**Does central bank’s perception regarding the state of the economy affect entrepreneurs’ expectations? Are entrepreneurs’ expectations important for investment?**

Empirical Evidence from Brazil

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**Abstract**

Studies on central bank communication in emerging countries are still scarce. There are no studies regarding the influence of central bank communication on entrepreneurs’ expectations. This paper contributes to the literature in the following aspects: (i) based on the minutes of the COPOM meetings, we use an indicator that reveals central bank’s perception related to the state of the economy, and (ii) we analyze the influence of central bank communication on expectations and confidence of entrepreneurs, and the influence of such expectations on aggregate investment. The findings reveal that the information provided by the Central Bank of Brazil regarding the economic environment affects entrepreneurs’ expectations and, aggregate investment is influenced by these expectations.

**Keywords**: communication, expectation, central bank, monetary policy.

**Resumo**

Estudos sobre comunicação dos bancos centrais em países emergentes ainda são escassos. Não existem estudos sobre a influência da comunicação do banco central sobre as expectativas dos empresários. Este trabalho contribui para a literatura nos seguintes aspectos: (i) com base nas atas das reuniões do Copom, utilizamos um indicador que revela a percepção do banco central relacionada ao estado da economia, e (ii) analisamos a influência da comunicação do banco central sobre as expectativas e confiança dos empresários, e a influência de tais expectativas sobre o investimento agregado. Os resultados revelam que as informações fornecidas pelo Banco Central do Brasil em relação ao ambiente econômico afeta as expectativas dos empresários e, o investimento agregado é influenciado por essas expectativas.

**Palavras-chave**: comunicação, expectativa, banco central, política monetária.

**JEL Classification**: E22, E52, E58

Área 4 - Macroeconomia, Economia Monetária e Finanças.

**1. Introduction**

In decision-making process, economic agents use all relevant available information to form their expectations. Investment decisions, for example, are strongly influenced by expectations and therefore require a stable economic environment. In order to reduce uncertainties in the business environment, the management of expectations is an important task for the monetary authority, which involves the creation of a stable macroeconomic environment.

Since the management of expectations represents an important task of the monetary authority in economies with forward-looking agents, transparency and accountability through central bank communication have been gaining more importance. In fact, since the early 1990s, the conduct of monetary policy has shifted from secrecy towards more transparency. The main explanation for this global trend was the increasing understanding that transparency can improve the effectiveness of monetary policy (Woodford, 2003) and the essence of monetary policy is the art of managing expectations (Woodford, 2001). This approach has highlighted the role of communication in monetary policy.

Central bank communication emerges as an important tool in the task of managing expectations. According to Blinder *et al*. (2008), communication can be an important and powerful part of the central bank’s toolkit since it has the ability to move financial markets, to enhance the predictability of monetary policy decisions, and potentially to help achieve central banks’ macroeconomic objectives. As a consequence, to the extent that central bank communication becomes an instrument of large influence for central banks, studies about the influence of central bank communication on the expectations formation process are becoming more prominent (Erhmann and Fratzcher, 2007a).

In recent years, several studies on central bank communication have been developed. Most research focuses on developed countries and on the influence central bank communication has on expectations formed in financial markets about the behavior of interest rates and exchange rates, and about future monetary policy (Kohn and Sack, 2004; Connolly and Kohler, 2004; Musard-Gies, 2006; Andersson, Dillén and Sellin, 2006; Rosa and Verga, 2007; Reeves and Sawicki, 2007; Ehrmann and Fratzscher, 2007a and 2009; Brand et al., 2010; Hayo, Kutan and Neuenkirch, 2010; Ranaldo and Rossi, 2010; Sturm and de Hann, 2011; Rosa, 2011; Berger et al., 2011; Hayo and Neuenkirch, 2012). However, studies on central bank communication in emerging countries – such as Brazil – are still scarce (Costa Filho and Rocha, 2009 and 2010; de Mendonça and Faria, 2010 and 2011; Montes, 2012).

As pointed out by Blinder et al. (2008), nearly all the research to date has focused on central bank communication with financial markets. It is time to pay more attention to communication with the general public. Reviewing the literature on central bank communication, it is observed that there are no studies regarding the influence of central bank communication on entrepreneurs’ expectations. In turn, there are few studies related to the influence of entrepreneurs’ expectations on investments in emerging economies (e.g., Montes, 2013).

This paper analyzes whether central bank’s perception regarding the state of the economy – obtained through the minutes of the Brazilian Monetary Policy Committee (COPOM) meetings – affects entrepreneurs’ expectations. Moreover, due to the fact that such expectations are important for investment decisions, the paper also analyzes the influence of entrepreneurs’ expectations on aggregate investment. The study contributes to the literature in the following aspects: (i) based on the minutes of the Brazilian Monetary Policy Committee (COPOM) meetings, we develop, using the theory of fuzzy sets, an indicator that reveals central bank’s perception related to the state of the economy, and (ii) based on this indicator, we analyze the influence of central bank communication on expectations and confidence of entrepreneurs, and the influence of such expectations on aggregate investment in Brazil. The analysis covers the period of inflation targeting in Brazil, thus, it begins from the second quarter of 1999.

But why the communication of the central bank should be taken into consideration? More precisely, why the information provided by the central bank should be considered by entrepreneurs in the expectations formation process? According to Blinder *et al*. (2008), the central bank may have, or may be believed to have, superior information on the economic outlook. Central banks usually devote many more resources than private sector forecasters to forecasting and even to estimating the underlying unobservable state of the economy. Therefore, the creation of an indicator that captures the central bank’s perception regarding the state of the economy is important, since entrepreneurs use all available information concerning the state of the economy to make their decisions, including, particularly, the information provided by the central bank. Moreover, an analysis of the influence of this indicator on entrepreneurs’ expectations is important in order to know if they consider the information provided by the central bank in the expectations formation process.

The article is divided as follows. Section 2 presents a brief review of the empirical literature on central bank communication. Section 3 presents the empirical analysis. Section 4 presents the conclusions.

**2. Central bank communication: importance and main empirical results**

According to Blinder et al. (2008), central bank communication can be defined as the provision of information by the central bank to the public regarding present and future monetary policy, the economic outlook and the goals of the central bank. This information is important since it affects, for example, the expectations formation process regarding future monetary policy and inflation in the following periods. In this sense, central bank communication acts in a helpful way since it guides agents' expectations and, thus, plays an important role in decision-making (Jansen, 2011). Due to the fact that central bank communication affects expectations, communication represents an important tool for central banks affect the economy through agents’ expectations, and to improve monetary policy (Gürkaynak, Sack and Swanson, 2005).

Most of the existing empirical literature on central bank communication analyzes the influence of communication on interest rates and on expectations about future monetary policy (e.g., Guthrie and Wright, 2000; Kohn and Sack, 2004; Gürkaynak, Sack and Swanson, 2005; Andersson, Dillén and Sellin, 2006; Ehrmann and Fratzcher, 2007a and 2007b; Rosa and Verga, 2007; Heinemann and Ullrich, 2007; Rozkrut *et al*., 2007; Sturm and de Haan, 2011; Demiralp *et al.,* 2012). In turn, there are also studies on the effects of central bank communication on financial markets (Berger, Ehrmann and Fratzcher, 2011; Rosa, 2011; Jansen, 2011; Hayo and Neuenkirch, 2012).

There are also studies regarding the effect of central bank communication on exchange rate (Jansen and de Haan, 2005 and 2007a; Comrad and Lamla, 2007; Fratzscher, 2008; Siklos and Bohl, 2008; Beine, Janssen and Lecourt, 2009). In general, the studies suggest that communication is effective in affecting the level and volatility of exchange rates.

There are also studies related to the influence of central bank communication on the macroeconomic performance, however, these studies exist to a lesser extent. There are, for example, studies related to the effect of central bank communication on inflation expectations. Jansen and de Haan (2007b) examined the relationship between inflation expectations and risks to price stability. The result found was a negative relationship between the communication of the ECB and inflation expectations. Ullrich (2008) analyzed the impact of ECB communication on expectations formation. The results indicate that a communication that shows monetary tightening increases inflation expectations for six months. This is due to the content related to the risk of inflation obtained through the statement.

Regarding the empirical literature on central bank communication in Brazil, this is still scarce. 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 (e.g., Costa Filho and Rocha, 2009 and 2010; de Mendonça and Faria, 2010, 2011 and 2013; Montes, 2012).

**3. Empirical analysis**

The minute of COPOM meeting is an important communication tool of the monetary authority in Brazil. The minute of the meeting explains the reasons for the monetary policy decision and provides perspectives for future meetings considering the economic outlook.

The minutes of the meetings provide important information about the perception of the Central Bank of Brazil regarding the state of the economy. This perception is relevant to the expectations formation process. Therefore, based on the information regarding the economic outlook offered through the minutes of the meetings, the indicator for the perception of the Central Bank of Brazil is built. The idea is to classify the minutes of COPOM meetings and thus capture the perception of the Central Bank of Brazil in relation to the economic environment, and whether this perception affects entrepreneurs’ expectations.

In order to make decisions, such as investment decisions, entrepreneurs use the information they have about the current economic environment, long term interest rates, and their expectations about the future (Montes and Bastos, 2013). In this sense, communication is an important tool for the central bank to influence agents' expectations (Gürkaynak, Sack and Swanson, 2005).

**3.1 Data**

The analysis uses quarterly series for the period from 1999.Q2 to 2012.Q3. In all series was applied the natural logarithm. The monthly series (interest rate Selic, real exchange rate, inflation rate, real interest rate, and credit) were transformed into quarterly series by calculating the average of the three months comprising the quarter. The series are:

**Industrial entrepreneur confidence index** **(*icei*):** The index is elaborated with the assistance of the Federations of Industries of 24 Brazilian States. The index is obtained on the basis of a survey that assesses the attitudes and stances of businessmen and their expectations in regard to the coming six months in terms of Brazilian economy and of their own companies. The index is constructed based on two other indexes, one considering actual conditions and the other considering expectations for the next six months. The *icei* varies in the 0-100 interval.

**Output gap (*gap*):** This series uses the GDP at current prices – R$ millions – (series 4382 from CBB web site) seasonally adjusted by the method Census X12, deflated by the IPCA. The natural logarithm was applied to the series and its long-term trend was obtained through the Hodrick-Prescott filter. Subsequently, the difference between the output and its long-term trend was calculated.

**Investment (*gfcf*):** The proxy used for measuring private investment is Gross Fixed Capital Formation (de Mendonça and Lima, 2011; Montes, 2013; Montes and Bastos, 2013). This indicator is published by the Brazilian Institute of Geography and Statistics.

**Interest rate Selic (*ir*)**: Nominal interest rate (Selic – series 4189 from CBB web site). This is the main monetary policy instrument.

**Real Exchange rate (*tc***)**:** Real effective exchange rate indexed by IPCA (series 11752 from CBB web site).

**Inflation rate (*infl*):** Official inflation rate in Brazil measured by IPCA accumulated in 12 months (series 13522 from CBB web site).

**Real interest rate (*ir\_real*):** this indicator is the result of the difference between the basic interest rate (SELIC – series 4189) accumulated in annual terms and the inflation rate (series 13522).

**Credit as a proportion of GDP (*credit*):** This series is obtained by dividing the series of credit operations in the financial system to private sector (series 2046)by the GDP (series 4382).

**Index of central bank communication (*ic*):** Based on economic outlook information provided in the minutes of the COPOM meetings, the index of central bank communication measures the perception of the Central Bank of Brazil in relation to the economic environment. 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 state of the economy. When it is considered optimistic thus the paragraph assumes a value equal to 1, and when pessimistic it assumes a value equal to zero. After analyzing the entire content of the minutes, a counting procedure is applied to measure the degree of economic stability perceived by the central bank. The count is the number of paragraphs with optimistic content regarding the economic environment divided by the total number of paragraphs. The index has values between 0 and 1, and is increasing when the central bank’s perception regarding the economic environment gets more optimistic, i.e., the higher is the index, it means that the central bank is more optimistic about the state of the economy.[[1]](#footnote-1) Thus, the communication index is:

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. Due to the fact that the minutes of COPOM meetings present a large content, related to several aspects of the economy, the classification of the document is a task that incorporates interpretation. Hence, the theory of fuzzy sets is recommended for the construction of this type of index since it mitigates the risk of classifying objects in the wrong set.[[2]](#footnote-2)

**Dummy variable for domestic shocks (*SHOQ*):** This dummy variable was created in order to consider domestic shocks that occurred in the period analyzed (i.e., the energy crisis and the effect of the presidential election, which elected Lula as president of Brazil). This variable assumes value equal to one from the first quarter of 2001 to the fourth quarter of 2002, and zero otherwise.

**3.2 Analytical scheme and Methodology**

Figure 1 illustrates the analysis performed in this study. The scheme summarizes the core ideas analyzed in the paper: the impact of central bank’s perception regarding the state of the economy on entrepreneurs’ expectations and, the influence of entrepreneurs’ expectations on the aggregate investment. Following Montes (2013) and Montes and Bastos (2013), the influence of the monetary policy, the economic activity and the exchange rate are considered in the analysis of the entrepreneurs’ expectations. In turn, following Ribeiro and Teixeira (2001), de Mendonça and Lima (2011) and Montes (2013), the effects of the real interest rate, the credit and the inflation are taken into account in the analysis of aggregate investment. Figure 2 presents scatterplot graphs with correlations (regression lines).

**Figure 1 – Analytical scheme**



*Author’s elaboration*

**Figure 2 – Scatterplot graphs**



*Author’s elaboration*

A first condition to be analyzed before applying the econometric analysis is to check if series are stationary. Therefore, the Kwiatkowski-Phillips-Schmidt-Shin test (KPSS) was applied. The advantage of this test results from the powerless of conventional tests, as these tend not to reject the null hypothesis too often (Franses and Haldrup, 1994; Cati et al., 1999). Moreover, Kwiatkowski, Phillips, Schmidt and Shin (1992) argue that the KPSS test can distinguish series that appear to be stationary, series that appear to have a unit root, and series for which the data are not sufficiently informative to be sure whether they are stationary or integrated – as is the case of series with short periodicity. The results show that all series are I(0) (Table A.1, appendix).

The empirical analysis makes use of ordinary least squares (OLS) and generalized method of moments (GMM). One reason for using GMM is that while OLS estimates have problems of serial autocorrelation, heteroskedasticity or non-linearity, which is typical in macroeconomic time series, this method provides consistent estimators for the regression (Hansen, 1982). Besides, a manner of avoiding the problem of identification has been the use of GMM models (Hall, 2005). As pointed out by Wooldridge (2001, p. 95), “to obtain a more efficient estimator than two-stage least squares (or ordinary least squares), one must have overriding restrictions”. The weighting matrix in the equation was chosen to enable the GMM estimates to be robust, considering the possible presence of heteroskedasticity and autocorrelation of unknown form.[[3]](#footnote-3) The estimations were performed using the software E-Views 7.0.

**3.3 Estimates for the industrial entrepreneur confidence index** **(*icei*)**

Taking as reference the works of Montes (2013) and Montes and Bastos (2013), the variables of equation (1) have been defined. The central idea is to analyze the influence of central bank’s perception regarding the state of the economy (based on the minutes of COPOM meetings) on entrepreneurs’ expectations. The lags of the variables were determined empirically, following the general-to-specific method, observing the statistical significance of the coefficients and the principle of parsimony.

, (1)

The expected signs for the relations are expressed through partial derivatives,

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Table 1 shows the results of the estimates. In OLS estimation, due to the problems of heteroskedasticity and autocorrelation, the Newey-West matrix was used. In turn, the Ramsey (RESET) test indicates that the model is not misspecified.[[4]](#footnote-4) Furthermore, the F-test shows that the equation is significant. Regarding GMM, the J-statistic indicates that we cannot reject the hypothesis that the model is correctly specified.[[5]](#footnote-5)

**Table 1 – OLS and GMM estimates for equation (1)**

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

The estimates reveal that the coefficients present the expected signs and are statistically significant through OLS and GMM, except the interest rate (*ir*), which was not statistically significant through OLS. The results for the influence of both economic activity and monetary policy on entrepreneurs’ expectations corroborate the findings present in Montes (2013) and Montes and Bastos (2013). Positive signs were found for the relation between *icei* and *gap*, i.e., when economic activity increases, entrepreneurs become more optimistic and thus their expectations and confidence increase. The estimated coefficients for the interest rate presented negative signs. Thus the higher the interest rate, expectations and confidence of entrepreneurs deteriorate.

In turn, positive signs were found for the relation between *icei* and *ic.* The evidence suggests that the content in the minutes of COPOM meetings directly affect expectations and confidence of entrepreneurs, i.e., when the central bank reveals a more optimistic view about the state of the economy, expectations and confidence of entrepreneurs regarding the economic environment increase.

Regarding the exchange rate, the estimated coefficients showed positive signs. This result indicates that when the exchange rate depreciates, entrepreneurs tend to form optimistic expectations and therefore increase confidence, since it stimulates exports.

**3.4 Estimates for the aggregate investment**

Taking as reference the works of de Mendonça and Lima (2011) and Montes (2013) for the Brazilian economy, the variables of equation (2) have been defined. The lags of the variables were determined empirically, following the general-to-specific method, observing the statistical significance of the coefficients and the principle of parsimony.

, (2)

The expected signs for the relations are expressed through partial derivatives,

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Table 2 shows the results of the estimates. In OLS estimation, due to the problem of autocorrelation, the Newey-West matrix was used. The Ramsey (RESET) test indicates that the model is not misspecified. [[6]](#footnote-6) Furthermore, the F-test shows that the equation is significant. In terms of GMM estimation, the J-statistic indicates that we cannot reject the hypothesis that the model is correctly specified.[[7]](#footnote-7) The estimated coefficients for the dummy variable (*SHOQ*) showed negative signs, which justify its inclusion in the equation.

**Table 2 – OLS and GMM estimates for equation (2)**

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

Estimates show that when entrepreneurs are more optimistic about the economy (and therefore the higher the *icei*), the gross fixed capital formation increases. In this sense, the information provided by the central bank about its perceptions related to the state of the economy influence the expectations and confidence of entrepreneurs, and these expectations and confidence are important for investment decisions.

The estimated coefficients for the relationship between credit and *gfcf* presented positive signs, indicating that when the availability of credit increases, entrepreneurs make more investments. This result corroborates the findings presented by de Mendonça and Lima (2011) and Montes (2013) for the Brazilian economy under inflation targeting. The estimated coefficients for the real interest rate had negative signs, indicating that the higher the interest rate the lower the investments made by entrepreneurs – this result was also found by de Mendonça and Lima (2011) and Montes (2013) for the Brazilian economy under inflation targeting. Moreover, the estimated coefficients for the inflation rate had negative signs – this result was also found by de Mendonça and Lima (2011) – indicating that in higher inflation environments, entrepreneurs will reduce investments.

So far, the individual estimates provide evidence that CBB’s perception regarding the state of the economy directly affects the expectations of entrepreneurs, and the aggregate investment is affected by expectations and confidence of entrepreneurs.

**3.5 Estimates through system of simultaneous equations**

In order to provide robustness to the results already found, a system of simultaneous equations is estimated by GMM. Based on the system it is possible to observe the transmission mechanism related to the influence of central bank’s perception regarding the state of the economy on investment through the expectations and confidence of entrepreneurs. The system is as follows:

***System***

Where and are the error terms.

Table 3 shows the estimates of the system.[[8]](#footnote-8) The signs of the estimated coefficients are the same found in the equations estimated individually. In addition, all variables were statistically significant, and the standard errors of all variables are lower than those found in the individual estimates.

The evidence suggests that CBB’s perception regarding the state of the economy based on economic outlook information provided in the minutes of the COPOM meetings affects the expectations and confidence of entrepreneurs, i.e., when the monetary authority signals that the economy presents good indicators, entrepreneurs form optimistic expectations about the state of the economy and their own businesses. In turn, when the monetary authority signals that problems are occurring in the economy, expectations and confidence deteriorate. Thus, the perspectives of the central bank about the state of the act as useful guides for expectations and, consequently, affect investments in the economy, because investments are sensitive to changes in expectations and confidence. So far, the findings reveal that monetary policy and central bank communication affect investments through the interest rate channel and the expectations channel. Moreover, estimates show that the credit is an important element for investments.

**Table 3: GMM estimates for the system**

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

**3.6 Dynamic analysis through vector autoregressive (VAR)**

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

Aiming at evaluating the transmission mechanism, the set of variables used in the VAR analysis is represented by*gfcf*, *icei*, *ic*, *gap* and *ir*. Moreover, the dummy variable (*SHOQ*) is used as exogenous variable. The choice of the VAR lag order was determined using the Akaike (AIC) and Hannan-Quinn (HQ) information criteria. Table 5 below indicates that the VAR lag order is 3

**Table 5 – AIC and HQ criteria for VAR lag order**



*Author’s elaboration*

Figure 3 shows the results of the generalized impulse response functions. Figure 4 shows the stability of the VAR. The diagnostic tests to detect autocorrelation heteroskedasticity and non-normality are in the Appendix (tables A.4, A.5 and A.6).

**Figure 3 – Impulse Response**



*Author’s elaboration*

**Figure 4 – VAR stability**



*Author’s elaboration*

According to Figure 3 the index of expectations and confidence of entrepreneurs (*icei*) is positively affected, with statistical significance, by an unexpected shock in the index of central bank communication (*ic*). This result is in accordance with those of the OLS and GMM analyses.

In turn, when economic activity increases and therefore an unexpected shock in the output gap (*gap*) is observed, this causes a positive response, with statistical significance, in the index of expectations and confidence of entrepreneurs (*icei*). This result indicates that positive changes in economic activity will positively affect the expectations and confidence of entrepreneurs. This result is in line with the evidence found by the estimations.

Corroborating the empirical literature and the evidence already found in this study, an unexpected shock in the interest rate will adversely affect, with statistical significance, the expectations and confidence of entrepreneurs.

In turn, when an unexpected shock in the index of expectations and confidence of entrepreneurs (*icei*) occurs, the investment (*gfcf*) responds positively. Despite the result did not show statistical significance, the great mass of the *gfcf* response is above the zero axis (i.e., is in the area with positive values).

A positive shock in the index of central bank communication caused a positive change in investment. Moreover, a positive shock in the interest rate caused a decrease in investment.

**4. Conclusion**

The literature on central bank communication is focused mostly on the effects of communication on financial market expectations. Reviewing the literature on central bank communication, a gap is observed with respect to empirical studies regarding the influence of central bank communication on expectations in emerging countries. The present study sought to fill this gap by analyzing the influence of central bank communication on expectations and confidence of entrepreneurs, and the influence of such expectations on aggregate investment in Brazil. Besides, based on the minutes of the Brazilian Monetary Policy Committee meetings, we developed, using the theory of fuzzy sets, an indicator that reveals central bank’s perception related to the state of the economy.

The results show that the expectations formed by entrepreneurs follow the information provided by the central bank in relation to the economic environment, i.e., the state of the economy reported by the monetary authority is taken into account by the entrepreneurs, and induces expectations to move on the same direction. Besides, the findings reveal that monetary policy and central bank communication affect investments through the interest rate channel and the expectations channel.

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**Appendix**

**Table A.1: KPSS test**



**Table A.2: Diagnostic tests (OLS estimation) – equation (1)**

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**Table A.3: Diagnostic tests (OLS estimation) – equation (2)**



**Table A.4: VAR Residual Serial Correlation LM Tests**



**Table A.5: VAR Residual Heteroskedasticity Test**



**Table A.6: Normality**



1. By the end of 2005 the minutes were published monthly, after the beginning of 2006 the minutes are now published every 45 days. In order to adjust the publication of the minutes to the database, from 2006 ahead, regarding the months that there is no publication of the minutes, it is considered that the agents use the latest information available, i.e., the minutes of the previous month. Thus, the value found in the index is repeated for the month that there is no minute. [↑](#footnote-ref-1)
2. The theory of fuzzy sets has been formalized to create an alternative theory to conventional set theory. According to the theory of fuzzy sets, there are degrees of pertinence, so that an element is not classified as belonging or not to a set, exclusively; the element has a degree of pertinence according to a defined numerical function. Thus, the theory of fuzzy sets is useful for classifying diffuse concepts that lose information when classified in binary form (Zadeh, 1965). [↑](#footnote-ref-2)
3. Regarding the GMM technique, Cragg (1983) pointed out that overidentification analysis has an important role in the selection of instrumental variables to improve the efficiency of the estimators. Hence, a standard J-test was performed with the objective of testing this property for the validity of the overidentifying restrictions (Hansen, 1982). [↑](#footnote-ref-3)
4. Diagnostic tests are shown in Table A.2 (appendix). [↑](#footnote-ref-4)
5. Instrumental variables: c, icei(-2), icei(-3), ic(-1), ic(-2), ir(-1), ir(-2), tc(-3), tc(-4), gap(-2), gap(-3), gap(-4). [↑](#footnote-ref-5)
6. Diagnostic tests are shown in Table A.3 (see Appendix). [↑](#footnote-ref-6)
7. The instrumental variables are: gfcf(-1), gfcf(-2), gfcf(-3), gfcf(-4), credit(-2), credit(-3), credit(-4), ir\_real(-4), ir\_real(-5), ir\_real(-6), ir\_real(-7), infl(-2), infl(-3) icei(-2), icei(-3), icei(-4), icei(-5). [↑](#footnote-ref-7)
8. The estimation of the system through GMM applies the same instrumental variables of the individual estimates. [↑](#footnote-ref-8)