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Do the central bank actions reduce interest rate volatility?☆

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ABSTRACT

This paper investigates how Central Bank of Brazil (CBB) actions influence market uncertainty. We consider two kinds of actions: the monetary policy decision about the interest rate target and the pure communication event of this decision published one week later. Unlike related papers, we measure the market uncertainty by the implied volatility extracted from interest rate options. Implied volatility is more suitable than physical volatility to assess economic effects since it encompass market beliefs adjusted by risk. We use an event study approach to evaluate the impact of CBB actions. The results show that both the decisions about the target rate and the communication event reduce the interest rate volatility.

1. Introduction

Central bank actions can lead to negative impacts on the economy, especially if they are not well understood by the public. Therefore, communication is a key issue that must be carefully managed by central banks in order to allow market participants make more efficient decisions. Blinder et al. (2008) survey the large literature on this topic, emphasizing the communication aspect related to monetary policy actions. They conclude that the great majority of the examined empirical studies suggest that more central bank transparency contributes to the predictability of monetary policy decisions and reduces uncertainty.

The main goal of this paper is to analyze the influence of the actions of the Central Bank of Brazil (CBB) on market uncertainty. More specifically, we investigate what happens to the interest rate volatility around two events: the basic interest rate target decision and the release of the minutes of the corresponding meeting. The CBB's Monetary Policy Committee (Copom) sets the interest rate target in regular meetings. Shortly after each of these meetings, the Copom issues a statement where the target rate is revealed. One week later, the minutes are released, which include the Copom's assessment of the economic outlook. As the dates of these events are known in advance, but not the contents, we expect that the yield curve uncertainty to be affected by them.

There are a number of models devoted to gauging volatility of financial variables. Many of them rely on time series data. In this paper, we follow a different approach and use the implied volatility as a measure of uncertainty. Implied volatility has many advantages over physical/historical volatility estimated by time series models. First, it is forward-looking, reflecting the aggregate opinion about the dispersion of future prices. However, implied volatility is connected with the risk-neutral distribution, which encompasses the market beliefs (likelihood of the states of nature) adjusted by risk aversion. Therefore, it differs from physical volatility by the risk premium. Although the physical distribution is useful in forecasting exercises, according to Aït-Sahalia and Lo (2000) the risk-neutral probabilities are more suitable to evaluate the economic impacts, since they contain fundamental information about time preferences. Moreover, as pointed out by Bali et al. (2011), it is very difficult to estimate the physical probabilities. On the other hand, the risk-neutral density can be easily obtained from option prices, as demonstrated by Breeden and Litzenberger (1978).

Besides the second moment of the interest rate risk-neutral distribution, we also analyze the behavior of the mean around CBB actions. There are two reasons to consider the first moment. The mean is directly observed from interest rate future contracts, which are more liquid than options. Moreover, the mean is a central measure, so its movements are more connected to next steps of monetary policy. An increase in the mean is related to a monetary policy squeeze while a reduction indicates an easy monetary policy.

We use the event study approach as the statistical technique to evaluate the impact of the CBB's statement and the minutes' release on the first two moments of the interest rate risk-neutral distribution. Our sample period begins in January 2006 and ends in March 2015. This

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was a period of markedly decreasing interest rates, according to the CBB's intention to stimulate growth. However, we also note some hikes in response to external shocks, such as the 2008 subprime crisis and 2011 European crisis, and to local issues such as the increasing domestic inflation since 2013.

Our results show that the Copom's decisions significantly reduce the level and the time dynamics of the interest rate volatility around the dates of meetings, which is consistent with the central bank communication literature. Moreover, this effect holds until the release dates of the minutes. Regarding the interest rate mean, we find that around statement dates in which the Copom increases the target rate, the one-year yield presents statistically significant rises. For the case of target reduction decisions, the statement is more effective to alter the level than the time dynamics of the interest rate. However, one week later, when the minutes are released, we do not note a persistence of the effects of the target rate decisions on the mean of the interest rate risk-neutral distribution.

Certainly, we are not the first to assess the impact of monetary policy actions on the financial market. A number of papers have addressed this question.[1] However, a still incipient strand of this literature has examined the reaction of options markets to central bank announcements. Bhar and Chiarella (2000) investigate the behavior of option-implied distributions of short-term interest rates around four interest rate reductions conducted by the Reserve Bank of Australia. They find that the probability of a decline in interest rates increases before the central bank rate reductions, suggesting that market participants anticipate the forthcoming interest rate cut. Mandler (2003) extracts risk-neutral probability density functions from LIFFE-Euribor futures options and looks for characteristic differences in market expectations related to meetings of the European Central Bank (ECB). He also shows that monetary policy meetings of the ECB tend to decrease the uncertainty of market expectations. Vahamaa (2005) focuses on the skewness of option-implied distributions around ECB monetary policy actions. He finds that asymmetries in market expectations tend to increase before changes in the monetary policy stance and to decrease afterwards. Breeden and Litzenberger (2014) estimate state prices from 3-month interest rate options around major actions of the Federal Reserve Board and the European Central Bank in the 2008-2013 period, a time of historic levels of central bank interventions. They show that these policy actions do affect the probability distribution of future interest rates. Sinha (2015) uses options data to extract state-price densities of investor beliefs. He finds that announcements about extension of the zero-lower bound policy in the U.S. during 2012-13 reduced the expectations about crash risk, but increased the uncertainty about future long-term yields.

Although all of these works investigate the impacts of central bank communication on the interest rate risk-neutral distribution, there are at least two new aspects analyzed by us. We are the first to study the effects on the yield curve risk-neutral distribution in an emerging economy. According to Papadamou et al. (2015), the central bank's transparency has a more important role in the transmission of monetary policy in emerging markets than in the developed world. Moreover, as pointed out by Mendonça and Faria (2013), Brazil is a preferred laboratory experiment as an emerging economy since it has a developed financial market and successful inflation targeting regime. Second, we extract the implied volatility from Asian interest rate options instead of swaptions. This is an interesting feature since we can directly associate this volatility to the volatility of the yield with the same maturity of the option.[2]

[1] Birru and Figlewski (2010) review this literature, focusing on Federal Open Market Committee's (FOMC) decisions.

[2] Let t be the present date. The underlying asset of an interest rate swaption maturating at $u > t$ is the yield between u and T ($T > u$). On the other hand, the underlying asset of the main Brazilian interest rate option maturating at u is the accumulated one-day rate between t and u. To the best of our knowledge, this kind of option is only available in the Brazilian financial market, where it has high liquidity.

Regarding the Brazilian case, some papers study the influence of CBB decisions on financial markets. Costa Filho and Rocha (2010) find that the interest rates increase while the volatility decreases after the minutes' release. Mendonça and Faria (2013) show that an increase of CBB transparency improves the efficiency of the expectation hypothesis and the anticipation of changes in the interest rate target. Carvalho et al. (2013) point out that the CBB statements have meaningful effects on yields at short-to-medium ma- turities. However, this effect stopped from 2011 to 2015. Cabral and Guimarães (2015) show that CBB statements influence the yield curve and the stock market index. In addition, they help to predict the content of the minutes. Notwithstanding the fact that all of these papers are devoted to the Brazilian case and share similar conclusions, unlike ours they do not analyze the impact of CBB actions on the risk-neutral distribution, in particular on the interest rate volatility. Moreover, we take into account two central bank actions: a monetary policy decision (statements of the Copom meetings) and a pure communication event (the minutes' release). Therefore, we can compare the market reactions to these two kinds of actions. Finally, we use an event study approach with different window sizes, which allows investigating the persistency of the effects of CBB actions on the yield curve. According to Campbell et al. (1997), event study is an appropriate method to analyze announcements of macroeconomic variables.

The reminder of this paper is organized as follow. The Section 2 presents the dataset considered in this paper, followed by a brief description of the methods used to calculate model-free implied volatilities of interest rate. It also describes the event study approach, the technique employed to test the impact of Copom decisions on implied volatilities. Section 3 presents the results and Section 4 provides concluding remarks.

2. Methodology

In this section, we first describe the database we used to calculate model-free risk-neutral volatilities of the interest rate distribution. Then we discuss how we extract these volatilities from the price of interest rate options. Finally, we present the statistical technique used to test the impact of Copom decisions on the moments of this distribution.

2.1. Data description

Copom sets the Selic interest rate target. The Selic rate is the interest rate for overnight interbank loans collateralized by government bonds traded in the Selic system (Special Settlement and Custody System). It is the basic rate used as reference for the monetary policy conducted by the CBB. To obtain the risk-neutral probability distribution of the interest rate, we use the option contracts whose underlying asset is another interest rate, known as the DI rate, since there are no option contracts defined on the Selic rate. The DI rate is an interbank deposit rate represented by the average of one-day loan rates for transactions between financial institutions. It is calculated by Cetip (Center for Custody and Financial Settlement of Securities), a company that offers services related to registration, deposit, trading and settlement of bonds and other securities in the Brazilian market. The Selic and the DI rates are closely related, since both are overnight interest rates, but the DI rate reflects interbank transactions not guaranteed by government bonds.

The one-day interbank deposit future contract (DI future for short) with maturity T is a future contract whose underlying asset is the accumulated DI daily rate between t and T. This contract is very similar to a zero-coupon bond, except that investors' positions are updated daily. Each daily cash flow is the difference between the settlement price on the current day and the settlement price on the day before, corrected by the DI rate of the day before. The settlement price at t is the amount of R$ 100,000.00 (one hundred thousand Brazilian Reais,