para que meus inimigos tenham pés e não me alcancem
Tenham mãos e não me peguem e não me toquem
Tenham olhos e não me enxerguem
E nem em pensamento eles possam ter para me fazerem mal
Armas de fogo o meu corpo não alcançarão
Facas e lanças se quebrem se o meu corpo tocar
Cordas e correntes se arrebentem se o meu corpo amarrar
Pois eu estou vestido com as roupas e as armas de Jorge

Dedico este trabalho à pessoa mais forte que eu conheço: Alexandra Moreira Couto. Às vezes eu me pergunto se o Gen. Patton fora tão forte e vigoroso quanto você é no dia a dia. Foram inúmeras as coisas que você abriu mão para que eu tivesse todas essas oportunidades e eu sou muito grato por isso. Muito obrigado por todo o investimento feito em mim.

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Abstract

Taylor Rules are an easy alternative to parametric model the response function of monetary authority to inflation as interest rates are the most common instrument for monetary policy. Nonetheless, a lot of research has been done on the subject: for example, [Clarida, Gali and Gertler \(2000\)](#) have incorporated the role for forward looking behavior through condition expectation operators, and results suggest that it is a useful benchmark in different regions. Although, this parametric relation was primarily suited for maintenance of low volatility and control of inflation, some authors argue that this setup can be extended to accommodate financial stresses. In this sense, we estimate an augmented Taylor Rule for Brazil from 2001 to 2018 by GMM, with moment conditions following closely [Castro \(2011\)](#). Our results suggest that the Brazilian Central Bank did not respond to the FCI proposed in the literature using a vector of house prices, stock market returns and exchange rates. However, our regressions with Taylor Rule model setups augmented only by with stock market returns shows a modest response of the Brazilian Central Bank to financial stress.

Key-words: monetary policy. financial economics. econometrics, Taylor rule.

Resumo

As regras de Taylor são uma alternativa fácil ao modelo paramétrico da função de resposta da autoridade monetária à inflação, uma vez que as taxas de juros são o instrumento mais comum para a política monetária. No entanto, um grande número de pesquisas tem sido feito no assunto: [Clarida, Gali and Gertler \(2000\)](#) incorporam o papel para o comportamento prospectivo através de operadores de expectativa de condição, e os resultados sugerem que é uma referência útil em diferentes regiões.

Embora essa relação paramétrica tenha sido primariamente adequada para a manutenção da baixa volatilidade e controle da inflação, alguns autores argumentam que essa configuração pode ser estendida para acomodar as tensões financeiras. Nesse sentido, estimamos uma Regra de Taylor aumentada para o Brasil de 2001 a 2018 por GMM, com condições de momento seguindo de perto [Castro \(2011\)](#). Nossos resultados sugerem que o Banco Central não respondeu ao índice de condições financeiras proposto. Contudo, nossas regressões com modelos de Regra de Taylor aumentado apenas por retorno de ações mostram uma modesta reação do Banco Central a estresse financeiro.

Palavras-chave: política monetária, economia financeira, econometria, Regra de Taylor

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Introduction

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Brazil has a long tradition dealing with inflation. In the twentieth century, however, fiscal imbalances, specially after the 1970's, allied with increasing inflationary pressures were a cause for concern for the Brazilian Central Bank.

Failed attempts to keep inflation cycles below the two digits mark were exhaustively tried. Only in 1993 the country developed a *solid inflation management program* (Real Plan) but, by the end of 1999, the situation was uncertain: the fixed exchange rate regime was unsustainable, and the new currency faced strong devaluation and pass through pressures. Fortunately, the economic measures based upon a floating exchange rate, primary surplus and inflation targeting adopted in 1999 were successful, and by 2004, expected inflation rates were low compared to the historical average.

Despite this, inflation rates have experienced a few spikes in recent years and some economists argue that, after the 2008 crisis, this was due to a more accommodating behavior on the part of the Brazilian Central Bank regarding inflation. In this paper, we analyze the Brazilian reaction function; we argue that it is unlikely that supply shocks alone were responsible to these inflation spikes. Similarly to the argument of [Clarida, Gali and Gertler \(2000\)](#) for the US, jumps on oil prices explain transitory periods of inflation rises, but they do not explain the persistence of the process. We examine Brazilian Monetary Policy since 2001 and test parameters through a Taylor Rule Setup. We also expand the basic Taylor Rule model to account for possible financial stress, which has not been done with Brazilian data yet. The Brazilian Central Bank has its monetary policy guidance set by law. According to the official decree 3088, from July 21st 1999, the Brazilian monetary policy shall be guided by Inflation Targets. These targets and their respective tolerance intervals shall be set by The National Monetary Council [CMN in portuguese]:

“Single paragraph. If the goal is not met, the Central Bank will publicly disclose the reasons for noncompliance, by means of an open letter to the Minister of Finance, which shall contain:

I - a detailed description of the causes of noncompliance;

II - measures to ensure the return of inflation to the established limits;
and

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III - the period within which the measures are expected to be effective."
²

The bank's President and directors' mandates are not fixed and suffer from political influence. Since 2001, the target center has been often missed. The inflation rate have remained consistently close to the upper bound in certain periods. Our results show that the Brazilian Central Bank has shown an accommodating behaviour during the period 2001-2018, since our "inflation parameter is less than one. Furthermore, our augmented Taylor rule regressions show a positive and significant response by Brazilian monetary authority from deviations of the share market to its target.

This thesis unfolds as follows: chapter 1 contains our literature review, in chapter 2 include our the method and data employed and in 3 we discuss our results.

²Translated from the original in Portuguese

1 Theoretical Framework

1.1 The Taylor Rule

Part of the debate on monetary policy regards the discussion on whether central banks should follow a rule or act discretionarily. In this context, [Taylor \(1993\)](#) advocates that the Central Bank should set interest rates considering deviations of the inflation rate from its target and of the output from its potential level. According to [Taylor \(2001\)](#), monetary policy in the United States between 1987 and 1992 could be described by the following parametric relationship:

$$i_t = 2 + \pi_t + 0.5y_t + 0.5(\pi_t - 2) \quad (1.1)$$

in which i_t is the interest rate set by the Federal Reserve; π_t is the inflation rate over the previous four quarters; y_t is the percentage deviation of output from its potential. He assumes that both the inflation target and the real equilibrium interest rate are 2 percent. The principle behind the rule is simple: if the monetary authority wishes to decrease inflation, it has to raise nominal interest rates faster than inflation growth. The mechanism is straightforward: these higher real interest rates lead to a decline on several variables such as business fixed investment, housing investment, consume durable expenditure, among others, which in turn contributes to a decline in aggregate output. ([TAYLOR, 1993](#))

As pointed by [Aguilar-Conrarias, Martins and Soares \(2018\)](#), from a positive point of view, this approach is useful to describe the US monetary policy, not only between 1986 and 1992, but in other periods as well. They, however, stress that:

from a normative point of view, Taylor Rules may also be considered a useful benchmark for monetary policy, highly valuable in informing and aiding policymaker's decision, even if it is not to be followed mechanically (...). Moreover it has the advantage of simplicity, making it very easy to communicate and understand.

They also notice that there have not been any references to *Taylor-type models* in the Federal Open Market Committee Meetings and that the Federal Reserve never acknowledge adhering to such rule. Empirically, a wide array of econometric techniques have been used to estimate monetary policy rules in several countries but not in Brazil. In this work, we will follow the baseline model proposed by [Clarida, Galí and Gertler \(1998\)](#). According to them:

$$i_t^* = r^* + \pi^* + \beta(\pi_t - \pi^*) + \gamma(y_t - y_t^*) \quad (1.2)$$

in which i_t^* is the interest rate set by the Federal Reserve; r^* stands for the long run (or equilibrium) real interest rate; π_t is the inflation rate over the previous four quarters; π^* represents a constant inflation target; and $\pi_t - \pi^*$ and $y_t - y_t^*$ are, respectively, gaps between inflation and its target and the output level. It is useful to rearrange equation 1.2 as

$$i_t^* = \alpha + \beta\pi_t + \gamma(y_t - y_t^*) \quad (1.3)$$

In equation 1.3, the parameter α is equal to $r_t^* - (\beta - 1)\pi^*$ and it implies that the coefficient α needs to be larger than one to raise the nominal interest rate by more than the inflation rate and, by this, to increase the real rate.

“New” Taylor rules have addressed the issue of incorporating rational expectations, and, therefore, new research on the subject deal with forward looking expectations. Our parametric equation to characterize the Taylor rule (which will be exhaustively used in this thesis) will follow closely the one proposed by Clarida, Gali and Gertler (2000). They assume a forward-looking behavior on the part of the Central Bank as follows

$$i_t^* = \alpha + \beta E(\pi_{t,k}|\Omega_t) + \gamma E(y_{t,q}|\Omega_t) \quad (1.4)$$

where $\pi_{t,k}$ denotes the percent change in the price level between periods t and $t+k$ (expressed in annual rates); π^* is the target for inflation (within α); $y_{t,q}$ is a measure of the average gap between period t and $t+q$, with the output gap ($y_{t,q}$) being defined as the percent deviation between actual GDP and the corresponding target; i^* is the desired nominal rate when both inflation and output are at their target levels.

Clarida, Gali and Gertler (2000) also argue that Funds rate responds to lagged inflation and output rather than to their expected future values. Formally

$$i_t = \rho_i i_{t-1} + (1 - \rho_i) i_t^* + \nu_t, \quad (1.5)$$

where $\rho \in [0, 1)$ indicates the degree of smoothing of interest rate changes and ν_t is a homokedastic, non autocorrelated, zero-mean shock on the interest rate. Inserting equation 1.5 in 1.4, and assuming that the monetary authority is able to control interest rates only up to an independent and identically distributed stochastic error (BUENO, 2008), (u_t) yields the following equation

$$i_t = (1 - \rho_i)[\alpha + \beta(E\pi_{t,k}|\Omega_t) + \gamma E(y_{t,q}|\Omega_t)] + \rho_i i_{t-1} + u_t \quad (1.6)$$

This forward looking rule nests the Taylor rule as a special case of either a lagged inflation rate or a linear combination of lagged inflation rate and the output gap as

sufficient statistics for forecasting future inflation. If so, equation 1.6 collapses to Taylor's rule [Castro \(2011\)](#). This last equation is a general case of a Taylor rule in which agents build expectations based on a time horizon. It is worth noticing that interest rates in Brazil show an auto-regressive structure. Therefore, we follow [Castro \(2011\)](#)'s suggestion of introducing lagged interest rates.

1.2 Asset Prices and Monetary Policy: Augmenting the Taylor Rule

In this section, we discuss why asset prices may be important to the conduction of monetary policy and why asset prices can be a source of information for policy and financial stability is important.

1.2.1 The link between Asset Prices and Monetary Policy

[Mishkin \(2001\)](#) holds that although the instrument set by monetary policymakers is typically an interest rate, monetary policy affects the economy through other asset prices beyond those on debt instruments. Thus, movements in these other asset prices are likely to play an important role in how monetary policy is conducted. [Mishkin \(1995\)](#) emphasizes that monetary policy affects the universe of relative asset prices and real wealth. They are often reluctant to commit themselves to specific mechanisms, because they see these mechanisms as changing during different business cycles ([MISHKIN, 1995](#)). Nonetheless, three channels are often emphasized: the first one is Tobin's Q; the second one is the theory of investment and wealth effects on consumption, and the last one is the accelerator effect ([MISHKIN, 2001](#); [GILCHRIST; LEAHY, 2002](#)).

[Tobin \(1969\)](#) argued that the ratio of the stock price to the replacement cost of capital, a statistic known as Tobin's Q, should be a good indicator of a firm's invest incentives. If this ratio is greater than one, then capital is more valuable within the firm as its value is greater than its cost on the open market, and investment is profitable ([GILCHRIST; LEAHY, 2002](#)). By noting when the money supply falls, economic agents decrease their spending. One place the public can spend less is in the stock market, decreasing the demand for equities and consequently lowering their prices. Hence, it follows that the lower equity prices leads to a lower Q, and thus to lower investment spending ([MISHKIN, 1995](#)).

The second channel, the wealth effect, is based on the relation between budget constraints regarding consumption and asset prices. This channel has been strongly advocated by [Modigliani \(1971\)](#). In his setup, a major component of financial wealth is common stocks. When stock prices fall, the value of financial wealth decreases, reducing lifetime resources of consumers which, in turn, induce consumers to change their consumption plans ([MISHKIN, 2001](#)). There is also an indirect wealth effect of asset prices movements

through households' and firms' balance-sheets. Households and firms face borrowing constraints due to adverse selection and moral hazard issues. In this sense, borrowing capacity is a function of their net-worth, and share prices may be seen as a proxy for asset valuations (BERNANKE; GERTLER; GILCHRIST, 1999).

The last channel is known as the financial accelerator. Bernanke and Gertler (1986) argue that the net worth of entrepreneurs may play an important role in propagating shocks to the economy. In order to align the incentives of entrepreneurs and those who supply them the capital, it may be important that entrepreneurs put up some of capital for investment. The greater the share of investment that is self-financed, the more closely incentives are aligned and the greater the willingness of lenders to supply capital (BERNANKE; GERTLER, 1986; GILCHRIST; LEAHY, 2002).

Moreover, credit markets are not frictionless: information, incentives, and enforcement are pervasive. Because of these problems, credit access is not the same for every agent. It may be extended more freely and at a lower cost to borrowers who already have strong financial positions. Additionally, balance sheets are important determinants of agents' ability to borrow and lend. The effects of asset price changes on the economy are transmitted to a very significant extent through their effects on the balance sheets of households, firms, and financial intermediaries (BERNANKE; GERTLER, 2001). For example, firms or households may use assets they hold as collateral when borrowing, in order to ameliorate information and incentive problems that would, otherwise, interfere with credit extension. Deteriorating balance sheets and reduced credit flows effects on the economy are spread mostly in the short run through aggregate demand. In the long run, they may also affect aggregate supply by inhibiting capital formation and reducing working capital. There is also likely to be significant feedback and magnification effects: declining sales and employment imply continuing weakening of cash flows and hence further declines in spending (BERNANKE; GERTLER, 2001).

1.2.2 Shall Monetary Authority be concerned with Financial Stability?

Traditionally, although the most important concerns of central banks are the stabilization of inflation and full employment, there may also be a desire to minimize interest rate volatility (SIKLOS; BOHL, 2009). However, over the last decades, the implementation of monetary policy has changed. Innovations in the financial sector were responsible for more interdependence among economic systems (MONTAGNOLI; NAPOLITANO et al., 2005).

In this framework, we need to define what we mean by financial stability. According to Käfer (2014), financial *instability* occurs when economic agents are struggling due to a financial crisis which is not their responsibility. Thus, financial stability is defined as a state in which a crisis is improbable.

Hatzius et al. (2010, p.1) argues that:

financial conditions can be defined as the current state of financial variables that influence economic behavior and (thereby) the future state of the economy. In theory, such financial variables may include anything that characterizes the supply or demand of financial instruments relevant for economic activity. This list might comprise a wide array of asset prices and quantities (both stocks and flows), as well as indicators of potential asset supply and demand. The latter may range from surveys of credit availability to the capital adequacy of financial intermediaries.

In this approach, the main components to be dealt with are, essentially, assets and equities. These are commonly used financial instruments to measure financial stability and to be included in the “expanded” monetary policy (KÄFER, 2014). However, the role of monetary policy on financial stability is not a general agreement, and it can be analyzed under two perspectives: (i) a conventional or reactive view; and (ii) a proactive one (KÄFER, 2014).

The conventional view states that crisis prevention is a task for regulatory instruments rather than for the interest rate and should not concern the monetary authority. For example, Bernanke and Gertler (2001, p. 253) argue that

the inflation-targeting approach gives a specific answer to the question of how central bankers should respond to asset prices: changes in asset prices should affect monetary policy only to the extent that they affect the central bank’s forecast of inflation. To a first approximation, once the predictive content of asset prices for inflation has been accounted for, there should be no additional response of monetary policy to asset-prices fluctuations.

Gilchrist and Leahy (2002) argue that asset prices are endogenous variables reflecting the underlying state variables, such as productivity, capital shocks and new worth of entrepreneurs. Hence, it would be better to base policy on these variables directly instead of on financial instruments (GILCHRIST; LEAHY, 2002). Gertler, Goodfriend and Issing (1998) argue that financial and price stability are complementary: by stabilizing prices and output, monetary authority would also be stabilizing asset prices. Also, low inflation gives the monetary authority room to react to financial crisis, while reacting in a high inflation scenario would breed instability Gilchrist and Leahy (2002)

In this sense, Bernanke and Gertler (2001) argue that an aggressive inflation-targeting rule stabilizes output and inflation when asset prices are volatile, whether the volatility is due to bubbles or to technological shocks. According to them, given an aggressive response to inflation, there is no significant additional benefit to considering asset prices. Therefore, the monetary policy should aim only at price stability and full employment, in accordance to the baseline Taylor rule.

Bernanke and Gertler (2001, p.6) state that:

in the economists usual benchmark case, a world of capital markets and without regulatory distortions, movements in asset prices simply reflect changes in underlying economic fundamentals. Under these circumstances, central bankers would have no reason to concert themselves with asset prices volatility per se. Asset prices would be of interest only to the extent that they provide useful information about the state of the economy. Matters change, however if two conditions are met. The first is that 'non-fundamental' factors sometime underlie asset market volatility. The second is that change in asset prices unrelated to fundamental factors have potentially significant impacts on the rest of the economy. If these two conditions are satisfied, then asset price volatility becomes to some degree an independent source of instability, of which policy-makers should take account.

Bernanke and Gertler (2001) hold that there are mainly two potential sources of "non-fundamental" fluctuations in asset prices: poorly regulatory practice and imperfect rationality on the part of investors. Examples regarding the former are financial reforms which dramatically increased access to credit by firms and households that contributes to asset price booms, as well as financial liberalization in developing countries which opened themselves for capital inflows from abroad and experienced sharp rising asset values and booms in both lending and consumption Bernanke and Gertler (2001). Regarding the later, there has been a large body of literature in finance on irrational behavior by investors such as herd behavior, excessive optimism as well as researches concerned with bubbles and fads.

However, Cecchetti et al. (2000, p.19) points that

while Bernanke and Gertler's thesis that monetary policy is a sufficient tool to contain the potential damage of booms and busts in asset prices is misleading (...). Asset price crashes have sustained damage historically only in the cases when monetary policy remained unresponsive. It is, therefore, natural for central banks to view price stability and financial stability as highly complementary and mutually consistent objectives. They go on to propose that the best policy framework for achieving both objectives is flexible inflation targeting and that policy should not respond to movements in asset prices except insofar as they signal changes in expected inflation.

The proactive view argues that all relevant information may not be contained in the forecasts of inflation and output. In this sense, the monetary policy should take into account financial variables and pursue both financial and price stability goals. Woodford (2012, p. 2) states that "the existence of crisis justifies the reconsideration of the thesis that a central bank with an inflation target need not to pay attention to financial developments - such as a credit-financed real estate boom- except to the extent that such developments affect the outlook for inflation (or perhaps, either for inflation or for real activity)". Also, according to Goodhart, Hofmann et al. (2001) asset prices contain useful information about future demand conditions. Thus, not taking them into account may lead to biases in empirical models for the analysis of monetary policy.

Woodford (2012) argues that central banks should not be concerned with possible mispricing of assets in the marketplace — since there is no reason to believe that their own judgments should be more reliable than those of market participants. They should be seeking to deter extreme levels of leverage and of maturity transformation in the financial sector. He also points that such crises are not predictable enough for there to be any point in trying to “lean against” developing financial-sector risks. But he also argues that the excuse that crises are unpredictable is not as compelling as it might at first seem. After all, in order for it to be useful to adjust policy and to reduce the risk of financial crisis, it is unnecessary to predict exactly when crises will occur; it suffices to be able to identify circumstances under which the risk of a crisis increases (and that there be policies that can affect these risks).

However, a central bank may not need to be able to identify asset over-valuations in order to recognize situations in which the probability of simultaneous financial distress at several institutions is non-trivial. The typical case against which the central bank should be on guard is not one in which the mean of the distribution of possible future net worths for the institutions is too low, but rather one in which the lower tail of the distribution is too large. Moreover, the question for greatest concern is not even the size of the lower tail of outcomes for individual institutions, but the probability of a bad joint outcome. This question of systemic risk is not one with which individual institutions may have much concern in their financial decisions, and so the belief that is useful for the central bank or other regulators to assess systemic risk does not depend on a belief that the regulators are better at forecasting than private institutions (WOODFORD, 2012).

A second ground for skepticism about the relevance of financial stability concerns in monetary policy making is based upon doubts about how much monetary policy can do to influence the buildup of risks to financial stability, or even that it might be possible to identify such risks in real time. According to (WOODFORD, 2012, p.7):

Still, one might reasonably ask, will there not be a conflict between the use of monetary policy to control risks to financial stability, and the use of it to maintain price stability and stable real activity? Yes, I think there will almost inevitably be a tension between these alternative objectives, as the model in the next section illustrates. But I wish to argue that this tension is no different, in principle, than the conflict between inflation stabilization and output-gap stabilization, in the conventional theory of “flexible” inflation targeting.

Käfer (2014) argues that the discussion on the monetary role in financial stability should focus in two key-factors: identification of financial imbalances; and the costs and benefits of monetary intervention. Regarding the first one, the conventional approach concludes that it is not possible to detect a bubble. Actually, according to rational expectations, if that was possible, there would not be a bubble in the first place. So

there would have to be a reason for monetary policy to try to forecast and prevent financial instabilities. An alternative view argues that price stability is a necessary but not sufficient condition for financial stability. The advocates of this approach argue that it is not necessary to know if there is a bubble indeed (KÄFER, 2014).

Regarding the later factor, those who advocate against a monetary intervention in the financial role argue that interest rates need to be very high to influence financial markets. Hence, it would generate high fluctuations in inflation and output, generating high costs (KÄFER, 2014). The proactive counter-argument claims that not every interest rate rise has to be followed by an economic recession, and Käfer (2014, p.163) says that a “refraining from a monetary policy reaction would produce even higher costs(...), even in terms of inflation and output.

This “proactive” framework clears the room for the exchange rate to play a strong role as monetary policy in the sense of their respective impacts on the real sector. Nonetheless, one could always argue that monetary policy is already taking into consideration financial variables even though they are not explicit included in the monetary policy function.

As an exercise, consider the role of exchange rates in our standard Taylor rule (equation 1.6). Note, first that there is no direct reaction of the interest rate to the exchange rate, but there is an important indirect reaction. Here, we follow Taylor’s (TAYLOR, 2001) line of argument when an appreciation of the exchange rate occurs. A crucial point in the analysis is to notice that this policy rule is nothing but a contingency plan that will be used for many periods into the future. Therefore, in most open-economy models, such an appreciation will have two effects: it lowers real GDP by expenditure-switching, and it also lowers inflation because the price of imported goods will not increase as rapidly with the appreciation of the currency. It may be the case in which inflation may also be lowered by the decline in output. Moreover, in empirically estimated models, these inflation and output effects of the exchange-rate change occurs with a lag, because such lags exist in the data. There is inertia in the monetary-transmission mechanism. Because of this lag, an appreciation of the exchange rate today will decrease the level of output and inflation that is expected in the future. Hence, this expectation of lower future output and lower future inflation lowers expectations of interest rates in the future. According to (TAYLOR, 2001), p. 266

In other words, the appreciation of the exchange rate today (period t , say) will increase the probability that the central bank will lower the interest rate in the future (period $t + 1$, say). With a rational expectations model of the term structure of interest rates, these expectations of lower future short-term interest rates will tend to lower long term interest rates today. Thus, the appreciation of the exchange rate, through the inertial effects of exchange-rate transmission and the existence of a policy rule, will result in a decline in interest rates today, even though the exchange rate is not directly in the policy rule.

To summarize, although the policy rule in equation 1.6 may not appear to involve

an interest-rate reaction to the exchange rate, it implies such a reaction. What might appear to be a closed-economy policy rule is actually just as much an open-economy rule as if the exchange rate appeared directly. This may also explain why adjusting the h parameters away from zero might not improve performance very much: the exchange rate reaction is already there.

A second reason as to why reacting to the exchange rate may not improve performance very much was alluded to by [Taylor \(2001, p.267\)](#):

There may be some deviations of the exchange rate from purchasing-power parity that should not be offset by changes in interest rates; the required changes in interest rates will have adverse effects on real output and inflation that may be worse than the swings in the exchange rate themselves. In some situations the changes in the exchange rate might reflect changes in productivity that should not be offset. Even a random change in the exchange rate, due perhaps to fads or irrational expectations, may have small consequences relative to the cost of smoothing them out. This second reason suggests a preference for an indirect reaction of the interest rate, as described above, rather than a direct reaction. Temporary fluctuations in the exchange rate may not have much effect on expectations of inflation and thus have little effect on interest rates with an indirect reaction, while such movements could result in harmful swings in interest rates if there were a strong direct reaction

[Stein \(2012\)](#) creates a model that speaks to the goals and methods that the monetary authority should follow concerning financial stability policies. He is particularly interested in discussing why banks may create money in a non-socially optimal manner. The model considers which firms might be financed from either short or long-term debts, which are, in turn, invested in projects ([STEIN, 2012](#)). Households derive additional monetary services from holding any claim that is entirely riskless. Riskless in this context means that they are easy to value and are a useful method among households. Therefore, he shows that banks can manufacture some amount of riskless private “money” of this sort, which lowers their financing costs. Nonetheless, when banks issue cheaper short-term debt, they capture its social benefits but do not fully internalize its costs. In this sense, [Stein \(2012, p.58\)](#) argues that “in an adverse “financial crisis” state of the world, the only way for banks to honor their short-term debts is by selling assets at fire-sale prices”, which in turn might generate negative externality. Therefore, unregulated banks may engage in excessive money creation and may leave the financial system overly vulnerable to costly crises. In this context, for [Stein \(2012, p.59\)](#), “there are a variety of ways for a regulator to address this externality. One possibility is the use of conventional monetary policy tools, that is, open-market operations.”

There have been also arguments that the most Taylor rules models are incomplete. [Christiano et al. \(2010\)](#) analyze U.S. and Japanese data and identified several stock market boom-bust episodes. They find that, in all cases, inflation is relatively low during boom phase. In the U.S. economy, inflation averaged -2.5 per cent during stock market booms, in

comparison to 0.7 per cent that occurred over non-boom periods. Credit also grew twice as fast, on average, during stock market booms. For the Japanese one, one can highlight that inflation is high before the start of the 1980s stock market boom, and significantly slows as the boom proceeds (CHRISTIANO et al., 2010).

Looking at economic research over the past decades, a non trivial fraction of the most prominent work was done not when market equilibrium does work, but when there is a price misalignment. These *deviations* include information asymmetries, market failures, coordination problems, among others. In this sense, we review Cecchetti et al. (2000)'s model, in which financial institutions produce negative externalities. This is an case study illustration of when the neoclassical baseline equilibrium may not reflect a first best outcome. In this model, if monetary authority is willing to smooth output and inflation fluctuations, it may enhance these macroeconomic outcomes by setting interest rates according to asset price movements.

As we discuss in more detail below, the main reason for this is that asset price bubbles create distortions in investment and consumption, leading to extreme rises and then falls in both output and inflation. Raising interest rates modestly as asset prices rise above what are estimated to be warranted levels, and lowering interest rates modestly when asset prices fall below warranted levels helps to smooth these fluctuations by reducing the possibility of an asset price bubble coming into existence in the first place.¹

1.2.3 Financial Conditions Indexes

Theories that deal with asset prices (*latu sensu*) movements as indicators of future inflation or economic activity have been extensively used in Economic research. However, despite of theoretical issues, empirical evidence itself has had some trouble reaching a consensus. For example, Stock and Watson (2003) have found no evidence that stock prices might improve performance of inflation forecasting.

Nonetheless, it has been extensively argued that combining both interest and exchange rates in a single policy indicator - a Monetary Conditions Index[MCI] - may serve as a better indication of the overall policy stance (KÄFER, 2014). The MCI is designed to indicate the stance (the degree of tightening or loosening) of monetary policy during a given period. It is often argued that monetary authorities might gain a better assessment of the overall monetary conditions because the information content in the MCI would characterize the degree of pressure that monetary policy is placing on the economy and, therefore, on inflation rate. Particularly, in the case of small open economies, the exchange rate was seen to amplify the effect of changes in policy rates. Hence, measuring

¹However, it is important to emphasize that this policy prescription does not concern appropriate reactions to crises that might arise if asset prices should, for whatever reason, suddenly collapse. Instead, the central concern is with prophylactic policies designed to prevent the undesirable affects of asset price bubbles (CECCHETTI et al., 2000).

monetary conditions through a weighted index of both the short-term interest rate and the exchange rate was expected to give a more accurate picture of the overall monetary policy stance (PARIES; MAURIN; MOCCERO, 2014). For this reason, central banks of many industrialized countries have been spending resources on construction and implementation of MCI's: New Zealand (inflation target), Canada (operating target) and Sweden (leading indicator) (ANGELOPOULOU; BALFOUSSIA; GIBSON, 2014). In the past several years, however, attention has turned to the behavior of equity, housing², shares or other asset price indicators, as central banks are increasingly seen as having to stem the cycle of booms and busts in asset prices. Indeed, central banks can be thought of as reacting to some weighted average or linear combination of asset prices (SIKLOS; BOHL, 2009).

In this sense, the literature has improved this monetary index by adding "new" financial relevant variables. Therefore, these *financial conditions indexes* [FCI]'s³ are constructed in order to synthesize information about the future state of the economy which can be inferred by the analysis of some variables. Ideally, an FCI should measure financial shocks – exogenous shifts in financial conditions that influence or otherwise predict future economic activity. True financial shocks should be distinguished from the endogenous reflection or embodiment in financial variables of past economic activity that itself predicts future activity. If the only information contained in financial variables about future economic activity were of this endogenous variety, there would be no reason to construct an FCI: past economic activity itself would contain all the relevant predictive information (HATZIUS et al., 2010). In this sense, Hatzius et al. (2010, p.7) states that “Though the specific variables included in various FCIs differ⁴ considerably, there are commonalities. Most FCIs include some measure of short-term interest rates, long-term interest rates, risk premia, equity market performance, and exchange rates”.

The use of an index in order to proxy for the behavior of the financial cycle has its advantages. Statistically, introducing several variables into the same regression which

²Stock and Watson (2003) argue that housing constitutes a large component of aggregate wealth and gets significant weight in the CPI in many countries. More generally, housing is a volatile and cyclically sensitive sector, and measures of real activity in the housing sector are known to be useful leading indicators of economic activity, at least in the U.S. suggesting a broader channel by which housing prices might forecast real activity, inflation, or both.

³According to Angelopoulou, Balfoussia and Gibson (2014) the literature on financial conditions indices dates back to the early 2000s and was motivated, first, by evidence building up since the late 1980s on the importance of financial variables in monetary policy transmission, and, second, by the boom–bust cycle in stock markets in the period 1995–2000 (commonly known as the dot.com bubble), which gave rise to heated policy debates as to whether central banks should take into account financial asset prices when deciding their policy.

⁴In the past few years, extensive work has been done to analyze financial conditions in the United States and in the euro area. Some work has been done also on Japan, the United Kingdom, and groups of developed countries. A wide range of FCIs have been developed in the literature, including: the St. Louis Fed's Financial Stress Index, the Chicago Fed National Financial Conditions Index the ECB Global Index of Financial Turbulence three indices constructed at the International Monetary Fund; the OECD Financial Conditions Index, the Goldman Sachs FCI, the Deutsche Bank FCI Bloomberg FCI and some developed in the academic literature (PARIES; MAURIN; MOCCERO, 2014).

are potentially correlated could increase standard errors. Moreover, adopting an index instead of any particular variable provides a better understanding of the overall picture and makes it easier to monitor in practice (MA; ZHANG, 2016). The state of the economy also matters: for example, financial conditions that influence investment may be less important in periods of large excess capacity (HATZIUS et al., 2010)

Even if it is deemed desirable to incorporate a role for asset prices, one faces a number of additional difficulties. In particular, there is no widespread agreement on how best to define equilibrium real exchange rate or asset price levels. Siklos and Bohl (2009) states that it is unclear whether monetary authorities worry over perceived excesses in asset prices relative to some equilibrium or fundamental value, as opposed to their volatility. Identifying the magnitude of financial stress at any given point in time can depend critically on the indicators examined and the reference points used. For instance, Brave, Butters et al. (2012) emphasize a few crucial points regarding limitations and applicability of these techniques:

- firstly, *what could be considered “normal” level of financial stress and subsequently a level that would warrant concern?*
- *are risks associated with both extremely low values and high values the same?*
- finally, *how well does any measure predict the true underlying state of the financial system?*

Even though there is no easy answer to any of these questions, Cecchetti et al. (2000) states that it is probably no more difficult to measure the degree of stock price misalignment than it is to measure the size of the output gap, or the equilibrium value of the real interest rate, concepts that many central banks already use in preparing their inflation forecast. Specifically, output gap estimates depend on estimates of underlying productivity growth and the equilibrium equity risk premium. These inputs also are necessary to estimate stock price misalignments.

2

Method and Data

2.1 The Construction of a Financial Conditions Index

There are many different methods for constructing FCI's. According to [Hatzius et al. \(2010\)](#), they tend to fall into two broad categories: a weighted sum-approach and a principal-components one. In the former, weights are assigned accordingly to relative impacts of each of its components on real GDP. These methods includes large-scale macroeconomic models, vector autoregression models and reduced-form equations. The principal components methodology tries to extract a common factor from a group of few financial variables. Then, this common factor can be either used as a FCI itself or added to the weighted sum one ([HATZIUS et al., 2010](#)).

Nonetheless, we want to highlight a third method for constructing such an index. [Matheson \(2012\)](#) presents a dynamic factor model [DFM], in which each standardized indicator of financial conditions can be decomposed into a common and an idiosyncratic component. In this paper, we compute FCI weights based on all three of these categories. However, as we argue later in this chapter, the weighted sum-approach has more theoretical and empirical drawbacks. Therefore, we believe that both the principal-components analysis and the dynamic factor model methods are better suited for computing FCI weights.

2.1.1 Dynamic factor models

On dynamic factor models, we can assume that each standardized indicator of financial conditions, z_t , might be decomposed into a common component, χ_t , and an idiosyncratic component, ϵ_t . The common component captures the bulk of the covariation between z_t and the other indicators in the data set, whereas the idiosyncratic component is assumed mainly to affect only t."

$$z_t = \chi_t + \epsilon_t,$$

(2.1)

$$\epsilon_t \sim I$$

where $\chi_t = \Lambda_t G_t$ and ψ is assumed to be a diagonal matrix.

Thus, the common component is simply a scaled common factor, F_t , estimated using the entire set of financial indicators. For each economy, the FCI is defined to be this common factor. The dynamics of the FCI are captured by an autoregressive process:

$$G_t = \sum_{i=1}^p \beta_i G_{t-i} + \mu_t, \mu_t \sim N(0, \Sigma) \quad (2.2)$$

Because the seven financial variables used to construct the composite index differ with respect to type and unit, to convert them into one single composite index, we normalize the data using the standard min-max normalization method:"

$$Z'_{i,t} = \frac{Z_{i,t} - \text{Min}(Z_{i,t})}{\text{Max}(Z_i) - \text{Min}(Z_i)} \quad (2.3)$$

where V_{it} represents the value of variable i during period t ; $\text{Min}(V_i)$ and $\text{Max}(V_i)$ denote the minimum and the maximum, respectively, recorded by variable i in the sample period; V_{it} is the variable's normalized value. According to equation 2.4, this normalization process converts all variables to an identical range of $[0, 1]$ and an increase (higher value) means an improvement in financial conditions while a decrease means the opposite (deterioration in financial conditions). The normalized variables are then aggregated into a composite index (i.e. FCI):

$$\text{FCI}_i = \sum_{i=1} w_i z_i \quad (2.4)$$

2.2 Augmenting the Taylor Rule

Although originally the Taylor rule was created as a baseline attempt to guide monetary policy on pursuing inflation and employment goals, we showed that some authors defend that monetary policy should also pursue financial stability. On this subject, some studies have tested whether a Taylor rule baseline can be augmented in the way of incorporating those new objectives. For example, [Bernanke, Gertler and Gilchrist \(1999\)](#) make the case against including a reaction to asset prices whereas [Cecchetti et al. \(2000\)](#) argue in favor of adding equity returns to a standard Taylor rule. [Filardo \(2004\)](#) points out that if non fundamental asset price movements can have real economic effects, then they should be incorporated into the central bank's policy rule."([SIKLOS; BOHL, 2009](#))

In any event, as argued by [Clarida, Gali and Gertler \(2000, p.318\)](#), the guiding principle implicit in the forwardlooking Taylor rule concept, is that "...central banks look at everything but only to the extent that 'everything' is useful in forecasting inflation and possibly output." [Siklos and Bohl \(2009\)](#)

Cecchetti (2003) also reports that the Fed reacted to stock market developments relying again on a Taylor rule. [Clarida, Gali and Gertler \(1998\)](#) add a real exchange rate. While a real exchange rate variable in a Taylor rule can be statistically significant, it is generally economically small ([BRAVE; BUTTERS et al., 2012](#)).

Since we have argued that there are theoretical reasons for incorporating new variables on the Taylor rule, it is time to explain how it is possible to do so. Following [Castro \(2011\)](#), [Montagnoli, Napolitano et al. \(2005\)](#), [Goodhart, Hofmann et al. \(2001\)](#), the procedure is straightforward: adding a new coefficient, say θ , in order to capture the effects of the new variables added. According to [Castro \(2011\)](#) “we then procedure to estimate the alternative model in the same fashion as the baseline, except that we expand the parameter vector to include the coefficient θ on the additional variable, let’s say x_t , and expand our instrument list to include lagged variables of that variable.” It is then straightforward to evaluate whether the direct effect of x on the policy is quantitatively important. Hence, equation 1.6 is augmented to:

$$i_t^* = r^* + \pi^* + \beta[E\pi_{t+k}|\Omega_t - \pi^*] + \gamma E[(y_{t+q} - y_{t+q}^*)|\Omega_t] + E[\theta x_{t+p}] \quad (2.5)$$

It is also a common procedure in the literature to control for possible auto-correlation in interest rates, since monetary authority avoids sharp variations. There are several reasons behind this such as transaction frictions and uncertainty about the effects of economic shocks ([CASTRO, 2011](#)). This means it is seeking a smoothing on interest rates. Hence, the current level of interest rates can be described as follows:

$$i_t = (1 - \sum_{j=1}^n \rho_j) i_t^* + \sum_{j=1}^n \rho_j i_{t-j}, \quad (2.6)$$

$$\text{where } \sum_{j=1}^n 0 < \rho_j < 1$$

Therefore, combining equations 2.5 and 2.6, we obtain:

$$i_t = (1 - \sum_{j=1}^n \rho_j) [\alpha + \beta E_t(\pi_{t+k}|\Omega_t) + \gamma E_t(y_{t+q}|\Omega_t) + \theta x_{t+p}] + \sum_{j=1}^n \rho_j i_{t-j} \quad (2.7)$$

Equation 2.7 is therefore our baseline framework when considering “augmented” Taylor rule with smoothing. Our econometric model, GMM has good potential theoretically, but several applied studies have shown that its proprieties may in some cases be poor in small samples. ([CHAUSSÉ et al., 2010](#)).

2.3 Data

All data employed in this paper is publicly available. All of our estimations were conducted using quarterly data. However, some series are not originally quarterly. We had two different cases: monthly and semiannually (only a few observations regarding house prices fall into this category). Most of our series are monthly. In these cases, monthly index were accrued over the quarter and then annualized. Our procedure is the same as [BUENO \(2008\)](#). For example, if i_t is the interest rate in month t , then the interest rate corresponding to the first quarter is:

$$i_{1t} = \ln\left(\prod_{j=1t}^{1t+1} (1 + i_j)\right) \quad (2.8)$$

We wish to cover the period of 2001-2018. All of our series start before that. Nevertheless, in the case of nominal GDP, we had to estimate trends and employ methods to ensure that our series are stationary. In this case, we restricted our sample to cover the period which ranges from the third quarter of 1994 to the end of our sample (2018). This procedure is employed in order to avoid structural breaks due to hyperinflation which ended with the Real Plan.

The interest rate set by the Central Bank of Brazil is the SELIC rate (Special System for Settlement and Custody). The Price Consumer Index IPCA is the government's official inflation rate and it is employed on inflation targeting ¹.

The target for the inflation is set by the National Monetary Council [CMN]. To compute the expected inflation's deviation from the target, we follow ([BUENO, 2008](#)). Let $\pi_{t,m}^*$ be the current inflation target at period t and m . Let $\pi_{t+1,m}^*$ be the next inflation target at period t . If one assumes that inflation distributes evenly over the year, then the inflation target for the next twelve months at period t , π_t^* , is:

$$\pi_t^* = \left(\frac{12-m}{12}\right)\ln(1 + \pi_{t,m}^*) + \frac{m}{12}\ln(1 + \pi_{t+1,m}^*) \quad (2.9)$$

Following again [BUENO \(2008\)](#), the market's expected inflation for the current year at month t , $\pi_{t,m}^{mkt}$ is given by:

$$\pi_{t,m}^{mkt} = \ln\left(\frac{1+\pi_{t,m}^e}{1+\pi_{t,m}^{post}}\right) + \frac{m}{12}\ln(1 + \pi_{t+1,m}^{mkt}) \quad (2.10)$$

If the sample spans through a sufficiently long time, it is possible to use the sample average real rate to provide an estimate to of r^* . Therefore, we are able to construct an estimate of π^* as well [Clarida, Gali and Gertler \(1998\)](#).

¹We seasonally adjusted the IPCA series using X-13 ARIMA.

Our proxy for output is the quarterly non-seasonal GDP index. We used the IBOVESPA ² index as a proxy for share prices and FIPEZAP for house pricing. All real values on this paper were conducted using IPCA as our CPI. The time series graph of two proxies (ibovespa, fipezap) as well as exchange rates are shown below. We take the index January 2001 = 100 as our benchmark. Visual inspection suggests that only exchange rates are stationary. Unit roots tests conducted on the two non stationary lagged values show that taking *net returns* on both variables are sufficient to avoid non-stationarity. However, since it is common in the literature we take returns of these three variables to avoid any source of non-stationary bias.

Figure 1 – Nominal share prices in Brazil: selic overnight interest rates between 2001 and 2018

²Ibovespa is an index of the only stock exchange in Brazil

Figure 2 – Nominal house prices in Brazil(SP): FIPEZAP rates between 2001 and 2018

Figure 3 – Exchange rate prices in Brazil:(US\$/R\$) rates between 2001 and 2018

3 Results and Discussion

In this section we present the regression results and analyze our findings. We chose the time range between 2001 and 2018 because to avoid structural breaks: in 1999, Brazil went from a fixed exchange regime to a float which leads volatility issues . Moreover, since 2001, the Brazilian Central Bank started to report market expectations for inflation and other economic variables which we use as proxies. Hence, the objective is to test reaction functions of the Monetary Authority to deviations on GDP (the standard Taylor Rule) and financial assets, such as share prices, house prices and exchange rate prices.

The first equation we estimate is the standard Taylor rule following [Clarida, Gali and Gertler \(2000\)](#)'s moment conditions by GMM. We apply the same set of instruments as [BUENO \(2008\)](#) during the inflation targeting regime. In the first regression, the interest rate auto correlation parameter, ρ_i , is less than one, as expected, and 5% significant. The GDP gap parameter, γ_y is negative, as expected, but not significant. These results also shows that an 1% increase on the difference between inflation and its long trend (which we called target deviation) results in a change of only 0,78\$ on nominal interest rates. Therefore, the Brazilian economy has faced an accommodating behavior by the Central Bank during the period 2001-2018, since the estimated parameter, β_π is less than 1. Moreover, the Fischer equation enables us to identify the long run inflation rate π^* to be approximately 5,6%.

Table 1 – GMM Estimations for the standard Taylor rule.

	Coefficient	Std. Error	t-Statistic	Prob.
ρ_i	0.263381	0.125020	2.106706	0.0480
β_π	0.784644	0.083972	9.344087	0.0000
π^*	5.631995	0.560455	10.04896	0.0000
γ_y	-0.032896	0.087956	-0.374010	0.7123
Observations	70	Mean dependent var	16.83801	
Instrument rank	20	Prob(J-statistic)	0.941714	

Source: own elaboration

In our second exercise, we employ the same structure, but this time we add the returns of stock markets (ibovespa) as an explicit explanatory variable in the moment conditions. Therefore, there is now one extra parameter to be estimated. Our results show that this coefficient is positive and significant. Therefore, according to this model, during the analyzed period, the Central Bank has reacted to fluctuations on the share's market. Other coefficients, such as the auto corelation parameter and the GDP gap have

the expected signs and are significant. Moreover, it is important to highlight that the β_π coefficient remains less than one (0.62), so the result that monetary authority is not persistent fighting inflation remains unchanged.

Table 2 – GMM estimations for the Ibovespa augmented Taylor rule

	Coefficient	Std. Error	t-Statistic	Prob.
ρ_i	0.246728	0.076106	3.241874	0.0043
β_π	0.625903	0.041199	15.19216	0.0000
π^*	3.466778	0.428899	8.082978	0.0000
γ_y	-0.143097	0.030584	-4.678803	0.0002
θ_x	4.905848	0.5934687	8.266398	0.0000
Observations	70	Mean dependent var		16.83801
Instrument rank	21	Prob(J-statistic)		0.935625

In our third regression, we now use the FCI index instead of the ibovespa return one. However, this time our results are, at best, inconclusive even though the FCI parameter, θ_x is significant. We found that the long run inflation equilibrium value to be negative and non-significant. Wald tests do not reject that the β_π is equal to one.. The GDP parameter is positive but non-significant. Once again, our constant parameter is non-significant.

Comparing the three regressions, we can argue that the introduction of financial variables on a Taylor Rule setup in Brazil must be cautiously done. Firstly, it is important to highlight that our house price index may be not whole-country-representative since it proxies only for one of the 26 Brazilian States and the Federal District. Moreover, a considerable part of this time series was measured only twice a year, and we had to construct quarterly data by taking simple averages of periods t and $t+1$. Also, it is also easier to argue monetary policy would be more focused on frictions on the stock market than on house ones due to the nature of speculative behaviour of economic agents. Finally, despite of econometric and methodological issues emphasized, some key parameters remained stable: the autocorrelation parameter - which is significant and with the expected sign, and the key one: the target deviation, which is less than one, in all regressions.

Table 3 – GMM estimations for the FCI augmented Taylor rule

	Coefficient	Std. Error	t-Statistic	Prob.
ρ_i	0.308389	0.104141	2.961253	0.0080
β_π	0.801569	0.072582	11.04366	0.0000
π^*	-5.789708	7.687125	-0.753169	0.4606
γ_y	0.024565	0.082439	0.297978	0.7690
θ_x	6.895324	2.178136	3.165700	0.0051
Observations	70	Mean dependent var	16.83801	
Instrument rank	21	Prob(J-statistic)	0.970616	

4 Conclusion

There has been a long debate among economists on the role of monetary policy. Most agree that monetary authority should aim the maintenance of a low level of inflation and a stable level of unemployment or GDP. This discussion is intimately attached to the single or dual mandate debate. However, there is a more controversial agenda regarding monetary policy that is related to the issue of regulation on financial markets. The proactive view argue that monetary should interfere on financial imbalances since financial instability can be seen as an externality. Others advocate exactly the opposite: they argue that it is not an easy task to identify a financial imbalance and a fail attempt to address the "issue" could make thinks worse.

We started our analysis on 2001 to avoid structural breaks in the time series. In the end of 1990's the Brazilian Economy faced strong external shocks and went from a fixed to a float exchange regime. The result was strong inflationary pressures due to pass through effects. In 2001 the Brazilian started to report market expectations which is one of our proxies in this study. The only structural break which remains in our time series is due to the 2002 election, when exchange and inflation rates series showed a sharp increase. Keeping this information was important for two reasons: to analyze the whole period where a left party was in charge of monetary policy and to avoid a lack of observations since our data is quarterly.

In this paper, we have tested the hypothesis that during the 2001-2018 period, Brazilian Central Bank has put some effort in stabilizing not only inflation and GDP but asset price movements as well. We run a series of Taylor-type inflation reaction functions based on [Castro \(2011\)](#) and [Clarida, Gali and Gertler \(2000\)](#). Considering the standard Taylor rule for the whole sample, we saw an accommodating behavior by the Brazilian Monetary since our inflation reaction parameter is less than one in our specification (0,78). We also employed a dynamic factor model strategy to compute the financial conditions index for the Brazilian economy. We normalize a set of financial variables: share prices index (ibovespa), property index (Fipe-zap) and a exchange rate index. However, our results suggest that only the share index can be used on Taylor-type models to enhance its predictability. Financial Conditions Index are not an useful tool to this task.

Therefore, this research contributes to the literature in a few important aspect: it is to the best of our knowledge the first research to incorporate asset price frictions on Taylor Rule setups in Brazil. Finally, the results corroborate the hypothesis that the monetary authority reaction functions in Brazil during this period was not strong enough

to deal with inflationary pressures.

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