

Central bank communication and inflation expectations in Brazil

Gabriel Caldas Montes^a, *Rodolfo Tomás da Fonseca Nicolay*^{b,*}

^a Fluminense Federal University, Department of Economics; National Council for Scientific and Technological Development (CNPq), Rua Tiradentes, 17, Ingá, Niterói, Rio de Janeiro, Brazil.

^b Doctorate Student at Fluminense Federal University, Corresponding author. E-mail address: r-nicolay@hotmail.com

Abstract

Studies on central bank communication in emerging countries are still scarce. Besides, there are few studies related to the influence that central bank's perspectives about the state of the economy have on inflation expectations. Thus, this study contributes to the literature in the following aspects: analyzes the influence of central bank communication on inflation expectations, and develops a new index of central bank communication based on the fuzzy set theory.

Key words: central bank; communication; inflation expectation

JEL classification: E31, E52, E58

Resumo

Estudos sobre comunicação do banco central em mercados emergentes continuam escassos. Ademais, existem poucos estudos relacionados com a influência da perspectiva do banco central acerca do estado da economia sobre as expectativas de inflação. Logo, este estudo contribui para a literatura das seguintes formas: analisa a influencia da comunicação do banco central, e desenvolve um novo índice de comunicação do banco central baseado na teoria dos conjuntos fuzzy.

1. Introduction

The management of expectations is an important task of the monetary authority. In this sense, central bank communication has grown in importance and has become an instrument of great influence (Blinder et al., 2008).

Regarding the influence of communication on the economy, there are two main approaches. One discusses the impact of central bank communication on financial markets (e.g., Kohn and Sack, 2004; Rosa and Verga, 2007; Ehrmann and Fratzscher, 2007a and 2007b). The other deals with the influence of communication on economic performance (e.g., Fujiwara, 2005; Rozkrut et al., 2007; Ullrich, 2008). In turn, most studies on central bank communication concentrate their analyzes in developed countries and, mostly, on the influence that communication has on expectations formed in financial markets about the behavior of interest rates and exchange rates, as well as on the expectations formed for the future behavior of the monetary authority.

Regarding emerging economies, the analysis for the effects of central bank communication on expectations is crucial, because uncertainties in these economies are higher and, thus, more difficult it is to guide expectations. However, there are few studies addressing emerging countries. Hence, based on existing literature, three gaps are identified: (i) studies on central bank communication in emerging countries are still scarce, (ii) there are few studies related to the influence that central bank's perspectives about the state of the economy have on inflation expectations, and (iii) there are few works using economic outlook content of central bank communications, that is a better way to evaluate the communication influence over inflation expectations. For Brazil (an inflation targeting emerging country), so far there are no studies about the influence of communication through the minutes of the Monetary Policy Committee (COPOM) meetings on inflation expectations.

Hence, this study contributes to the literature in the following aspects: 1) analyzes the influence of central bank communication on inflation expectations, and; 2) different from other studies on central bank communication, this one proposes a new index of central bank communication based on the fuzzy set theory and the economic outlook content of the minutes.

Thus, the paper is divided as follows. The second section addresses the importance of central bank communication for the process of expectations formation and presents a brief review of the empirical literature. The third section presents the index of communication based on the fuzzy set theory and an empirical analysis for the influence of central bank communication on inflation expectations. The fourth section presents the conclusions.

2. Importance of communication as a guide to expectations

The communication of the central bank is the provision of information to the public about present and future monetary policy, the economic outlook and the goals of the central bank. This information helps, for example, the formation of agents' expectations regarding the conduct of monetary policy in the future and inflation in the following periods. In this sense, communication acts in a helpful way, guiding agents' expectations and, thus, plays an important role in decision-making (Jansen, 2011). Since communication is capable of guiding expectations, monetary policy becomes more predictable and, thus, communication turns into an important tool for central banks affect the economy through agents' expectations (Gürkaynak, Sack and Swanson, 2005).

The existing empirical literature on central bank communication focuses efforts on showing the influence of communication on interest rates (e.g., Guthrie and Wright, 2000; Kohn and Sack, 2004; Andersson et al., 2006; Ehrmann and Fratzcher, 2007a and 2007b;

Rosa and Verga, 2007; Heinemann and Ullrich, 2007; Sturm and de Haan, 2011) and on exchange rate (Jansen and De Haan, 2005 and 2007a; Comrad and Lamla, 2007; Fratzscher, 2008).

In turn, the studies regarding the effect of communication on inflation expectations are scarcer in the literature. The study of Jansen and De Haan (2007b) found evidence of a negative relationship between ECB communication regarding risks to price stability (measured on the basis of the frequency and strength of the keyword ‘vigilance’) and changes in euro area break-even inflation. The work of Ullrich (2008) analyzed the informational content of the monthly introductory statements of the ECB president explaining interest rate decisions with regard to inflation expectations of financial market experts for the euro area. Estimations are conducted for the influence of ECB communication on expectations formation as well as the influence of other macroeconomic variables. The results suggest that the indicator developed to measure the informational content of ECB rhetoric contributes to the explanation of inflation expectations formation. Besides, the results indicate that a communication that shows a monetary tightening increases inflation expectations for six months. This is due to the content on inflation risk obtained in a statement.

Kuttner and Posen (1999) analyzed the link between inflation expectations and inflation targeting coupled with more communication in the UK, New Zealand and Canada. Nevertheless, the analysis does not rely on direct measures of inflation expectations but rather employs indirect approaches such as the Taylor rule and the time series properties of inflation rates. The study of Kliesen and Schmid (2004) investigates the influence of surprises in macroeconomic data releases, monetary policy surprises and central bank communication of the Federal Reserve on inflation expectations. The inflation expectations are gathered from concepts of inflation compensation included in nominal Treasury securities and inflation indexed Treasury securities. Communication measured as an indicator variable for days when communication is priced in the market reduces the uncertainty of future inflation rates measured as the volatility of the series.

Regarding the literature on central bank communication in Brazil, this is still incipient. The existing literature provides results that central bank communication influences interest rates with different maturities as well as expectations formed in relation to monetary policy (Costa-Filho and Rocha, 2009 and 2010; de Mendonça and Faria, 2010 and 2011; Montes, 2012). In turn, studies about the influence of communication on inflation expectations are scarce in the literature as a whole, and, particularly, for the Brazilian case there is none.

Since the main goal of the central bank is to control inflation and anchor expectations, and its communication represents an important instrument to guide expectations, a special attention should be given to this. Moreover, due to the language used in communications is not clear, and the content commonly used in the literature on monetary policy is not the most suitable to explain the formation of agents’ expectations, because they use all available information, it is necessary the creation of a new index that measures the perception of the central bank about the economic outlook.

2.1 Measures of central bank communication

There are different ways of measuring the communication of the central bank through indexes. It is possible to distinguish the following approaches. The first seeks to classify all manifestations of the central bank in accordance with the content and signals, and thus use a numerical scale to encode these ratings. The second seeks to analyze all forms of communication in the media – by the committee or its members – which are important for monetary policy. In this case, specialized news agencies are used to extract the statements of committee members in the days when they occurred. The extractions are done mechanically

using a set of search words that includes the name of the member of the monetary policy committee and the words “interest rate”, “monetary” and “inflation” when the objective is to evaluate the conduct of monetary policy, as well as the words “economy” and “economics perspective” when the objective is to assess the future economic outlook. The third considers some institutional characteristics related to the announcement of monetary policy to measure the impact of communication.

The literature on central bank communication presents some possibilities of constructing indices of communication. Hermann and Fratzscher (2007b) use research tools to collect the communications of all members of the monetary policy committee. Rosa and Verga (2007) present a discrete index, and based on the information contained in the minutes, from a glossary of sentences, classify the minutes indicating the path of future monetary policy. Berger et al (2011) analyzes the communications in terms of future monetary policy, price stability, real sector and monetary indicators. Heinemann and Ullrich (2007) shows the *Wording Indicator*. This index is based on code words according to the full cycle of high and fall of interest rates from the ECB.

In terms of content, the main efforts on the literature is about the path of monetary policy (Connolly e Kohler, 2004; Musard-Gies, 2006; Andersson *et al.*, 2006; Rosa e Verga, 2007; Ehrmann e Fratzscher, 2009; Hayo e Neuenkirch, 2012; Brand *et al.*, 2010; Hayo, Kutan e Neuenkirch, 2010; Ranaldo e Rossi, 2010; Sturm e de Hann, 2011; Rosa, 2011; Demiralp *et al.*, 2012). Only a few works make an effort on other contents of the central bank communication. The paper of Siklos and Bohl (2008) analyzes the content of central bank communication in five aspects: exchange rate, output, assets price, fiscal policy and international regards. The study of Rozkrut *et al.* (2007) focuses on the path of future monetary policy, economic outlook and exchange rate. The work of Berger *et al.* (2011) analyzes the press conference on three topics: (1) price stability; (2) developments in the real economy; and (3) monetary indicators. The papers of Hayo and Neuenkirk (2010), Hayo *et al.* (2012), Kohn and Sack (2004) and Ehrmann and Fratzscher (2007a) study the influence of communication on the path of monetary policy and economic outlook content.

Regarding information related to inflation, Conrad and Lamla (2007) present an indicator that withdraws the forward-looking content from the speeches of the ECB president about risk to price stability, and turns it in an index about the path of monetary policy. The main differences between the indicator proposed by Conrad and Lamla (2007) and the index proposed in this paper are related to the content used in the index and the construction methodology. The indicator presented in Conrad and Lamla (2007) seeks to indicate future monetary policy, while the index proposed in this study provides information about the instability of the economic environment, more precisely in relation to inflation control.

3. Empirical analysis

The period of analysis is from May 2003 to April 2013 (monthly).¹ All series were obtained from CBB website. The variables used are: Inflation expectations (*ie*); Inflation rate

¹ The choice of the period is because, since May 2003, the minutes are published eight days after the end of the meeting.

(*inf*); Output gap (*gap*)²; Credibility index (*ci*)³; Real interest rate (*real_ir*); Real Exchange rate (*real_er*); Energy price (*energy*); Index of central bank communication (*communication*).

3.1 Index of central bank communication based on the theory of fuzzy sets

Based on economic outlook information provided in the minutes of the COPOM meetings, the index of central bank communication measures the perception of the CBB in relation to price stability. Due to the fact that the content of the minutes of the COPOM meetings does not possess a high degree of clarity, the methodology used to construct the index makes use of the theory of fuzzy sets (Zadeh, 1965). The theory of fuzzy sets is useful for classifying diffuse concepts that lose information when classified in binary form. The minutes are divided into sections and each section has numbered paragraphs. Each paragraph has had its content analyzed as positive (optimistic) or negative (pessimistic) for the control of inflation. After analyzing the entire content of the minutes, a counting procedure is applied to measure the degree of instability for controlling inflation which was communicated by the central bank. The count is the number of paragraphs with content deemed negative (pessimistic) to control inflation divided by the total number of paragraphs. The index has values between 0 and 1, and is increasing in relation to the increased risks to inflation control, i.e., the higher (lower) is the index, it means that the central bank is more pessimistic (optimistic) about the behavior of inflation.

The methodology used to construct the index of communication (which uses the theory of fuzzy sets) can be generalized and used to evaluate different subjects covered by the releases. The index is formed based on the information about economic outlook, with focus on inflation risks. However, the same methodology can be applied to evaluate the communications related to economic growth forecast or expectations for the path of the exchange rate. Moreover, although the methodology uses the minutes of the COPOM meetings, this methodology can be extended to other types of announcements of different central banks.

3.2 Estimations and results

² The Output gap is constructed using the natural logarithm of GDP, seasonally adjusted by the method Census X12, deflated by the IPCA. The long-term trend was obtained through the Hodrick-Prescott filter;

³ The success of inflation targeting depends on the credibility in this monetary regime. According to de Mendonça (2009) and de Mendonça and Valério (2010), in economies that use inflation targeting, credibility is an important aspect in the determination of the inflation. In this sense, it is expected that credibility is important to anchor inflation expectations, and thus to affect inflation expectations. The index is based on de Mendonça (2007). The index shows a value between 0 and 1 if the expected inflation (π^e) is situated between the maximum and minimum limits (π_t^*) established for each year. Hence,

$$ci = \begin{cases} 1 & \text{if } \pi^e = \pi_t^t \\ 1 - \frac{1}{\pi_t^* - \pi_t^t} [\pi^e - \pi_t^t] & \text{if } \pi_{tMIN}^* < \pi^e < \pi_{tMAX}^* \\ 0 & \text{if } \pi^e \geq \pi_{tMAX}^* \text{ or } \pi^e \leq \pi_{tMIN}^* \end{cases}$$

Considering the period analyzed, Table 1 below presents the correlations between the variables of the analysis.

Table 1 – Correlations

	<i>ie</i>
<i>ie</i>	1.000
<i>inf</i>	0.753
<i>gap</i>	0.209
<i>real_ir</i>	-0.121
<i>real_er</i>	0.128
<i>energy</i>	0.202
<i>ci</i>	-0.340
<i>communication</i>	0.011

The empirical analysis uses ordinary least squares (OLS), the generalized method of moments (GMM) and vector-autoregressive (VAR) through impulse-response analysis. Before proceeding with the estimates, a standard stationarity test was performed (Table A.1 in the Appendix).

The Generalized Method of moments is used to deal with the problems of heteroscedasticity, autocorrelation and endogeneity (Hansen, 1982). According to Wooldridge (2001, p. 95), “to obtain a more efficient estimator than two-stage least squares (or ordinary least squares), one must have overriding restrictions”. The weighting matrix in the equation was chosen to enable the GMM estimates to be robust, considering the possible presence of heteroskedasticity and autocorrelation of unknown form. It is important to note that the coefficients estimated by GMM are consistent only if the instrumental variables used in the analysis are exogenous. Therefore, the hypothesis of exogeneity of instruments requires that these variables do not directly affect the dependent variable. In this sense, a standard procedure that guarantees such hypothesis is based on Johnston (1984), i.e., the chosen instruments were dated to the period $t-1$ or earlier. Cragg (1983) pointed out that overidentification analysis has an important role in the selection of instrumental variables to improve the efficiency of the estimators. Hence, a standard J-test was performed with the objective of testing this property for the validity of the overidentifying restrictions.

The equation estimated through OLS and GMM is based on Ulrich (2008) and considers the characteristics of an emerging economy (such as Brazil) based on Cerisola and Gelos (2005), de Mendonça (2009) and de Mendonça and Valério (2010). The equation is:

$$ie = a_0 + a_1.inf + a_2.gap + a_3.real_ir + a_4.real_er + a_5.ci + a_6.energy + a_7.communication + v \quad (1)$$

Where, $a_1 > 0$, $a_2 > 0$, $a_3 < 0$, $a_4 > 0$, $a_5 < 0$, $a_6 > 0$ $a_7 > 0$ and v is a random error term.

Table 2 below shows the results of the estimates.⁴ The lags were determined in an empirical basis, following the general-to-specific method.

Regarding the OLS estimates, the F statistics show that the estimated equation is significant and the Ramsey (RESET) tests indicate that the model does not present problem of specification. Regarding GMM, the J statistics indicate that we cannot reject the hypothesis that the model is correct specified.

Table 2 – OLS and GMM estimates

⁴ The reported t-statistics in the OLS estimates are based on the estimator of Newey and West (1987), due to heteroskedasticity and autocorrelation.

Dependent variable: inflation expectations

	OLS				GMM			
	spec.1	spec. 2	spec. 3	spec.4	spec.1	spec. 2	spec. 3	spec.4
<i>constant</i>	2.12091*** (0.63892) [3.319525]	3.029059*** (0.840933) [3.602021]	1.461419* (0.81735) [1.787995]	2.352763** (1.036626) [2.269635]	3.870768*** (0.260718) [14.84655]	4.626957*** (0.381147) [12.13954]	3.346917*** (0.37333) [8.965042]	3.33485*** (0.574885) [5.800897]
<i>inf(-1)</i>	0.247479*** (0.022186) [11.15447]	0.253459*** (0.023821) [10.64018]	0.249846*** (0.024439) [10.22309]	0.254258*** (0.025067) [10.14316]	0.176526*** (0.015222) [11.59678]	0.173733*** (0.015331) [11.33186]	0.170184*** (0.017212) [9.887427]	0.198821*** (0.018665) [10.65201]
<i>gap(-1)</i>	7.865531 (6.49854) [1.210354]	2.985471 (5.797457) [0.514962]	7.009302 (6.42106) [1.091611]	3.175189 (5.565856) [0.570476]	20.67621*** (2.813324) [7.349388]	17.71646*** (3.348812) [5.290372]	19.21555*** (2.801486) [6.859058]	7.432297** (3.73972) [1.987394]
<i>real_ir-3)</i>	-0.063091*** (0.016608) [-3.798868]	-0.049093** (0.01973) [-2.488199]	-0.065842*** (0.015476) [-4.254482]	-0.053714*** (0.018115) [-2.965119]	-0.060152*** (0.009407) [-6.394356]	-0.044961*** (0.01299) [-3.461216]	-0.056285*** (0.008632) [-6.520108]	-0.032071*** (0.010564) [-3.035818]
<i>real_er(-1)</i>	0.033597* (0.018002) [1.866253]	0.026601 (0.016337) [1.628207]	0.035492** (0.014234) [2.493559]	0.029317** (0.014342) [2.044206]	0.061591*** (0.006683) [9.216277]	0.053871*** (0.007986) [6.745328]	0.058524*** (0.006387) [9.162852]	0.043458*** (0.007047) [6.167201]
<i>ci</i>		-0.925168** (0.46541) [-1.987856]		-0.762131* (0.438249) [-1.739034]		-0.513302* (0.295951) [-1.734415]		-0.828367*** (0.271091) [-3.055678]
<i>energy</i>	0.02219*** (0.005651) [3.926736]	0.017398*** (0.006066) [2.868126]	0.02193*** (0.005571) [3.936515]	0.018039*** (0.006485) [2.781452]	0.009002*** (0.002173) [4.141908]	0.003023 (0.00289) [1.045968]	0.009284*** (0.002287) [4.059414]	0.007903** (0.003369) [2.345336]
<i>communication</i>			1.389581** (0.699311) [1.987072]	1.087783* (0.631518) [1.722488]			1.011398* (0.56701) [1.783738]	1.502752*** (0.499535) [3.008298]
<i>adjusted R²</i>	0.72	0.75	0.75	0.77	0.40	0.42	0.45	0.64
<i>F-statistic (p-value)</i>	0.00	0.00	0.00	0.00				
<i>Ramsey - RESET (1)(p-value)</i>	0.43	0.41	0.67	0.46				
<i>Jarque-Bera (p-value)</i>	0.82	0.78	0.54	0.93				
<i>ARCH (1)(p-value)</i>	0.00	0.00	0.00	0.00				
<i>ARCH (2)(p-value)</i>	0.00	0.00	0.00	0.00				
<i>ARCH (4)(p-value)</i>	0.00	0.00	0.00	0.00				
<i>ARCH (8)(p-value)</i>	0.00	0.00	0.00	0.00				
<i>LM(1)(p-value)</i>	0.00	0.00	0.00	0.00				
<i>LM(2)(p-value)</i>	0.00	0.00	0.00	0.00				
<i>Rank</i>					25	25	25	25
<i>J-statistic (p-value)</i>					0.87	0.88	0.82	0.83

Note: Standard errors in parentheses and t-statistics in square brackets. Marginal Significance Levels: *** denotes 0.01, ** denotes 0.05 and * denotes 0.1.

Regarding the influence of past inflation, the evidence points a positive relation, with statistical significance. Thus, when inflation in the past period increases, inflation expectations also increase. This result corroborates Carlson and Parkin (1975) which argue that past inflation affects inflation expectations.

The output gap is used to capture the influence of the economic cycle on inflation expectations. The results suggest that when the economy is heated (sluggish), higher (lower) inflation expectations are formed. However, statistical significance was found only in the estimates through GMM.

In turn, the evidence for the influence of the real interest rate indicate an inverse relationship (negative sign of the estimated coefficient) and with statistical significance. Therefore, an increase (reduction) in the real interest rate causes a decrease (increase) in inflation expectations.

The findings for the influence of the real exchange rate on inflation expectations indicate that, if the real exchange rate increases (decreases), inflation expectations will raise (reduce). The estimated coefficients showed positive sign and statistical significance. This result corroborates the analysis of Cerisola and Gelos (2005) which also found that a more depreciated real exchange rate implies an increase in the real costs of imported inputs and a pass-through link between depreciation and inflation expectations.

The findings for the influence of credibility on inflation expectations suggest, with statistical significance, that the higher the credibility, inflation expectations will be lower, which represents an important result, especially for emerging countries with inflation targeting.

The findings for the influence of energy prices on inflation expectations suggest that such prices exert a positive influence on inflation expectations. This result was also found by Ueda (2010) when he analyzed the determinants of inflation expectations in Japan and the United States.

Regarding the effect of central bank communication on inflation expectations, the estimated coefficients showed positive signs and statistical significance. The evidences suggest that in periods of inflationary pressures, when the central bank communicates that there are difficulties in relation to the control of inflation, such announcements may act raising inflation expectations.

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

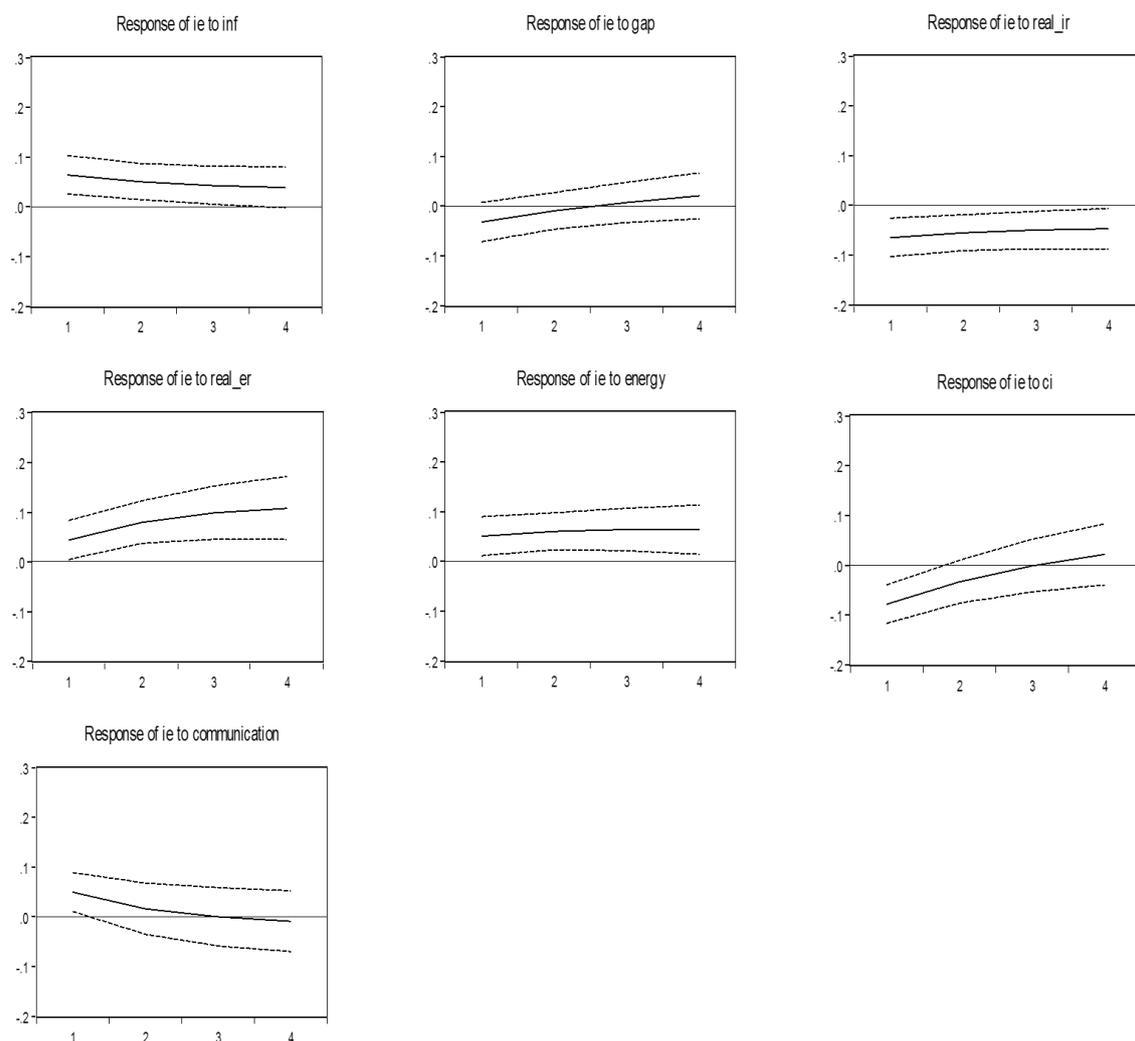
Thus, aiming at eliminating the known problem in the results caused by the order of variables in the VAR, the generalized impulse response function is adopted. The variables used in the analysis are: *ie*, *inf*, *gap*, *ci*, *real_ir*, *real_er*, *energy*, *communication*.⁵ The choice of the VAR lag order was determined using the Schwarz information criterion (SIC). Based on SIC the VAR lag order is 1. The stability test for the VAR is showed through Figure A.1 at the appendix. Figure 1 below shows the results.

Based on the different methods of analysis (OLS, GMM and VAR), the following findings are important to highlight: inflation expectations are positively affected by past inflation and energy prices; demand pressures (output gap) positively affect inflation expectations (statistical significance was not found in the VAR); inflation expectations are negatively affected by the real interest rate; credibility is an important element to reduce inflation expectations, and; in periods of inflationary pressures, when the central bank communicates that there are difficulties in relation to the control of inflation, such announcements may act raising inflation expectations.

Figure 1 – Impulse Response

⁵ The VAR includes an exogenous variable: a dummy variable for the subprime crisis, which assumes value 1 from 2008.11 to 2009.8, and zero otherwise.

Response to Generalized One S.D. Innovations ± 2 S.E.



4. Conclusion

The present study sought to fill a gap regarding empirical studies for the influence of central bank communication on inflation expectations, especially for developing countries, by analyzing the effects of the economic outlook content of the minutes of the COPOM meetings on inflation expectations.

The paper contributes with a new index of central bank communication. Besides, the findings suggest that the expectations of the agents react according to the content of the information provided by the central: announcements cause deterioration of expectations in times of instability, and reduce inflation expectations when inflation is controlled. The results also support the idea that the credibility of inflation targeting plays a key role in determining inflation expectations.

References

- Anderson, M., Dillén, H., Sellin, P., 2006. Monetary Policy Signaling and Movements in the Term Structure of Interest Rates. *Journal of Monetary Economics*, 53(8): 1818-55.
- Brand, C., Buncic, D., Turunen, J., 2010. The Impact of ECB Monetary Policy Decisions and Communication on the Yield Curve. *Journal of the European Economic Association*, 8(6): 1266-1298.
- Berger, H., de Haan, J., Sturm, J. E., 2011. Does Money Matter in the ECB Strategy? New Evidence Based on ECB Communication. *International Journal of Finance and Economics*. 16: 16-31.
- Blinder, A., Ehrmann, M., Fratzscher, M., De Hann, J., Jansen, D. J., 2008. Central bank communication and monetary policy: A survey of theory and evidence. *Journal of Economic Literature*, 46 (4): 910-945.
- Carlson, J. A., Parkin, M., 1975. Inflation expectations. *Economica*, 42: 123–138.
- Cerisola, M., Gelos, R. G., 2005. What Drives Inflation Expectation in Brazil? An Empirical Analysis. IMF working paper, Washington, n. 05/109, p. 1-22.
- Connolly, E., Kohler, M., 2004. News and Interest Rate Expectations: A Study of Six Central Banks. RBA, Annual Conference Volume, in: Christopher Kent & Simon Guttman (ed.), *The Future of Inflation Targeting Reserve Bank of Australia*.
- Conrad, C., Lamla, M. J., 2007. The high-frequency response of the EUR–US Dollar exchange rate to ECB monetary policy announcements. Working paper 07-174, KOF Swiss Economic Institute, ETH Zurich.
- Costa-Filho, A. E., Rocha, F., 2009. Comunicação e Política Monetária no Brasil. *Revista Brasileira de Economia* 63, 4.
- Costa-Filho, A. E., Rocha, F., 2010. Como o Mercado de Juros Reage à Comunicação do Banco Central? *Economia Aplicada*, 14 (3), 265-292.
- de Mendonça, H. F., 2007. Towards credibility from Inflation targeting: the Brazilian experience. *Applied Economics*, 39: 2599–2615.
- de Mendonça, H. F., 2009. Output-inflation and unemployment-inflation trade-offs under inflation targeting: Evidence from Brazil. *Journal of Economic Studies*, 36 (1), 66-82.
- de Mendonça, H. F., Faria, I., 2010. Effects of the Brazilian Central Bank Communication on Financial Markets Expectations. *Encontro Brasileiro de Econometria*, Salvador.
- de Mendonça, H. F., Faria, I., 2011. Transparência, comunicação e formação de expectativas: consequências para a política monetária. *Ensaio FEE*, 32 (2): 553-574.
- de Mendonça, H. F., Valerio, D., 2010. What kind of Phillips curve works in the Brazilian inflation targeting? *The Empirical Economics Letters*, 9, 803-809.
- Demiralp, S., Kara, H., Özlü, P., 2012. Monetary policy communication in Turkey. *European Journal of Political Economy* 28, 540-536
- Ehrmann, M., Fratzscher, M., 2007a. The Timing of Central Bank Communication. *European Journal of Political Economy*, 23(1), 124-45.
- Ehrmann, M., Fratzscher, M., 2007b. Communication by central bank committee members: Different strategies, same effectiveness. *Journal of Money, Credit, and Banking*, 39(2–3), 509–541.
- Ehrmann, M., Fratzscher, M. 2009. Purdah – On the Rationale for Central Bank Silence around Policy Meetings. *Journal of Money, Credit and Banking*, 41(2-3), 517-528.
- Fratzscher, M., 2008. Oral Interventions Versus Actual Interventions in FX Markets - an Event-Study Approach. *The Economic Journal*, 118, 1079-1106.
- Fujiwara, I., 2005. Is the central bank's publication of economic forecasts influential? *Economics Letters*, 89 (3), 255-261.
- Gürkaynak, R. S., Sack, B., Swanson, E. T., 2005. Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements. *International Journal of Central Banking*, May, 55-93.

- Guthrie, G., Wright, J., 2000. Open Mouth Operations. *Journal of Monetary Economics*, 46(2), 489-516.
- Hansen, L. P., 1982. Large sample properties of generalized method of moments estimators. *Econometrica*, 50(4), 1029–1054.
- Hayo, B.; Neuenkirch, M.; 2012. Bank of Canada communication, media coverage, and financial reactions. *Economic Letters* 115, pp. 369-372.
- Hayo, B., Kutan, A. M, Neuenkirch, M. 2010. The impact of U.S. central bank communication on European and pacific equity markets. *Economics Letters*, 108 (2), 172-174.
- Heinemann, F., Ullrich, K., 2007. Does it pay to watch central bankers lips? The information content of ECB wording. *Swiss Journal of Economics*, 143(2), 155–185.
- Jansen, D., 2011. Does the Clarity of Central Bank Communication Affect Volatility in Financial Markets? Evidence from Humphrey-Hawkins Testimonies. *Contemporary Economic Policy*, 29 (4), 494–509.
- Jansen, D., De Haan, J., 2005. Talking heads: The effects of ECB statements on the Euro–Dollar exchange rate. *Journal of International Money and Finance*, 24(2), 343–361.
- Jansen, D., De Haan, J., 2007a. Were Verbal Efforts to Support The Euro Effective? A High-frequency Analysis of ECB Statements. *European Journal of Political Economy*, 23(1), 245-259.
- Jansen, D., De Haan, J., 2007b. The importance of being vigilant: Has ECB communication influenced euro area inflation expectations?, Technical report, CESifo.
- Kliesen, K. L., Schmid, F. A., 2004. Monetary Policy Actions, Macroeconomic Data Releases, and Inflation Expectations, *Federal Reserve Bank of St Louis Review*, 86(3), 9–21
- Kohn, D. L., Sack, B., 2004. Central Bank Talk: Does it Matter and Why? *Macroeconomics, Monetary Policy, and Financial Stability*, Ottawa: Bank of Canada, 175-206.
- Koop, G., Pesaran, M. H., Potter, S. M., 1996. Impulse response analysis in nonlinear multivariate models. *Journal of Econometrics*, 74: 119–147.
- Kuttner, K. N., Posen, A. S., 1999. Does Talk Matter After All? *Inflation Targeting and Central Bank Behavior*, CFS Working Paper , No. 04.
- Lutkenpohl, H., 1991. *Introduction to Multiple Time Series Analysis*. Springer, Berlin.
- Montes, G. C., 2012. Financial market reaction to central bank communication and monetary policy: evidence for an inflation targeting emerging economy. *CEPAL Review*.
- Musard-Gies, M., 2006. Do European Central Bank's Statements Steer Interest Rates In The Euro Zone? *Manchester School*, University of Manchester, 74(s1), 116-139.
- Pesaran, M. H., Shin, Y., 1998. Generalized Impulse Response Analysis in Linear Multivariate Models. *Economics Letters*, 58: 17–29.
- Rinaldo, A., Rossi, E., 2010. The reaction of asset markets to Swiss National Bank communication. *Journal of International Money and Finance*, 29 (3), 486-503.
- Rosa, C., Verga, G., 2007. On the Consistency and Effectiveness of Central Bank Communication: Evidence from the ECB. *European Journal of Political Economy*, 23(1), 146-75.
- Rosa, C., 2011. Words That Shake Traders. *Journal of Empiric Finance*, 18 (5), 915-934.
- Rozkrut, M., Rybinski, K., Sztaba, L., Szwaja, R., 2007. Quest for central bank communication: Does it pay to be "talkative"? *European Journal of Political Economy*, 23 (1), 176-206.
- Siklos, P. L., Bohl, M., 2008. Policy works and policy deeds: The ECB and the euro. *International Journal of Finance and Economics* 13, 247-265
- Sims, C., 1980. Macroeconomics and reality, *Econometrica*, 48(1): 1-48.

- Sturm, J., De Haan, J., 2011. Does central bank communication really lead to better forecasts of policy decisions? New evidence based on a Taylor rule model for the ECB. *Review of World Economics (Weltwirtschaftliches Archiv)*, 147 (1), 41-58.
- Ueda, K., 2010. Determinants of Households' inflation expectations in Japan and the United States. *Journal of the Japanese and International Economies*, 24 (4): 503-518.
- Ullrich, K., 2008. Inflation Expectations of Experts and ECB Communication. *North American Journal of Economics and Finance*, 19, 93-108.
- Zadeh, L.A., 1965. Fuzzy sets. *Information and Control*, 8, 338-53.

Appendix

Table A.1 - Stationarity test

KPSS						
	Exogenous	Bandwidth	Test	1%	5%	10%
<i>inflation expectation</i>	I	9	0.282	0.739	0.463	0.347
<i>inflation</i>	I	8	0.429	0.739	0.463	0.347
<i>output gap</i>	I	9	0.047	0.739	0.463	0.347
<i>real interest rate</i>	IT	9	0.129	0.216	0.146	0.119
<i>real exchange rate</i>	I	8	0.045	0.739	0.463	0.347
<i>credibility</i>	IT	8	0.113	0.216	0.146	0.119
<i>energy price</i>	IT	8	0.084	0.216	0.146	0.119
<i>fuzzy communication index</i>	I	7	0.098	0.739	0.463	0.347

Note: Based on Schwarz criterion, (I) intercept or (IT) intercept and trend was applied.

Figure A.1: VAR stability test

