Does Inflation Targeting Help Information Transmission?*

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October 11, 2020

Abstract

This paper studies the informational impact of inflation targeting on financial market volatility in an emerging market context by using a novel monetary policy regime-switching approach. We find that the changeover to inflation targeting in India did not result in a greater impact of monetary policy surprises on bond and equity market volatility. We rule out financial frictions as a factor driving our results. Our evidence-based textual analysis of central bank policy announcements shows an increased focus on inflation, but not on growth, possibly explaining why the equity market impact of monetary policy announcements remained weak even after inflation targeting.

JEL Codes: E44, E58

Keywords: inflation targeting, monetary policy, information transmission

*We thank Viral Acharya, Chetan Ghate, Abhinav Narayanan and other seminar participants at IGIDR for their helpful comments. We thank Tanmay Saxena, Divya Singh, and Abhinav Surya for excellent research support. Shekhar Tomar also thanks the NSE-ISB Trading Lab, ISB for their generous support on this project. This paper reflects the views of the authors and should not be construed as reflecting the views of the Reserve Bank of India, nor the International Monetary Fund, its Management and Executive Board.

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1 Introduction

Monetary policy decisions exert significant real and financial impact. Whether they be acts of commission, i.e., policy changes, or acts of omission, i.e., status quo maintenance, such decisions transmit information about the economic outlook, potential risks and the future direction of policy that is held by the policymakers. Unless fully expected, policy announcements alter the borrowing costs for financial institutions and lead to a change in financing conditions for other economic agents. Anticipating this, financial markets respond immediately after policy announcements, which is reflected in changes in trading volumes, asset returns and market volatility. Cross-country evidence for advanced economies (Bernanke & Gertler (2000), Jarocinski & Karadi (2018)) supports the view that policy announcements, such as a change in the policy interest rate or in the stance of monetary policy, impact both returns and volatility in the bond and stock markets.

An implicit assumption in the preceding paragraph is that monetary policy reacts credibly and predictably in response to information about the future evolution of the economy. It allows the market to invert the signal provided by the policy decision, infer the underlying information and respond with portfolio adjustments, which then trigger changes to asset returns and volatility. An implication of this chain of actions is that if the monetary policy framework changes to one that serves to enhance credibility and predictability, then it will impact financial market trading, returns, and volatility. In this paper, we analyze one such change; viz., the change in the monetary policy framework to inflation targeting (IT).

We use an event study design to understand the impact of IT on central bank information transmission to the market. We examine the switch to IT by the Reserve Bank of India (RBI) in March 2015 to evaluate the existence of a differential impact on market outcomes of information released by policy decisions under the post-IT (PIT) versus the pre-IT (BIT or before IT) regime. The Indian case provides a compelling example since it was a hard change in the information release policy. Before IT, the market did not possess precise information about the RBI's monetary policy target, nor was there a consistent method of releasing information through monetary policy. We test for whether the IT framework, which, in theory, should clarify the central bank's policy objectives and improve its communication, has helped the market to better understand signals from the RBI.

Our empirical strategy is to evaluate this information transmission through IT on trading volumes in the bond market and on the volatility of returns in the bond and stock markets in India. A switch to IT should improve information absorption by the market which should translate into higher trading volumes and market volatility, whenever central bank's decisions contain information that is not yet known to the market. We use 10-year benchmark Government of India bonds, the most liquid segment of the Indian bond market and the large-cap, NIFTY-50 equity index for our analysis.[1] We model the volatility in these markets as a GARCH process with a deterministic scale factor.

We find clear evidence that monetary policy has exerted a substantial effect on bond market activity in India throughout the last decade, during both periods, BIT and PIT. The volatility of bond market returns increases immediately after the announcement if the policy decision is not completely anticipated.[2] However, the central result of our analysis is the finding that the switch to IT increased neither the volume of bond market trading nor the volatility of bond returns over and above the impact that policy announcements exerted during the BIT period.

Turning to equity markets, neither in the BIT period nor in the PIT period do we see a systematic and visible impact on equity return volatility of monetary policy announcements and surprises. We find no evidence of a significant policy day effect in terms of higher volatility of stock returns of large-cap Indian firms. As with bond markets, there is no

[1]NIFTY-50 is the benchmark index based on market valuation of top 50 firms in the National Stock Exchange (NSE) in India.

[2]Our definition of the information content of monetary policy decisions accounts for the fact that some decisions may, in full or in part, be anticipated by markets. For example, monetary policy may respond to information contained in asset prices about future developments in inflation and output (Bernanke & Gertler (2000)). It may also reflect anticipated developments in macro-financial variables, including asset returns and volatility (Romer & Romer (2004)). Hence, the information content of monetary policy is not the change in the policy rate and stance, but instead an induced change in a market price, since this induced change will reflect the incorporation of new information.

evidence supporting the case for an increase in information transmitted by RBI monetary policy during the PIT period that is perceived by markets as being significantly relevant to the pricing of large-cap equity.

A possible explanation for the absence of a significant increase in financial markets' response to information released by the monetary policy during the PIT period could be the prevalence of financial frictions. However, this argument appears less salient in the context of large-cap equity markets in India, which are known to have significant depth and liquid trading conditions (Naik *et al.* (2020)). Moreover, when we test for the impact of US monetary policy surprises on Indian markets, we find evidence of significant policy day effects on equity market volatility. This appears to rule out financial frictions as a significant factor behind the lack of response in equity markets to monetary policy surprises during BIT and PIT regimes.[3]

Another factor that can be driving our result is a possibility that although there was a hard switch to IT regime, there may be less-than-material difference in RBI communications between the two regimes. To test this, we perform a textual analysis of RBI policy statements. We measure whether the emphasis on growth and inflation changed between the BIT and PIT periods. We do this in two steps. First, we use topic modelling algorithm, Latent Dirichlet Allocation (LDA), for an unsupervised classification of policy text into various topics (similar to Hansen *et al.* (2018)). Next, we assign these topics to four groups: growth-related, inflation-related, both, or neither. We then test whether the importance of growth- and inflation-related topics in RBI communication shows a change across the two regimes. Our analysis suggests no significant difference in the emphasis on topics related to growth; however, the RBI emphasis on inflation witnessed an increase. This provides an additional explanatory channel supporting our interpretation of the results that the switch to IT did not materially impact market perceptions of policy-induced information transmission

[3]These findings are robust to many alternative specifications, including limiting attention to monetary policy announcements involving repo rate changes and to studying the effect of policy decisions on foreign portfolio investment flows and other specifications.

related to growth.

Other structural and cyclical factors may also be contributing to the lack of an increase in the equity market's response to policy surprises during the PIT period. On the structural side, the preeminence of fiscal policy in driving economic activity in emerging markets and developing countries (EMDCs) like India could translate into a modest or negligible impact of monetary policy in affecting growth. This would inhibit the information content of monetary policy surprises from the perspective of valuation of large corporate firms.[4] From a cyclical standpoint, the PIT period in India coincides with a period of significant dislocation in credit markets which may have enervated the growth-relevant information channel of monetary policy surprises.[5]

Overall, our paper makes two significant contributions to the literature. First, we study how market behavior around policy announcements changes after a hard switch to an IT policy regime. The novel analytical feature of our approach is to utilize a hard switch to the IT regime in India which give us a better benchmark, i.e., the BIT regime, against which to compare the impact of information release during the PIT period. Our paper joins, and adds to, the rich literature on the information content of monetary policy decisions and its impact on financial markets and the real economy. For the US, our paper is closest to Bomfim (2003), Bernanke & Kuttner (2005), and Gürkaynak *et al.* (2005), who assess the domestic stock market's response to monetary policy announcements.[6] Most of these papers show how the news effect on stock market returns and volatility depends on a variety of factors, including the state of the business cycle, the direction of monetary policy shocks, and whether there is a bull or bear run in the market. However, insofar as we are aware, we are the first to directly study the role that inflation targeting can play in increasing the

[4]The long-term co-movement of equity returns and economic growth is well-grounded from both theoretical and empirical perspectives. As argued by Bernanke & Kuttner (2005), a statistically significant response of equity returns to monetary policy surprises likely reflect the market-inferred changes in growth expectations.

[5]Specifically, the twin balance-sheet problems of banks and their corporate borrowers, especially in the infrastructure and power sectors constituted persistent challenges to growth after 2010 that were difficult to address using monetary policy alone.

[6]Roley *et al.* (1998) evaluate the reaction of the stock market to monetary policy non-announcements.

responsiveness of markets to news contained in monetary policy decisions and the resulting implications for the dynamics of trading and volatility around the decision date.

Second, our study extends the literature on the market response to information released by monetary policy in advanced economies to the case of Emerging Markets and Developing Countries (EMDCs). In EMDCs, monetary policy signals may be noisier and financial markets have lesser depth. Hence, it is unclear ex-ante whether a change in the monetary policy framework which serves to clarify policy objectives and the policy reaction function would exert in EDMCs, the effects of which are predicted by theory and supported empirically for advanced economies. The use of the regime switch by the RBI helps us in cleanly identifying the impact of a change in information release policy in a major emerging market economy. Since IT is increasingly adopted by EMDC central banks, our work fills an important gap in understanding its efficacy for them. Outside the US domestic context, Faust *et al.* (2003) propose an empirical framework to identify the response of non-US output, interest rates, and the exchange rates to US monetary policy surprises. Zare *et al.* (2013) assess the impact of monetary policy shocks on financial markets in Asian emerging market countries. Similarly, Kim *et al.* (2014) and Sun (2020), study the response of EMDC markets to monetary policy announcements. However, they do not incorporate the impact of a policy or regime switch and are not concerned with the question of the impact of a change in the monetary policy framework to IT on market behavior and volatility. Thus, our paper is the first to examine whether IT improves market response to the information contained in monetary policy decisions in EMDCs.

More broadly, our paper is also related to recent work on central bank communication and its impact on the expectations and actions of various agents in the economy. The recent papers by D'Acunto *et al.* (2019) and Coibion *et al.* (2018) evaluate how much of this information from the central banks is actually absorbed by these agents. For instance, Coibion *et al.* (2018) use randomized controlled trial to show how firms in Italy with better information about central bank policy react more in line with the theoretical predictions of the models with rational agents. Our paper studies whether an IT regime can help improve central bank communication in the case of EMDCs. We present the institutional details about the RBI and the switch to IT in the next section. In Sections 3 and 4, we discuss our datasets and empirical framework, while in Section 5, we give our main results. Section 6 concludes.

2 Background

In this part, we describe the monetary policy framework and the changes instituted by the RBI after adopting IT. We also conduct textual analysis on the RBI's monetary policy statements to gauge if the changes in the central bank's communication are consistent with the change in the policy framework.

2.1 Monetary Policy Framework: Details and Changes

The policy decisions of the RBI are defined to include the choices pertaining to the level of the policy interest rate as well as public announcements regarding the stance of monetary policy. These announcements contain a qualitative description of the evolution of future policy rates, given the central bank's explicitly stated view of the likely trajectory of the economy and risks surrounding the baseline outlook.

India formally adopted the IT framework in 2015.[7] Following the signing of the Monetary Policy Framework Agreement (MPFA) between the Government of India and the RBI in February 2015, the nominal anchor and operating target of monetary policy changed to maintaining the headline CPI inflation at 4 percent for the financial years 2016–17 through

[7] The Government of India and Reserve Bank of India signed the Monetary Policy Framework Agreement on February 20, 2015, and fixed the target inflation rate of 4 percent with an error band of +/- 2 percent (https://www.finmin.nic.in/sites/default/files/MPFAgreement28022015.pdf). The first Monetary Policy Committee was constituted on August 5, 2016 (http://pib.nic.in/newsite/PrintRelease.aspx?relid=148405), after an amendment to the RBI Act, 1934, by Finance Act, 2016. We consider the former date as the start of the inflation-targeting regime as the formal inflation target was fixed and RBI was given the mandate to achieve it.

2020–2021 with a band of +/- 2 percent. Practically speaking, given external pressures in the wake of the taper tantrum, the RBI had already established a formal framework in 2014 to guide monetary policy operations. It included a disinflationary glide path to below-6-percent CPI headline inflation by January 2016, in line with the IT operational target.

Between May 2011 and February 2015, the BIT period, the operational target of monetary policy was the weighted average overnight call money rate (WACMR). The repo rate was in the middle of a 200-basis-points corridor, flanked by the reverse repo rate at the bottom and the marginal standing facility rate at the top. Finally, the liquidity management framework was revised to strengthen monetary transmission by anchoring the WACMR close to the policy repo rate. However, the repo rate constituted the main instrument of monetary policy in both the BIT and PIT periods.

The approach to communicating monetary policy decisions has also undergone significant changes after IT in terms of both the timing and content of policy announcements. During the BIT period, there were two types of monetary policy reviews, Quarterly and Mid-Quarterly. In the Quarterly reviews, which were scheduled during the first week of a quarter, the policy meetings took place over two days, with the RBI releasing a written statement on the state of the economy a day before the final announcement on the policy stance. This statement contained the central bank's views regarding risks to the baseline outlook for growth, inflation, exchange rate, etc., which, in combination, provided justification for the policy stance announced the next day. Hence, during the Quarterly reviews of the monetary policy of the BIT era, the market obtained important clues about the policy decision a day prior to its announcement. By contrast, the Mid-Quarter review policy meetings took place on a single day with a short statement justifying the policy stance being released simultaneously with the policy decision. To account for this different information release policy during the BIT period, we control for the dates immediately around the two-day information release period separately in our empirical analysis. During the PIT period, RBI followed a bi-monthly meeting calendar, with the policy decision and its justification released on the same day.

Another important difference between the BIT and PIT periods lies in the absence of a pre-announced calendar for upcoming monetary policy meetings in the BIT period. Instead, the date of the next policy meeting was announced alongside each Monetary Policy Statement. The Monetary Policy Reviews started to be held bi-monthly beginning April 2014, and the policy stance and justification for it were announced simultaneously on the same day. However, the practice of announcing the next policy date along with the Monetary Policy Statement continued, and the regime moved to a fully pre-announced calendar only after the formation of the Monetary Policy Committee in August 2016.

Overall, the switch to IT entails three significant changes. First, the inflation target of the RBI is now public information. Second, policy decisions are taken only on a single, pre-announced day. Third, it has led to clearer communication since the RBI now explains each of its policy stances to the public in a standardized manner.

This leads us to the question of whether IT adoption has changed market expectations formation and evolution process. By way of suggestive evidence for improved information transmission, we find that the switch to IT is associated with the firming up of market expectations regarding the likely evolution of interest rates and is associated with lower average forecast errors regarding policy decisions. Comparing statistics from the RBI's quarterly survey of professional forecasts to actual policy-induced repo rate changes, we find that the average forecast errors fall significantly during the PIT period relative to the BIT period. Panels (a) and (b) of Figure 1 show that the difference in mean and median forecast against repo rate falls in the PIT period. Moreover, the uncertainty in market forecasts of the repo rate, measured as the difference between the market's maximum and minimum forecast rate, also fell in the IT regime relative to the BIT period, as seen in Panel (c) of Figure 1.

2.2 Did IT Lead to a Change in Communication by the RBI?

The improvement in professional forecasters' performance suggests some changes in communication by the RBI during the PIT period. However, it does not provide an answer to the nature of this change. Therefore, we conduct a textual analysis of monetary policy statements issued by the RBI between 2011 and 2019. We analyze how the switch impacted RBI's focus on two main policy variables, growth and inflation.

2.2.1 Measuring Importance of Inflation and Growth

We collect all the monetary policy statements from the RBI released at the time of monetary policy announcements between 2011 and 2019 (Table 2). We focus on them because they are the main source of information on which the market reacts immediately after the policy announcement. These statements are shorter relative to the minutes of the MPC meetings or quarterly review published by the RBI. Also, the minutes of the MPC meetings and quarterly review are not released on the day of the policy announcement.[8]

For our analysis, we download the policy announcement documents from the RBI's website and use a two-step process to measure the importance of inflation and growth in them:

- Use an algorithm for topic modeling on policy announcement text
- Classify each topic as related to growth, inflation, both or none

Methodology: In order to make the documents usable for topic modeling, we first perform various text cleaning measures. We convert all text to lower case, remove numbers, punctuation and stop-words and lemmatize the text. Finally, we use Latent Dirichlet Allocation (LDA) for topic modelling on the cleaned text corpus. LDA is a generative probabilistic model of a corpus as used in Hansen *et al.* (2018).[9] A corpus, C, comprising m documents,

[8]The minutes of the meeting are released only in the PIT period. The minutes are published two or three weeks after the policy announcement. Also, in the baseline analysis reported here, we only use the policy statements released on the second day of two-day policy announcements in the BIT period.

[9]The algorithm was introduced by Blei *et al.* (2003) and is commonly used in other fields like machine learning and linguistics. Hansen *et al.* (2018) provides a richer discussion on this modeling technique.

(D_1, D_2, D_3, ... , D_m), is modeled as a distribution over a set of K latent topics, where each topic is in-turn characterized by a distribution over a set of N unique terms of the corpus. In our case, we use bigrams, i.e., two words, as the set of unique terms to be utilized in topic modeling. The reasoning behind using bigrams instead of unigrams, i.e. single words, is that the former allows better meaning extraction and to differentiate usage of the same word in different contexts (see Hansen *et al.* (2018) and Picault & Renault (2017)).

Finally, the corpus is decomposed into two matrices. The first matrix represents the distribution of each document over K latent unobserved topics, thereby indicating the share of each topic, k, in the document D_d, $d \in (1,m)$. The second matrix represents the distribution of each topic over the bigrams. The product of these two matrices represents the corpus. In total, we have 38,299 unique bigrams over 60 policy documents.

Implementation: We use *sklearn* package in Python to implement LDA. For a given value of K, the algorithm provides K topics and their importance in each policy document. Since our goal is to identify topics as being growth- or inflation-related, we use values of K below 20, so that topics are easily identifiable. We report the results with a baseline $K = 12$, as it allows minimum overlap of the most frequent bigrams in each topic. For larger values of k, there is a more significant overlap of bigrams over multiple topics.

Classification: The LDA gives us a set of 12 topics, which we manually classify as those related to growth, inflation, both or none. Like other similar methods, the classification of a topic into a category involves subjective judgement by the researcher. We use the top 7 bigrams, listed in Table B.8, to classify each topic into 4 different categories.

Out of 12 topics, three are related exclusively to inflation, three exclusively to growth, and five are related to both inflation and growth. We combine the importance of all the topics on inflation and growth and compare their occurrence in the two periods. It allows us to measure how the official policy statements differ from each other in the BIT and PIT regimes in terms of importance given to growth vs. inflation. For each document, the importance variable lies on the scale of 0–1, where the sum of importance over all 12 topics is one.

2.2.2 Inflation Is More Salient During the PIT period

We report the evolution of the importance of growth and inflation topics in Figure 2. Here we aggregate importance of topics in Panel (a) and (c) for inflation and those in Panel (b) and (c) for growth from Table B.8. We find that in the BIT period, growth topics were more prevalent while the distribution completely changes in the PIT period in favor of inflation. The importance of inflation topics is much lower in the BIT relative to the PIT period. It is only after 2017 that the policy statements again start putting emphasis on growth-related topics.[10]

We also formally test for a difference in means of these topics in Table 3. We find that the inflation topics receive more importance in the PIT period. The difference in means between the PIT vs. BIT is positive and significant. It holds when we consider topics exclusive to inflation, i.e. topics in Panel (a) of Table B.8, in the first row. It is also positive and significant when we consider the difference in means of All Inflation topics (third row). The results for growth are completely different. In both cases, when we use Only Growth (row 2) or All Growth (row 4) topics, there is a relative fall in the importance of growth topics. The difference is negative and significant in case of topics related to Only Growth. For All Growth topics, the difference in means is negative, but not significant. Broadly, these results confirm that inflation becomes more salient in the PIT period, with no increase in discussion on growth-related topics in the RBI policy statements.[11]

It is also important to mention that realized inflation is much lower during the entire PIT period relative to the BIT. However, the RBI statements still put more emphasis on inflation in the PIT period, as captured by the inflation-related topics. Overall, these results

[10] We also report time-series on the importance of individual topics in Appendix Figure B.1. It again shows that the importance of topics in policy statements has changed over time. One of the most important topics in the PIT period is Topic 6, which is related to both growth and inflation and witnessed an increase towards the end of the PIT period. It is simultaneously accompanied by a reduction in the importance of Topic 5, which is related to inflation.

[11] As a robustness check, we also use bag-of-words algorithm on bigrams and classify them into growth- or inflation-related terms. We then test their frequency of occurrence in policy statements in the BIT and PIT period and find similar results, i.e., inflation becomes more salient in the PIT period, while there is no impact on growth.

provide textual evidence that the switch to the IT regime was followed up by actual changes in communication by the RBI. However, the communication focus has relatively increased only in the case of inflation and not growth. How the markets perceived these changes is something we test in the following sections. We begin by describing our primary datasets.

3 Data

We use multiple sources of data in our empirical exercise. The first set consists of yield and returns data. We use daily data on benchmark G-Sec yield for the 10-year benchmark government bond and NIFTY-50 index from the National Stock Exchange between January 2011 and August 2019. The former corresponds to the most liquid bond market, while the latter to the largest 50 firms on the National Stock Exchange in India. The G-Sec yield data is taken from the Clearing Corporation of India Limited, while the NIFTY-50 data comes from the National Stock Exchange. Finally, we construct monetary policy surprise using the one-month-ahead overnight interest rate swap (OIS) data, which comes from Bloomberg. Finally, we use the repo rate, the main policy instrument, information from the RBI.

Sample stratification: As discussed in the introduction, the switch to the IT framework entailed a change to the nominal anchor/target of monetary policy and corresponding operational changes to the conduct of monetary policy. Consequently, we stratify the longitudinal sample into two periods, one corresponding to the BIT period (January, 2011–February, 2015) and the other corresponding to the PIT period (March, 2015–August, 2019). Moreover, within the PIT period, the months between November 2016 and June 2017 (all inclusive) need a separate assessment since they bore witness to the major exogenous shock of demonetization, which may have exerted a potentially confounding influence on the information content of RBI monetary policy decisions and on the relationship between informativeness and market response in terms of trading and asset price volatility. We drop the three policy days corresponding to the demonetization period in our analyses.

Next, we hand-collect the dates of monetary policy announcements for the same period from the Reserve Bank of India website. Our final dataset consists of a total of 2,072 business days, of which 999 are from the BFT and 1,073 are from the PIT period (Table 1). There are a total of 60 policy days during this period, out of which 31 days belong to BIT period and the rest to the PIT. There are 26 policy days with a change in the repo rate, with 16 belonging to the BIT and 10 to the PIT period.

We also use additional datasets related to the Federal Open Market Committee (FOMC) meetings and Foreign Portfolio Investment (FPI) flows in India. We collect information on FOMC meeting dates and Fed Funds Future rate for January, 2011–August, 2019, from Bloomberg. The Foreign Portfolio Investment data on debt and equity for India comes from Bloomberg.

4 Empirical Framework

The main objective of the empirical exercise is to test whether the days around the monetary policy decision of the RBI display heightened volatility in the bond and stock markets. Since we study the impact of IT on both these markets, it is essential to highlight the context behind this choice.

Bonds vs. stocks: In the advanced economies, the success of IT has meant a significantly greater analytical interest in the impact of monetary policy surprises on the price of risky assets rather than benchmark (government) bonds. The monetary policy in these countries is informative about the evolving growth outlook and should be expected to have a predictable impact on equity returns. Therefore, it should trigger an immediate and short-lived increase in stock trading and market return volatility. Developing countries are a different kettle of fish. While domestic monetary policy does exert influence on local financial conditions, policy transmission is imperfect and incomplete, even in the bond market. The constraints on transmission of domestic monetary policy in emerging market economies relative to the advanced economies could be an important contributor to well-known differences in business cycle properties across the two groups of countries (Aguiar & Gopinath (2007)).[12] Indeed, as has been recently argued, emerging market countries may be confronted with a policy dilemma, wherein, even with floating exchange rates, monetary policy may have limited room for maneuver in the presence of free and volatile global capital flows that are heavily influenced by a common global factor linked to US monetary policy (Obstfeld (2015);Rey (2015)). Consequently, we first test the impact of monetary policy announcements on the bond markets and subsequently extend the analysis to the stock market.

4.1 Impact of Policy Announcements on Trading of Government Securities

Before we analyze the impact of IT on volatility, we do a preliminary test on the total volume of government securities traded in the bond markets. If the adoption of IT improves information transmission, we should expect market activity to be at a lower level immediately prior to the decision date, and at a relatively higher level on the policy decision date during the PIT period when compared to the BIT period. We use the following event study regression framework to test it:

$$
\begin{aligned}
Growth(Volume)_t = \alpha_0 + \alpha_1 I_t^{MPC-} + \alpha_2 I_t^{MPC} + \alpha_3 I_t^{MPC+} + \alpha_1^{'} I_t^{MP2--} \\
+ \alpha_2^{'} I_t^{MP2-} + \alpha_3^{'} I_t^{MP2} + Week_{FE} + \varepsilon_t \quad (1)
\end{aligned}
$$

where $Growth(Volume)_t$ is the dependent variable and is equal to the growth in daily volume traded in the government securities market. We consider trading in the benchmark 10-year

[12] Equities and (government) bond markets are mature, deep and liquid in advanced economies. For example, while US monetary policy shocks impact price of risk globally (Miranda-Agrippino & Rey (2015)), monetary policy in developed countries, including small open economies, is able to largely control domestic financial conditions due to a combination of local financial market depth and floating exchange rates.

sovereign bonds as it is the most liquid market. This growth depends on three variables I_t^{MPC-}, I_t^{MPC} and I_t^{MPC+}. I_t^{MPC-} is a dummy variable that equals one if t falls one day before the MPC, else it is zero. Similarly, the dummy variables I_t^{MPC} and I_t^{MPC+} take a value equal to one on the day of MPC meeting and one day after the MPC meeting respectively, and zero otherwise. We also include additional dummy variables for the policy days when policy is declared over two days through the variables I_t^{MP2}, I_t^{MP2-} and I_t^{MP2--}. Here I_t^{MP2} is equal to 1 on the final policy day, while I_t^{MP2-} is equal to 1 on the day pre-policy statement is released and I_t^{MP2--} is equal to 1 on the day prior to that. On all other days, these variables take a value of zero. Finally, we also include the fixed-effect term $Week_{FE}$ which captures the impact of unanticipated economic and policy developments other than monetary policy in a given week. We report robust standard errors.

If policy days are special and drive higher trading volume on the market, then the coefficient α_2 should be positive. If the market behaves like any other trading day on the day prior to the policy meeting, then α_1 should be zero. If instead trading is subdued on this day then α_1 will be negative. Finally, if the policy day has a higher trading activity, i.e., α_2 is positive, then the next day can have a negative volume growth even if the trading volume is average on that day. Due to this reversal in level effect, α_3 can be negative purely because of a positive α_2. Lastly, our goal is to test whether the trading behavior changed during the PIT period. Therefore, we include dummy variables for I_t^{MPC-}, I_t^{MPC} and I_t^{MPC+} interacted with the PIT dummy in equation 1. We expect the coefficient on $PIT \times I_t^{MPC}$ to be significantly positive for the PIT period if the market associates RBI policy releases to have superior information content during this period leading to higher trading volume.

4.2 Impact of Policy Announcement on Volatility

In this sub-section, we describe our framework to study the impact of policy days on market volatility. We use various models to estimate the impact of policy announcements on market volatility.

Model 1: The baseline empirical model is given by the following set of equations:

$$r_t = \alpha + \beta x_t + u_t \tag{2}$$

$$log[Var(u_t)] = h_t + s_t \tag{3}$$

$$log(h_t) = f(\sigma_{t-1}, u_{t-1}) \tag{4}$$

$$s_t \;\; = \;\; \tau + \delta_1 I_t^{MPC-} + \delta_2 I_t^{MPC} + \delta_3 I_t^{MPC+} + \mu_1 I_t^{MP2--} + \mu_2 I_t^{MP2-} + \mu_3 I_t^{MP2} \tag{5}$$

where the dependent variable r_t in equation 2 captures either the evolution of bond yields or stock market returns. This r_t depends on a vector of variables given by x_t that includes a lagged value of the dependent variable and a measure of future expectations about the monetary policy. This specification is similar to Bomfim (2003), with one major difference, i.e., we use the Overnight Interest Swap (OIS) rate of one-month maturity as a measure of future expectations about monetary policy. This is necessitated by the fact that unlike the US, India does not have an active, representative futures or forward market. The unpredictable component of r_t; i.e., u_t, follows an EGARCH (1, 1) process with a multiplicative heteroskedastic term, h_t and scale factor s_t. The term s_t provides the main channel for policy announcements to have a separate effect on the market volatility. The term s_t in equation 5 depends on three variables, I_t^{MPC-}, I_t^{MPC} and I_t^{MPC+}. These variables are defined in the same way as in equation 1. Consequently, the normal level of the scaling factor for bond yield or stock return volatility is fixed which is allowed to vary only around the policy dates.[13] To capture the differential effect during the two day policy regime, we have also included dummy variables, I_t^{MP2}, I_t^{MP2-} and I_t^{MP2--}, in equation 5.

The main coefficients of interest in Model 1 are δ_1, δ_2 and δ_3, which together capture

[13] As in Bomfim (2003), the model, combined with the definition of s_t implies that the conditional variance of u_t (and hence, bond yield or stock return volatility), will be higher/lower around MPC announcement days if market relevant information is released on those days.

the impact of scheduled policy announcement days by RBI on volatility of r_t. If the policy days are indeed special and deliver information to the market, then δ_2 should be positive and I_t^{MPC} should be associated with a higher volatility. At the same time, if there is lower volatility on the day before the policy i.e. *calm before the storm effect*, then $\delta_1 < 0$. Finally, δ_3 should be zero if the market incorporates all the relevant information on the policy day itself, and there is no impact on volatility on the day after the policy.

Model 2: It is possible that the market is volatile on the day of the policy, but any expected information should not drive up this volatility. If the information released is expected, then it should already be accounted for by market participants prior to the policy announcement. Instead, market volatility should be more pronounced only on the days when the policy day is also associated with an informational surprise. To test this, we modify equation 5 to incorporate a surprise effect in the following way:

$$s_t = \tau + \delta_1 I_t^{MPC-} + \delta_2 I_t^{MPC} + \delta_3 I_t^{MPC+} + \delta_4 I_t^S + \mu_1 I_t^{MP2--} + \mu_2 I_t^{MP2-} + \mu_3 I_t^{MP2} \quad (6)$$

where, we capture the surprise effect through the variable I_t^S. It is a dummy variable that takes a value equal to one when the policy announcement day is associated with a surprise, otherwise it is zero. We describe how we calculate surprise in detail through OIS in the next section. In Model 2, the additional coefficient of interest is δ_4, which should be positive if the policy days with a surprise are associated with a heightened market activity as well as volatility.

4.3 Evaluating the Change Due to IT

To analyze whether IT led to any change in market reaction to policy announcements, we augment the models described in the previous sub-section. We first test if there is any additional impact due to the IT itself.

Model 3: We modify equation 5 to capture the impact of IT on market volatility in the following way:

$$s_t = \tau + \delta_1 I_t^{MPC-} + \delta_2 I_t^{MPC} + \delta_3 I_t^{MPC+} + \mu_1 I_t^{MP2--} + \mu_2 I_t^{MP2-} + \mu_3 I_t^{MP2} + I_t^{PIT}\left(\gamma_1 I_t^{MPC-} + \gamma_2 I_t^{MPC} + \gamma_3 I_t^{MPC+}\right) \quad (7)$$

where I_t^{PIT} is a dummy variable equal to one for the PIT period. Since I_t^{PIT} is interacted with policy day dummies in equation 7, the additional impact on volatility due to PIT is captured by the coefficients γ_1, γ_2 and γ_3. If γ_2 is positive, then the PIT period is associated with an increase in the volatility on the policy day, which is over and above what is captured by the coefficient δ_2. If it is insignificant, then the PIT period is no different from the BIT period on the policy days. Similarly, γ_1 and γ_3 capture the additional effect one day before and after policy announcement during the PIT. Finally, we evaluate the impact of information in Model 4 below.

Model 4: It builds upon Model 3 and incorporates the additional effect of surprise during the PIT period. Once again, to capture this effect, we modify equation 7 as below:

$$s_t = \tau + \delta_1 I_t^{MPC-} + \delta_2 I_t^{MPC} + \delta_3 I_t^{MPC+} + \mu_1 I_t^{MP2--} + \mu_2 I_t^{MP2-} + \mu_3 I_t^{MP2} + \delta_4 I_t^{S} + I_t^{PIT}\left(\gamma_1 I_t^{MPC-} + \gamma_2 I_t^{MPC} + \gamma_3 I_t^{MPC+} + \gamma_4 I_t^{S}\right) \quad (8)$$

where relative to Model 3, the additional coefficient of interest is γ_4. It captures whether the surprise has an additional impact on volatility in the PIT period, which is over and above the impact captured by δ_4. A positive sign on γ_4 will indicate an additional effect of surprise, while a negative sign will reflect negative effect of surprise during PIT.

5 Empirical Results

In this section, we present the results from estimating the models presented in Section 4. We begin by describing how OIS can be used to measure the surprise component of monetary policy announcements in the Indian context. It is followed by evaluation of PIT's impact on market volume and volatility.

5.1 Using OIS to Measure Monetary Policy Surprise

The conventional approach of calculating the information content of policy announcements is to use the change in interest rate futures. However, this is not possible in the Indian context as there are no standard futures contract available for trading. Moreover, even in cases where futures are traded, it is usually done to support the liquidity management of banks' balance-sheets rather than extending to rates-trade arbitrage, short-sales, or trading in specials. Given these constraints, we use the change in the spread on the OIS contract as a measure of surprise information.[14] To construct the policy surprise dummy, I_t^S, we follow Kuttner (2001) and assign a value of one to days associated with the change in OIS above a certain threshold.[15]

Since the change in OIS is a non-standard way of measuring the information content of policy in the literature, we first provide evidence in favor of its validity. Figure 3 plots the time trend of one-month OIS spread, which provides preliminary evidence in this regard. The vertical lines on the graph correspond to MPC policy days and the blue shaded area

[14] Trading in OIS contracts in India is apparently limited primarily to foreign banks that hold a minority of the fraction of underlying assets. The market is tiered, in the sense that whereas non-US banks clear OIS trades through a domestic central counter-party, US banks that constitute over 30 percent of all trading volume engage in bilateral OTC trades, necessitating different counter-party risk management and capital requirements. Finally, in what is unconventional from a cross-country perspective, OIS contracts in India tend to trade at a premium relative to the underlying. These factors indicate limits to the interpretability of movements in the OIS spread as a measure of information flow to markets. Nonetheless, and particularly in view of the supporting evidence provided in this section for its use and of the absence of alternative measures, we view the use of OIS change as an acceptable and practical option to measure monetary policy surprises.

[15] In our main results, $I_t^S = 1$ on the policy days when OIS change is above its 75^{th} or below 25^{th} percentile value evaluated over the whole sample of policy days. However, the results are similar to other threshold levels as well.

corresponds to a 30-day period before the contract ends. We provide a snapshot of the OIS spread from May to December 2019 when the market expected a rate cut from the RBI after each policy meeting. As can be clearly seen from Figure 3, the evolution of OIS captures this sentiment very well as it falls in each of the blue shaded areas up until the next policy announcement date. Importantly, since it is a 1-month OIS, it starts falling exactly 30 days before the MPC meeting.

As a second test, we formally check whether the change in the OIS spread is a good predictor of the change in the 10-year sovereign bond yield on policy days. The information that the market has about the policy announcement should already be accounted by the OIS spread on the day prior to the policy meeting. Only unanticipated information will change the OIS spread on the policy announcement date, which should then perfectly explain the change in sovereign bond yield after the policy announcement. The results of this test are shown in Table 4, where we regress change in the 10-year bond yield on the expected and unexpected movements in the policy rate, i.e., repo rate. In column (1), we find that the change in the bond yield is positively correlated with the change in the repo rate. However, once we decompose this change in the repo rate into its expected and unexpected components, we see that it is only correlated with the latter, i.e. the unexpected component. This unexpected component is the difference in the OIS rate on the day of policy and one day prior. Both the graphical assessment and our formal test give strong evidence in favor of using the OIS spread to capture the unexpected component in policy announcements in the Indian context.

5.2 No Change in Bond Market Trading Volume After IT

We report the results from estimating equation 1 in Table 5. Column (1) reports the result for the impact of policy days on daily trading volume growth. We find a fall in trading volume growth one day before the policy announcement and an increase on the policy date, i.e., the coefficient on *One Day Before Policy* is negative and on the *Day of Policy* is positive. However, there is no differential effect on trading volume growth in the PIT period around the policy days as all the coefficients on $PIT \times$policy days are insignificant. We report the results with the inclusion of dummies for two-day policy dates in column (2). This specification has similar results with no differential impact on growth of trading volume during the PIT period. The main takeaway from this analysis is that trading activity is significantly different around policy days. However, there has been no significant change in it during the PIT period.

Robustness: We further stratify the policy days into those days where the policy rate, i.e., repo rate, changes versus others where there is no repo rate change. A change in repo rate can lead to large portfolio adjustments resulting in above average change in trade volume. We test for this differential impact on the subset of days when the repo rate changes. These results are reported in columns (3) and (4). Once again, we find no differential effect on trading activity during PIT.[16]

5.3 No Change in Bond Market Volatility After IT

Next, we estimate all models on bond market volatility and report the results in Table 6. In column (1) we report the results based on Model 1. We find that the policy days are associated with a significant and positive impact on bond market volatility as the coefficient δ_2, on the Day of Policy, is positive and significant. However, there is no *calm before the storm effect* as the coefficient on One Day Before Policy is insignificant. There is also some negative effect on the volatility one day after the policy meeting.

Next, we discuss how these results change during IT based on Model 3 (column (3)). We find that the coefficient on the day of policy is still significant. However, there is no additional effect during the PIT period as the coefficient on the policy day during IT i.e. γ_2 is insignificant. If greater information is conveyed during the PIT period, the volatility in the bond markets should be relatively higher on policy days during the period after the switch to this new framework and γ_2 would be positive and significant. Similarly, there is

[16]The results are similar even after inclusion of additional controls like day of the week fixed-effect to account for differences in trading activity on various days of a week.

no additional *calm before the storm effect* in the PIT period as the coefficient γ_1 is also insignificant.

Finally, to evaluate the impact of the policy surprise on volatility, we estimate Models 2 and 4 and report their results in columns (2) and (4) respectively. We find that the surprise element in policy has an impact on volatility in both cases. The coefficient δ_4 is positive and significant, which implies that volatility goes up whenever the RBI's policy announcements contain a surprise element. In the case of Model 2, the effect of the policy day on volatility, i.e., δ_2, still remains positive and significant. So, the surprise element in the policy announcement has a significant positive effect on bond yield volatility over and above that of the policy announcement itself. However, compared to Model 1 in column (1), the coefficient δ_2 is lower in magnitude, which reflects the fact that a significant portion of the effect in Model 1 is captured by the surprise component of the policy announcement.

The results capturing the differential impact of PIT period are reported in column (4). We find that there is no additional impact of policy surprises during the PIT period, above and beyond the one present during the BIT period. It is captured through the insignificant coefficient, γ_4. Overall, these results suggest that the IT regime has not had a significant impact on the bond market volatility.

5.4 RBI Policy Surprises Do Not Impact Equity Market Volatility

We report the results on the response of the stock market to monetary policy announcements and surprises in Table 7. Unlike the bond market, we find an increase in the volatility of stock returns one day prior to the policy announcement (positive and significant coefficient δ_1 for all Models 3–4). However, there is no increase in equity return volatility on the policy day itself, nor a significant impact of the surprise component of policy decisions in any of the periods.[17]

These results are intriguing, especially when put side-by-side with those for the bond

[17]The results are similar even when we separately account for days when repo rate, i.e. RBI's policy rate, changes. The bond and stock market volatility display no change in the PIT period (Table B.3 and B.4).

market. The Indian large-cap equity market, the NIFTY-50, is a relatively deep and liquid market, which means that the stock market results should be similar to those in more advanced economies, i.e., stock market volatility should react to monetary policy information transmission. It should specifically hold during the PIT period. For instance, in the case of United States (US), Bomfim (2003) finds a stronger market reaction after the change in the central bank's communication policy. It begs the question whether financial frictions, present in an emerging market like India but not in advanced market economies, or the market's perception of the absence of information regarding growth in monetary policy is behind these negative result. While we do not address this question directly in this paper, we conduct additional empirical exercises to argue that the second factor; i.e., market perception that monetary policy is not informative about growth, is the more likely explanation.

5.5 US Monetary Policy Impacts Market Volatility in India

The monetary policy decisions and surprises in the United States can be expected to exert an effect on returns and volatility of most risky assets, including emerging market equities and sovereign bonds. If such an impact exists and is significant for Indian financial markets, this would be indicative of sufficient depth and sensitivity of these markets. The first of our empirical exercises examines whether the US monetary policy decisions and surprises has an impact on volatility in Indian financial markets. We estimate Models 1 and 2 to evaluate the impact on market volatility due to the information released around the Federal Open Market Committee (FOMC) meeting days, the MPC counter-part in the US.[18]

The results for the estimation of Models 1 and 2 are reported in Table 8. The first two columns correspond to the impact on the domestic 10-year sovereign bond market around the FOMC policy meetings and announcement days and the subsequent two columns correspond

[18] Since Indian markets are closed at the time of FOMC announcements, we consider the next immediate market day in India as the policy announcement day. The one day before and one day after FOMC meeting are then defined relative to this policy announcement day. Finally, we calculate the surprise element in US Fed policy by taking the difference in the Fed Funds Future rate between the day of FOMC meeting and one day prior to it. This is based on US timezone. Equivalently, it is the difference in Fed Funds 1-year Future rate between $t-1$ and $t-2$ market day according to Indian Standard Time.

to the impact on the NIFTY-50 large-cap equities market.

In the bond market, the day of policy effect matters as the coefficient δ_2 is positive and significant in column (1). However, this effect disappears once we account for the surprise component in FOMC meetings in column (2). The impact on bond market volatility is mainly coming through the surprise element as in Model 2 only the coefficient δ_4 remains positive and significant. Additionally, we see no decline in bond yield volatility on the day before the FOMC announcement. Thus, the behavior of bond market volatility around FOMC days is broadly similar to days around the RBI policy announcement. The only crucial difference is that the policy day in itself is important for RBI announcements even after controlling for the surprise component of policy. Under the FOMC case, everything is explained by the surprise component of policy, and policy day alone is not important. This difference can arise due to the difference in timing of announcements by the two institutions. The bond market in India already knows about the FOMC decision before the start of the trading day and needs to incorporate only the surprise component of FOMC decision in its trading behavior.

The results for NIFTY-50 stocks are quite different as reported in columns (3) and (4). We find a significant and positive day of policy effect on equity return volatility (coefficient δ_2 is positive and significant) in both models. This day of policy effect does not vanish once we include the surprise component of policy, which itself is insignificant ($\delta_4 = 0$ in column (4)). Unlike the bond market, however, we find that the day prior to FOMC announcement witnesses a significantly negative volatility ($\delta_1 < 0$) in equity markets. These results are also in stark contrast when compared to the effect on stock market volatility around RBI policy days. The reaction of Indian stock markets to FOMC announcements is more in line with US stock markets' response to FOMC announcements than its response to RBI announcements.

5.6 Discussion

Overall, the main takeaway from our assessment of the impact of the US monetary policy on Indian financial markets is that both bond and stock markets respond to new information, especially in the case of the equities market. Additionally, we show in the Appendix how Foreign Portfolio Flows (FPI) do not significantly change around FOMC meeting days (Table B.1). Therefore, portfolio flows are not reacting to global push and pull factors, yet FOMC announcements appear to impact domestic financial market volatility but not through (induced) capital flow changes. So the revaluation of stocks is happening because of portfolio rebalancing within the domestic economy. Hence, large-cap equities in India retain substantial depth so as to absorb and reflect new information through changes to trading volumes, returns and volatilities. It seems far more plausible, therefore, that the negative results for equities relative to the RBI's policy announcements reflect the market perception of lack of information therein for economic growth rather than the inability to trade on the basis of this information even if judged material to portfolio choice.

6 Conclusion

Our paper uses the hard switch to an IT policy regime by India in 2015 to evaluate the hypothesis that such monetary policy framework improves information transmission by increasing the signal-to-noise ratio of central bank communications. We empirically test this hypothesis by analyzing the behavior of bond and stock market volatility on policy days under the pre- and post-IT regimes. A higher signal-to-noise ratio in policy decisions is expected to increase financial market volatility after the announcements of the decisions.

Our results belie this hypothesis that the switch to IT did result in additional information transmission to the market. We find that unexpected components of monetary policy announcements lead to higher volatility in bond markets, but without any additional effect of a switch to IT. And the equity market remains entirely unresponsive to the central bank announcements under both pre-IT and post-IT regimes even as it responds significantly to new information released in the US Federal Reserve's policy announcements. Therefore, it is unlikely that financial frictions in the Indian stock market make it non-responsive to policy announcements by the RBI. Our textual analysis of RBI policy statements uncovers one potential reason why the changeover to IT did not induce greater information transmission to the stock market. The considerable shift that occurred in RBI communication after IT adoption reflects the central bank providing more inflation-related, rather than growth-related, information.

Our paper extends the literature studying the market impact of monetary policy announcements in two crucial ways. First, we study the change in information transmission to the market in the context of a hard switch to an inflation targeting regime. Previous studies have looked at the effect of changes in the central bank's communication policy, but not specifically the impact of inflation targeting. Second, we do this exercise in the context of a large emerging market economy. As inflation targeting gets increasingly adopted by central banks, our paper provides direct evidence on objectives achievable with such a regime switch. We find that the markets in emerging economies are less likely to derive growth-related information from central bank announcements, unlike their peers in advanced economies, despite improvement in communication framework. We also show that the lack of response is not due to financial frictions or insufficient changes in central bank communication policy. These results leave open the opportunity of future work on understanding the factors that lead to non-response of markets to central bank policy announcements in the emerging economy context and how to alleviate them.

References

Acharya, Viral V, & Vij, Siddharth. 2018. Foreign Currency Borrowing of Corporations as Carry Trades: Evidence from India.

Aguiar, Mark, & Gopinath, Gita. 2007. Emerging market business cycles: The cycle is the trend. *Journal of Political Economy*, **115**(1), 69–102.

Bernanke, Ben, & Gertler, Mark. 2000. *Monetary policy and asset price volatility*. Tech. rept. National bureau of economic research.

Bernanke, Ben S, & Kuttner, Kenneth N. 2005. What explains the stock market's reaction to Federal Reserve policy? *The Journal of finance*, **60**(3), 1221–1257.

Blei, David M, Ng, Andrew Y, & Jordan, Michael I. 2003. Latent dirichlet allocation. *Journal of machine Learning research*, **3**(Jan), 993–1022.

Bomfim, Antulio N. 2003. Pre-announcement effects, news effects, and volatility: Monetary policy and the stock market. *Journal of Banking & Finance*, **27**(1), 133–151.

Coibion, Olivier, Gorodnichenko, Yuriy, & Ropele, Tiziano. 2018. *Inflation expectations and firm decisions: New causal evidence*. Tech. rept.

D'Acunto, Francesco, Hoang, Daniel, Paloviita, Maritta, & Weber, Michael. 2019. Human frictions in the transmission of economic policy. *University of Chicago, Becker Friedman Institute for Economics Working Paper*.

Faust, Jon, Rogers, John H, Swanson, Eric, & Wright, Jonathan H. 2003. Identifying the effects of monetary policy shocks on exchange rates using high frequency data. *Journal of the European Economic association*, **1**(5), 1031–1057.

Gentzkow, Matthew, & Shapiro, Jesse M. 2010. What drives media slant? Evidence from US daily newspapers. *Econometrica*, **78**(1), 35–71.

Gürkaynak, Refet S, Sack, Brian, & Swansonc, Eric T. 2005. Do Actions Speak Louder Than Words? The Response of Asset Prices to Monetary Policy Actions and Statements. *International Journal of Central Banking*.

Hansen, Stephen, McMahon, Michael, & Prat, Andrea. 2018. Transparency and deliberation within the FOMC: a computational linguistics approach. *The Quarterly Journal of Economics*, **133**(2), 801–870.

Jarocinski, Marek, & Karadi, Peter. 2018. Deconstructing monetary policy surprises: the role of information shocks. *ECB working paper*.

Kim, Hyeyoen, Kim, Junyeup, Lee, Jaeram, & Ryu, Doojin. 2014. The impact of monetary policy on banking and finance stock prices in China. *Applied Economics Letters*, **21**(18), 1257–1261.

Kuttner, Kenneth N. 2001. Monetary policy surprises and interest rates: Evidence from the Fed funds futures market. *Journal of monetary economics*, **47**(3), 523–544.

Miranda-Agrippino, Silvia, & Rey, Hélene. 2015. *US monetary policy and the global financial cycle*. Tech. rept. National Bureau of Economic Research.

Naik, Priyanka, Poornima, BG, & Reddy, YV. 2020. Measuring liquidity in Indian stock market: A dimensional perspective. *PloS one*, **15**(9), e0238718.

Obstfeld, Maurice. 2015. Trilemmas and trade-offs: living with financial globalisation. *BIS working paper*.

Picault, Matthieu, & Renault, Thomas. 2017. Words are not all created equal: A new measure of ECB communication. *Journal of International Money and Finance*, **79**, 136–156.

Rey, Hélène. 2015. *Dilemma not trilemma: the global financial cycle and monetary policy independence*. Tech. rept. National Bureau of Economic Research.

Roley, V Vance, Sellon, Gordon H, *et al.* 1998. *Market reaction to monetary policy nonannouncements*. Tech. rept. Federal Reserve Bank of Kansas City.

Romer, Christina D, & Romer, David H. 2004. A new measure of monetary shocks: Derivation and implications. *American Economic Review*, **94**(4), 1055–1084.

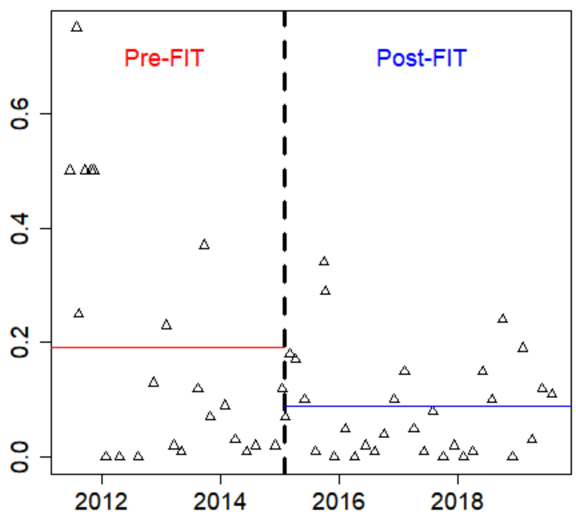
Sun, Rongrong. 2020. Monetary policy announcements and market interest ratesâ response: Evidence from China. *Journal of Banking & Finance*, **113**, 105766.

Zare, Roohollah, Azali, M, & Habibullah, Muzafar Shan. 2013. Monetary policy and stock market volatility in the ASEAN5: Asymmetries over Bull and Bear markets. *Procedia Economics and Finance*, **7**, 18–27.

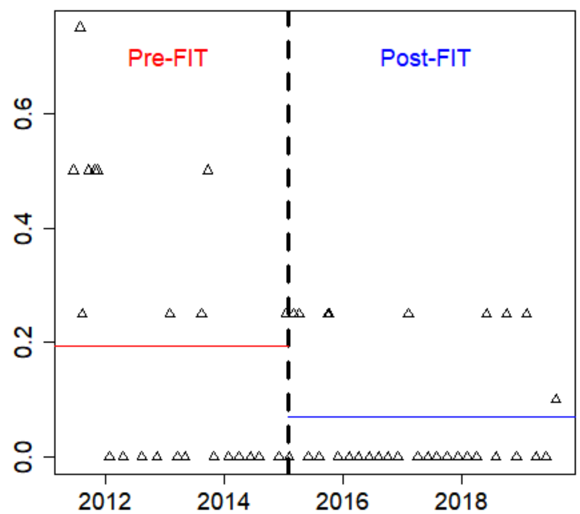
Figures

Figure 1: Performance of Professional Forecasters

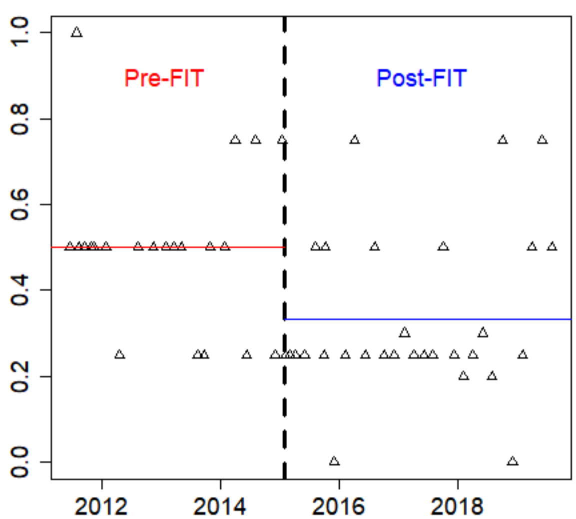
(a) Absolute (Error in Mean Forecast)



(b) Absolute (Error in Median Forecast)

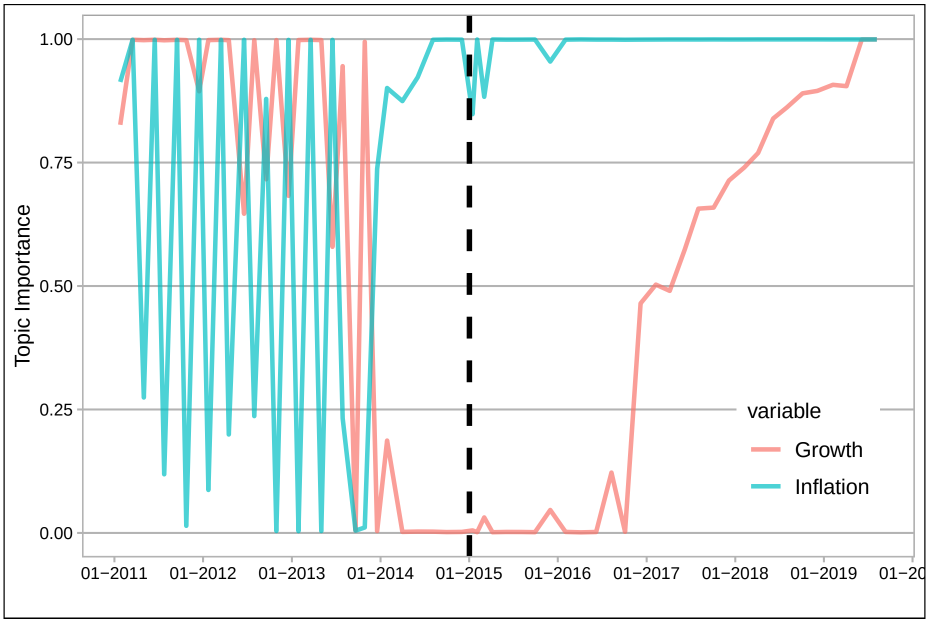


(c) Uncertainty (Max Forecast - Min Forecast)



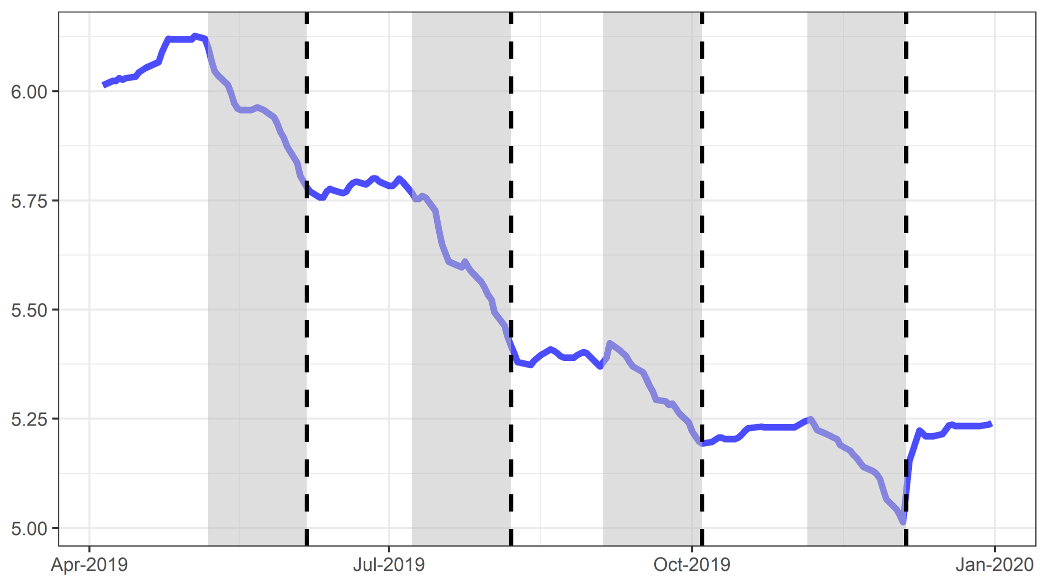
Notes: Panels (a)–(c): Each Δ corresponds to the absolute value of the error between the given forecast moment and announced repo rate. The red line corresponds to the average value of the statistic in the BIT period and blue line corresponds to the average value in PIT period. Panel (d) gives the difference between the maximum and minimum value of repo rate forecasts. All data comes from the RBI Survey of Professional Forecasters.

Figure 2: Importance of Inflation and Growth Topics in RBI Policy Statements



Notes: The two lines correspond to the importance of Growth- and Inflation-related topics in RBI policy announcements. Growth consists of all topics related to growth, i.e., Panel (b) and (c) in Table B.8. Similarly, Inflation consists of all topics in Panel (a) and (b) in the same table. The vertical line in the middle corresponds to the switch to Inflation Targeting Regime.

Figure 3: 1-Month OIS Provides Information About Monetary Policy Direction



Notes: The blue line corresponds to the 3-day moving average of 1-month OIS. The dashed vertical lines correspond to the RBI policy dates, while shaded gray corresponds to one-month periods before the policy dates.

Tables

Table 1: Descriptive Statistics on Monetary Policy Meetings of the RBI

	BIT (1)	PIT (2)
Meetings	32	28
Meetings with Repo Change	16	10
Total Business Days	999	1,073

Notes: This tables gives summary on the number of Monetary Policy Meetings under the two regimes.

Table 2: Descriptive Statistics on Text of RBI Policy Statements

	BIT (1)	PIT (2)
# of documents	32	28
# of words	47946	76772
Average length	1498.31	2741.86

Notes: The table provides summary information on the statements released by the RBI immediately after the announcement of its monetary policy.

Table 3: Difference in Topic Importance in RBI Policy Announcements

Variable	Mean Topic Importance		PIT - BIT	
	BIT	PIT	Difference	t-stat
	(1)	(2)	(3)	(4)
Only Inflation	0.31	0.53	0.22	2.16**
Only Growth	0.31	0.002	-0.30	-3.87***
All Inflation	0.63	0.99	0.36	4.44***
All Growth	0.64	0.47	-0.17	-1.59

Notes: The table presents the means and t-test for difference in means for topics on inflation and growth between the PIT and BIT periods. Only Inflation corresponds to topics in Panel (a), only Growth corresponds to topics in Panel (b) in Table B.8. Similarly, All Inflation contains topics in Panels (a) and (c), while All Growth contains topics in Panels (b) and (c). ***- $p < 0.01$ and **- $p < 0.05$.

Table 4: Surprise Component of Policy Announcement Impacts 10-year G-Sec Yield

	Log Change in G-Sec	
	(1)	(2)
1. β_0: Log Change in Repo Rate	-0.0040	
	(0.0362)	
2. β_1: Log Change in OIS (Unexpected Component)		0.2037***
		(0.0584)
1 - 2 β_2: (Expected Component)		-0.0208
		(0.0221)
N	57	57

Notes: The above table provides impact of repo and surprise repo change on 10-year benchmark G-Sec yield after policy announcement by the RBI. The equations are estimated using 57 policy days (pre-announced ones) between 2011 and 2019. We use the following equation:

$$\Delta Log(Yield_t) = \alpha + \beta_0 \Delta Log(Repo_t)$$

$$\Delta Log(Yield_t) = \alpha + \beta_1 \Delta Log(OIS_t) + \beta_2[\Delta Log(Repo_t) - \Delta Log(OIS_t)]\epsilon_t$$

Robust standard errors of the coefficients are reported in the parentheses. ***- $p < 0.01$ and **- $p < 0.05$.

Table 5: No Additional Effect on Bond Trading Volume around RBI Policy Days (after FIT)

	Growth in G-Sec Volume			
	All Days		Repo Change Days	
	(1)	(2)	(3)	(4)
One Day Before Policy	-25.549***	-23.903***	-22.158	-18.377
	(7.018)	(7.004)	(11.298)	(12.845)
Day of Policy	79.423***	69.304***	74.066***	57.248***
	(13.269)	(14.382)	(15.835)	(17.365)
One Day After Policy	-1.948	-7.475	-12.535	-15.517
	(8.000)	(8.284)	(9.720)	(10.010)
PIT× One Day Before Policy	-11.263	-12.854	-35.852	-39.632
	(15.295)	(15.842)	(19.780)	(20.741)
PIT×Day of Policy	1.509	11.573	0.854	17.673
	(23.228)	(25.206)	(35.208)	(36.005)
PIT×One Day After Policy	-10.163	-4.639	-36.903	-33.922
	(22.317)	(22.478)	(25.656)	(25.833)
N	2099	2049	2099	2049
Two Day Policy Dummies	N	Y	N	Y

Notes: This table reports the impact on 10-year benchmark G-Sec bond trading volume around the policy announcement days. It is based on equation (1) and uses a daily time series of total G-Sec traded in the secondary market for the period January 2011-August 2019. Robust standard errors of the coefficients are reported in the parentheses. ***- $p < 0.01$ and **- $p < 0.05$.

Table 6: No Additional Effect on Bond Market Volatility around RBI Policy Days (in PIT)

	Model			
	(1)	(2)	(3)	(4)
μ_1 : Day Before Two-day Policy	-1.565***	-1.522***	-1.590***	-1.545***
	(0.393)	(0.398)	(0.393)	(0.398)
μ_2 : First Day of Two-day Policy	0.740	0.684	0.532	0.486
	(0.664)	(0.644)	(0.730)	(0.707)
μ_3 : Second Day of Two-day Policy	0.678	0.617	0.562	0.564
	(0.525)	(0.498)	(0.597)	(0.570)
δ_1 : One Day Before Policy (All Days)	-0.236	-0.252	-0.031	-0.047
	(0.286)	(0.279)	(0.406)	(0.395)
δ_2 : Day of Policy (All Days)	1.043***	0.727**	0.993**	0.687
	(0.293)	(0.302)	(0.408)	(0.414)
δ_3 : One Day After Policy (All Days)	-0.507***	-0.452***	-0.327**	-0.298**
	(0.109)	(0.125)	(0.132)	(0.143)
δ_4 : Day of Surprise Policy		0.569***		0.486***
		(0.124)		(0.159)
γ_1 : PIT × One Day Before Policy			-0.417	-0.416
			(0.608)	(0.599)
γ_2 : PIT × Day of Policy			0.239	0.376
			(0.648)	(0.691)
γ_3 : PIT × One Day After Policy			-0.562*	-0.524
			(0.311)	(0.362)
γ_4 : PIT × Day of Surprise Policy				-0.160
				(0.336)
N	2052	2052	2052	2052

Notes: We estimate the equations (2)-(8) for 10-year benchmark G-Sec yield, using a daily time series from January 2011-August 2019. We report the estimates of the multiplicative heteroskedastic component of the Models 1 to 4 in this table. Specifically, the estimates reported here are based on the following equation:

$$s_t = \tau + \delta_1 I_t^{MPC-} + \delta_2 I_t^{MPC} + \delta_3 I_t^{MPC+} + \mu_1 I_t^{MP2--} + \mu_2 I_t^{MP2-} + \mu_3 I_t^{MP2} + \delta_4 I_t^S + I_t^{PIT}\left(\gamma_1 I_t^{MPC-} + \gamma_2 I_t^{MPC} + \gamma_3 I_t^{MPC+} + \gamma_4 I_t^S\right)$$

The standard errors of the coefficients are reported in the parentheses. ***- $p < 0.01$ and **- $p < 0.05$. The coefficients γ_1, γ_2 and γ_3 are not jointly significant at $p = 0.05$.

Table 7: No Effect on Stock Market (NIFTY-50 Index) Volatility around RBI Policy Days

	Model			
	(1)	(2)	(3)	(4)
μ_1 : Day Before Two-day policy	-0.318	-0.308	-0.341	-0.341
	(0.501)	(0.503)	(0.504)	(0.505)
μ_2 : First Day of Two-day Policy	-0.144	-0.143	-0.442	-0.443
	(0.820)	(0.825)	(0.845)	(0.846)
μ_3 : Second Day of Two-day Policy	0.779	0.765	0.955	0.956
	(0.646)	(0.652)	(0.674)	(0.674)
δ_1 : One Day Before Policy (all days)	0.351	0.347	0.643**	0.643**
	(0.188)	(0.188)	(0.269)	(0.269)
δ_2 : Day of Policy (All Days)	-0.156	-0.199	-0.492	-0.489
	(0.291)	(0.300)	(0.437)	(0.458)
δ_3 : One Day After Policy (All Days)	-0.427	-0.421	-0.251	-0.252
	(0.231)	(0.232)	(0.341)	(0.343)
δ_4 : Day of Surprise Policy		0.083		-0.003
		(0.115)		(0.152)
γ_1 : PIT × One Day Before Policy			-0.743	-0.744
			(0.433)	(0.434)
γ_2 : PIT × Day of Policy			0.876	0.840
			(0.632)	(0.662)
γ_3 : PIT × One Day After Policy			-0.463	-0.456
			(0.465)	(0.471)
γ_4 : PIT × Day of Surprise Policy				0.083
				(0.298)
N	2069	2069	2069	2069

Notes: We estimate the equations (2)-(8) for daily returns of NIFTY-50 index, using a time series running from January 2011 to August 2019. We report the estimates of the multiplicative heteroskedastic component of the Models 1 to 4 in this table. Specifically, the estimates reported here are based on the following equation:

$$s_t = \tau + \delta_1 I_t^{MPC-} + \delta_2 I_t^{MPC} + \delta_3 I_t^{MPC+} + \mu_1 I_t^{MP2--} + \mu_2 I_t^{MP2-} + \mu_3 I_t^{MP2} + \delta_4 I_t^S + I_t^{PIT}\left(\gamma_1 I_t^{MPC-} + \gamma_2 I_t^{MPC} + \gamma_3 I_t^{MPC+} + \gamma_4 I_t^S\right)$$

The standard errors of the coefficients are reported in the parentheses. ***- $p < 0.01$ and **- $p < 0.05$. The coefficients γ_1, γ_2 and γ_3 are not jointly significant at $p = 0.05$.

Table 8: Effect on Indian Market volatility around FOMC Meeting Days

	G-Sec		Nifty-50	
	(1)	(2)	(3)	(4)
One Day Before Policy	0.0131	0.0209	-0.4504***	-0.4744***
	(0.0974)	(0.0982)	(0.1211)	(0.1234)
Day of Policy	0.2434	-0.0420	0.7342***	0.7595***
	(0.1801)	(0.1979)	(0.1700)	(0.1780)
One Day After Policy	0.0088	0.0004	-0.1158	-0.1346
	(0.1515)	(0.1612)	(0.1468)	(0.1482)
Day of Surprise Policy		0.4680***		0.0409
		(0.0922)		(0.0902)
N	2070	2070	2070	2070

Notes: This table provides the impact on Indian bond (10-year G-Sec) and stock market (NIFTY-50 Index) around the FOMC announcements in the US. The surprise component in Federal Reserve Policy is measured by the change in Fed Funds 1-year Futures rate. The standard errors of the coefficients are reported in the parentheses. ***- $p < 0.01$, **- $p < 0.05$ and * - $p < 0.1$.

Appendix

A FPI Flows do not Explain the Impact of FOMC on Indian Markets

The results described above highlight the importance of Fed policy for domestic financial conditions in India. We now show how the channel of foreign portfolio investment (FPI) flows does not explain the differential impact of Fed policy on Indian bond and stock markets. We do so by testing for the impact on the volatility of FPI flows using a model similar to the one in Section 5.2. We are interested in FPI flow volatility one day before the FOMC meeting, on the day of the policy announcement and one day after FOMC meeting.[19] If Fed policy affects FPI flows, it should be reflected through a positive value on the coefficient α_2. A positive value implies heightened flows on the day of the FOMC policy announcement. Similarly, there should be less activity on the day before the FOMC meeting, which should be captured through a negative α_1. The results for the above regression are shown in Table B.1.

We find that FPI debt flows growth is lower than average on the day before the Fed policy announcement, but there is no significant change on the day of the policy (column (1)). Thus, FPI debt flows don't particularly explain domestic sovereign bond market reaction in India to FOMC announcements. The results are similar for flows into the equities market (column (2)). The growth in FPI flows is insignificant on all days around FOMC meeting days. Therefore the results in Table 8, i.e. the impact of the FOMC meetings on Indian markets, are primarily coming from the revaluation of stocks through portfolio rebalancing within the domestic economy.[20] Similarly, the growth in FPI flows do not change significantly around

[19]The press conference announcing the FOMC's decision occurs after the time of market closing in India on the same date. We consider the immediate next day as the one where I_t^{FOMC} takes the value of one.

[20]It is well-known that carry trade activity by the (non-financial) corporate sector in India increased very significantly after 2009 and volumes are impacted by U.S. monetary policy as was evident; e.g., during the taper tantrum (Acharya & Vij (2018)). Since the borrowed funds are invested in the domestic cash market

RBI policy days (Table B.2).

B Measuring Change in RBI Communication through Frequency of Bigrams

In this part, we provide robustness of the textual analyses presented in the main paper. Here, we use bag of words algorithm instead of LDA to evaluate change in communication.

B.1 Measuring Importance of Inflation and Growth

Lexicon Building: We manually classify each two-word phrase, bigrams, into growth and inflation categories within the RBI policy statements. Our approach is similar to Picault & Renault (2017), who classify phrases in ECB's statements into monetary policy and economic outlook categories. However, they go further and also assign sentiment (hawkish, neutral and dovish) to these categories, which requires some subjectivity. Our exercise only requires us to calculate the relative weight that RBI policy statements give to growth versus inflation.

Before classification of phrases, we follow the standard text processing protocol to convert raw text into usable format. We convert all words to lower case and use the Porter algorithm for stemming and removing all stop words. We then compute the total number of times each bigram appears in the entire text, both in the BIT and PIT periods. Finally, we are left with a total of 10,391 bi-grams in the whole period, with 1,023 of them unique (keeping only those which appear at least 10 times in the full corpus).

For classification, we restrict our attention to bigrams in the entire corpus. The list of bigrams classified under the two categories are given in Table B.5. For instance, CPI inflation, consumer prices and the crude price are classified under inflation-related phrases, and credit growth, external sector and aggregate demand are classified under growth-related

(typically 91-day treasury bills) and the currency risk is imperfectly, synthetically hedged, U.S. monetary policy shocks can significantly impact the sovereign yield curve and corporate stock valuations, but this impact is not necessarily echoed by changes to FPI flows.

phrases. We find that there is a common set of words which appear for both categories in both the BIT and PIT periods, but there is also a slight change in the vocabulary over time.

B.2 Inflation (not Growth) Became More Salient after IT

To formally test the impact of IT on growth- and inflation-related phrases in RBI statements, we calculate the Pearson's χ^2 statistic given by:

$$\chi^2 = \frac{N(ad - bc)^2}{(a + c)(b + d)(a + b)(c + d)} \tag{B.9}$$

where a, b, c and d are as defined in the contingency Table B.6. The above χ^2 statistic has 1 degree of freedom and is used to compare the frequency of words across two corpus. For example, Gentzkow & Shapiro (2010) use this statistic to classify phrases that are more commonly used by Republican or Democratic politicians in their speech. One crucial difference and innovation in our approach is that we do not use the above test to differentiate whether the individual word *growth* appears differently in the two corpora. We instead pool together all the bigrams related to growth and then test for the difference in their appearance in the text. We compute the χ^2 statistic for both growth- and inflation-related phrases.

The frequency distribution of keywords over the two periods is given in Table B.7. In Panel (a) we provide the contingency table for growth-related phrases. We find no significant difference in the growth-related keywords in monetary policy announcements between the two periods. The frequency of growth-related bi-grams increases slightly during the PIT period, but the χ^2 test shows that the change is not significant. In contrast, there is a significant increase in the keywords related to inflation (Panel (b)). The frequency of inflation-related bi-grams jump from 15.2 percent in the BFT to 18.0 percent in the PIT period and the difference is significant. The χ^2 test has a value 12.8 and is significant. Overall, these results are similar to those presented in the main paper using topic modeling through LDA and confirm increase in importance of inflation during IT.

Tables and Figures

Table B.1: Effect on FPI volume around FOMC Meeting Days

	Debt Market (1)	Equity Market (2)
γ_1: One Day Before Policy	-0.0821**	0.0014
	(0.0336)	(0.0104)
γ_2: Day of Policy	0.0676	0.0227
	(0.0465)	(0.0121)
γ_3: One Day After Policy	-0.0629	0.0207
	(0.0383)	(0.0127)
N	2053	2053

Notes: The following equation is estimated using daily volume of Foreign Portfolio Investment :

$$\Delta Log(Volume_t) = \alpha * \Delta Log(FedFutures_t) + \gamma_1 I_t^{FOMC-} + \gamma_2 I_t^{FOMC} + \gamma_3 I_t^{FOMC+} + Week_t + \eta_t$$

The time series is daily data from January 2011 to August 2019. The standard errors of the coefficients are reported in the parentheses. ***- $p < 0.01$ and **- $p < 0.05$.

Table B.2: Effect on FPI volume around RBI Policy Days

	Debt Market (1)	Equity Market (2)
μ_1 : Day before Two-day policy	0.0529	-0.0162
	(0.1313)	(0.0212)
μ_2 : First day of two-day policy	-0.0173	-0.0781
	(0.1438)	(0.0411)
μ_3 : Second day of two-day policy	0.0269	0.0141
	(0.1493)	(0.0316)
δ_1 : One day before policy	0.0289	0.0311
	(0.1189)	(0.0296)
δ_2 : Day of policy	-0.0462	-0.0170
	(0.1103)	(0.0196)
δ_3 : One day after policy	-0.1319**	0.0052
	(0.0652)	(0.0192)
γ_1 : PIT × One day before policy	-0.0565	-0.0344
	(0.1248)	(0.0330)
γ_2 : PIT × Day of policy	0.0563	-0.0045
	(0.1223)	(0.0222)
γ_3 : PIT × One day after policy	0.1116	0.0025
	(0.0788)	(0.0250)
N	2052	2052

Notes: The following equation is estimated using daily volume of Foreign Portfolio Investment :

$$\Delta Log(Volume_t) = \alpha * \Delta Log(OIS_t) + \delta_1 I_t^{MPC-} + \delta_2 I_t^{MPC} + \delta_3 I_t^{MPC+} + \mu_1 I_t^{MP2--} + \mu_2 I_t^{MP2-} + \mu_3 I_t^{MP2} +$$

$$\mathrm{I}_t^{PIT}\left(\gamma_1 I_t^{MPC-} + \gamma_2 I_t^{MPC} + \gamma_3 I_t^{MPC+}\right) + Week_t + \eta_t$$

The time series is daily data from January 2011 to August 2019. The standard errors of the coefficients are reported in the parentheses. ***- $p < 0.01$, **- $p < 0.05$ and * - $p < 0.1$

Table B.3: Effect on Bond volatility around RBI Policy Days (when repo rate changes)

	(1)	(2)
μ_1 : Day before Two-day policy	-1.498***	-1.520***
	(0.406)	(0.403)
μ_2 : First day of two-day policy	0.678	0.472
	(0.662)	(0.725)
μ_3 : Second day of two-day policy	0.751	0.693
	(0.516)	(0.586)
δ_1 : One day before policy (all days)	-0.235	-0.032
	(0.290)	(0.410)
δ_2 : Day of policy (all days)	0.907***	0.934**
	(0.292)	(0.408)
δ_3 : One day after policy (all days)	-0.520***	-0.434***
	(0.117)	(0.139)
δ_4 : Repo change day	0.193	-0.098
	(0.340)	(0.482)
δ_5 : One day after repo change	-0.026	0.211
	(0.320)	(0.452)
γ_1 : PIT × One day before policy		-0.421
		(0.615)
γ_2 : PIT × Day of policy		-0.010
		(0.721)
γ_3 : PIT × One day after policy		-0.248
		(0.418)
γ_4 : PIT × Repo change day		0.678
		(0.783)
γ_5 : PIT × One day after repo change		-0.587
		(0.735)
N	2069	2069

Notes: We estimate the equations (2)-(5) and (7) for 10 year benchmark G-Sec yield, using a daily time series running from January 2011 to August 2019. We report the estimates of the multiplicative heteroskedastic component of the Models 1 to 4 in this table. Specifically, the estimates reported here are based on the following equation:

$$s_t = \tau + \delta_1 I_t^{MPC-} + \delta_2 I_t^{MPC} + \delta_3 I_t^{MPC+} + \mu_1 I_t^{MP2--} + \mu_2 I_t^{MP2-} + \mu_3 I_t^{MP2} + \delta_4 I_t^{C} + \delta_5 I_t^{C+} + I_t^{PIT}\left(\gamma_1 I_t^{MPC-} + \gamma_2 I_t^{MPC} + \gamma_3 I_t^{MPC+} + \gamma_4 I_t^{C} + \gamma_5 I_t^{C+}\right)$$

The standard errors of the coefficients are reported in the parentheses. ***- $p < 0.01$ and **- $p < 0.05$.

Table B.4: Effect on NIFTy-50 volatility around RBI Policy Days (when repo rate changes)

	(1)	(2)
μ_1 : Day before Two-day policy	-0.316	-0.345
	(0.506)	(0.515)
μ_2 : First day of two-day policy	-0.150	-0.449
	(0.826)	(0.852)
μ_3 : Second day of two-day policy	0.771	0.926
	(0.653)	(0.678)
δ_1 : One day before policy (all days)	0.355	0.645**
	(0.187)	(0.268)
δ_2 : Day of policy (all days)	-0.413	-0.795*
	(0.318)	(0.458)
δ_3 : One day after policy (all days)	-0.246	-0.086
	(0.266)	(0.370)
δ_4 : Repo change day	0.551	0.662
	(0.510)	(0.810)
δ_5 : One day after repo change	-0.375	-0.299
	(0.492)	(0.775)
γ_1 : PIT × One day before policy		-0.758
		(0.426)
γ_2 : PIT × Day of policy		1.007
		(0.673)
γ_3 : PIT × One day after policy		-0.375
		(0.521)
γ_4 : PIT × Repo change day		-0.259
		(1.033)
γ_5 : PIT × One day after repo change		-0.279
		(0.994)
N	2069	2069

Notes: We estimate the equations (2)-(5) and (7) for NIFTY-50 index, using a daily time series running from January 2011 to August 2019. We report the estimates of the multiplicative heteroskedastic component of the Models 1 to 4 in this table. Specifically, the estimates reported here are based on the following equation:

$$s_t = \tau + \delta_1 I_t^{MPC-} + \delta_2 I_t^{MPC} + \delta_3 I_t^{MPC+} + \mu_1 I_t^{MP2--} + \mu_2 I_t^{MP2-} + \mu_3 I_t^{MP2} + \delta_4 I_t^{C} + \delta_5 I_t^{C+} + I_t^{PIT}\left(\gamma_1 I_t^{MPC-} + \gamma_2 I_t^{MPC} + \gamma_3 I_t^{MPC+} + \gamma_4 I_t^{C} + \gamma_5 I_t^{C+}\right)$$

The standard errors of the coefficients are reported in the parentheses. ***- $p < 0.01$ and **- $p < 0.05$.

Table B.5: Full list of bi-grams

Inflation Related Phrases			
commodity prices	headline inflation	policy stance	cpi inflation
price index	crude prices	consumer price	global commodity
food inflation	oil prices	excluding food	inflation excluding
inflation expectations	international crude	price situation	crude oil
inflation outlook	retail inflation	food prices	petroleum products
government employees	house rent	pay commission	hra impact
inflation pressures	inflation measured	petroleum gas	inflation trajectory
price pressures	vegetable prices	inflation remained	central pay
liquefied petroleum	inflation path	policy stances	food group
product prices	petroleum product	hra revisions	rent allowances
food items	inflation projections	oil non	baseline inflation
fuel inflation			

Growth Related Phrases			
liquidity conditions	global growth	aggregate demand	current account
credit growth	government securities	capacity utilisation	indian economy
capital flows	external sector	external demand	global economic
services sector	fiscal consolidation	investment demand	monetary developments
export credit	overall outlook	economic conditions	trade deficit
industrial activity	gold imports	export growth	economic activity
industrial production	industrial outlook	gdp growth	investment activity
gva growth	purchasing managers	rural demand	input costs
capital goods	global demand	evolving macroeconomic	macroeconomic situation
global financial	trade tensions	demand conditions	durable liquidity
private investment	direct investment	passenger traffic	value added
manufacturing sector	construction activity	new orders	output gap
private consumption	foreign portfolio	import growth	air passenger
retail sales	wage growth	global trade	services pmi
supporting growth	consumer confidence	manufacturing purchasing	cement production
domestic front	freight traffic	manufacturing activity	core industries
growth remained	economic data	engineering goods	allied activities
gross value	vehicle sales	new business	domestic demand
gold prices	sector activity	order books	consumption expenditure
supply management	net exports	growth prospects	foodgrains production
manufacturing firms	steel consumption	goods production	tourist arrivals
bank credit	domestic economy	rate cuts	world trade
rural wage	capital formation	domestic air	electricity generation
rabi sowing	financing conditions	consumer spending	international prices
public administration	capital market	business sentiment	staff costs
business expectations	consumption demand	gross fixed	commercial vehicle
electronic goods	urban demand	political tensions	railway freight
consumer durables	fixed capital	supply side	foreign tourist
merchandise exports	final consumption	net demand	productive sectors

Table B.6: Contingency Table for χ^2 test

	BFT statements	FIT statments	Total
Frequency of (growth/inflation) Phrases	a	b	a+b
Frequency of others Phrases	c	d	c+d
Total Phrases	a+c	b+d	N= a+b+c+d

Table B.7: Growth and Inflation Related Bi-Grams in Policy Statements (Pre- vs. Post-FIT)

	BIT (1)	PIT (2)	Total (3)
Panel (a): Growth Bigrams			
Frequency of Growth Phrases	855	1979	2834
Frequency of others Phrases	2419	5138	7557
Total Phrase	3274	7117	10391
χ^2 Value: 3.2			
Panel (b): Inflation Bigrams			
Frequency of Inflation Phrases	498	1285	1783
Frequency of others Phrases	2776	5832	8608
Total Phrase	3274	7117	10391
χ^2 Value: 12.8			

Notes: This table provides the χ^2 test based on bigram frequency in RBI Policy Statements. The bigrams are manually classified into growth-related, inflation-related or none. The full list of bigrams is provided in Appendix Table B.5.

Table B.8: Topics in RBI Monetary Policy Statements

Panel (a): Inflation Related Topics
Topic 3: term repos,food fuel,cent ndtl,unchanged per,policy statement,policy stance,repo rate
Topic 4: repo rate,stance monetary,liquidity condition,year ago,commission award,pay commission,food inflation
Topic 5: crude price,policy rate,bimonthly monetary,policy statement,financial market,commodity price,base effect

Panel (b): Growth Related Topics
Topic 1: exchange rate,risk remain,euro area,aggregate demand,capacity utilisation,financial market,global growth
Topic 7: rabi crop,rate reduction,flow credit,adequate flow,credit productive,international crude,growth risk
Topic 9: upside risk,credit growth,quarter review,monetary development,macroeconomic monetary,liquidity condition, go forward

Panel (c): Both Growth and Inflation
Topic 6 food fuel,policy repo,economic activity,crude oil,cpi inflation,oil price,repo rate
Topic 8: global economy,product inflation,repo rate,nonfood manufacture,manufacture product,commodity price
Topic 10: medium term,growth trade,coarse cereal,sharp fall,rate unchanged,fix capital,moderate inflation
Topic 11: global demand,increase policy,recent period,price petrol,india export,inflation respect,past policy
Topic 12: medium term,growth trade,coarse cereal,sharp fall,rate unchanged,fix capital,moderate inflation

Panel (d): None
Topic 2: exchange rate,foreign exchange,basis point,exchange market,repo rate,cent immediate,immediate effect

Notes: This table provides 12 topics based on LDA topic modeling. Each panel gives our classification of topics into various categories. Within a topic, we provide the list of top seven keywords.

Figure B.1: Importance of Individual Topics in RBI Policy Statements

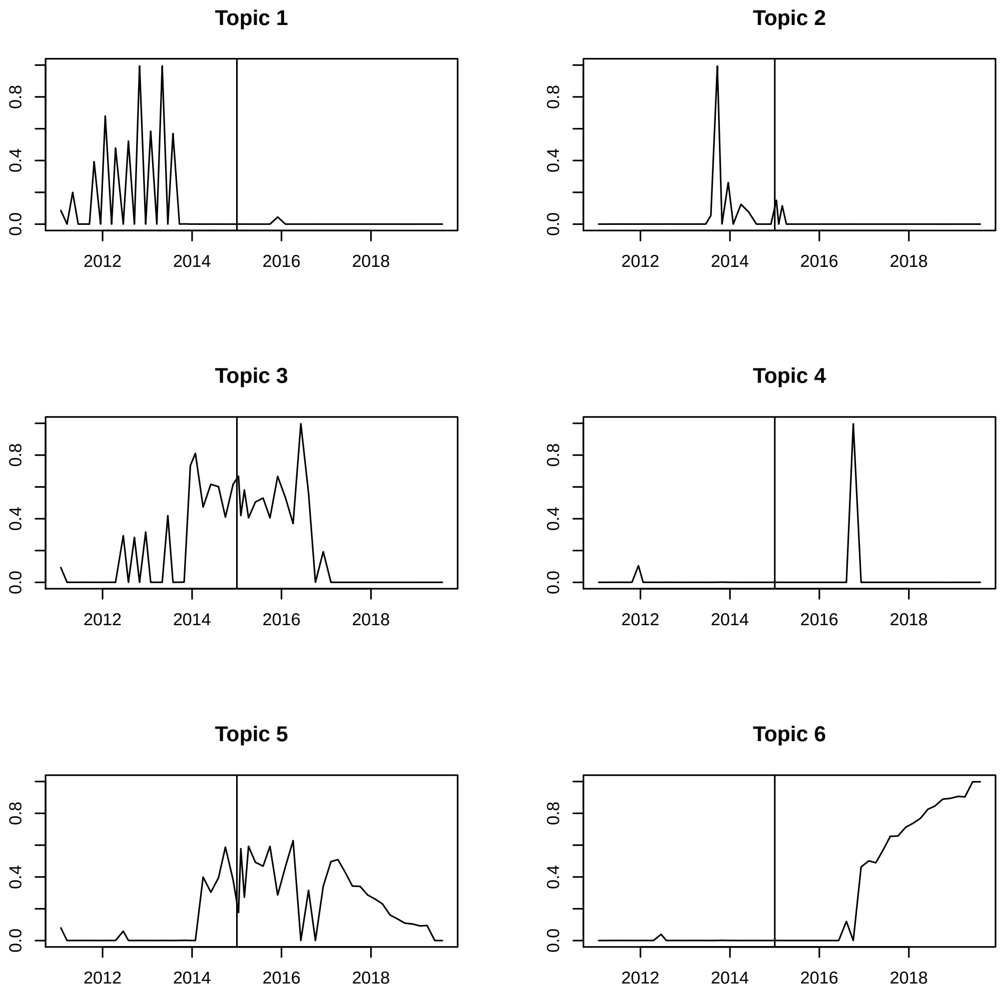
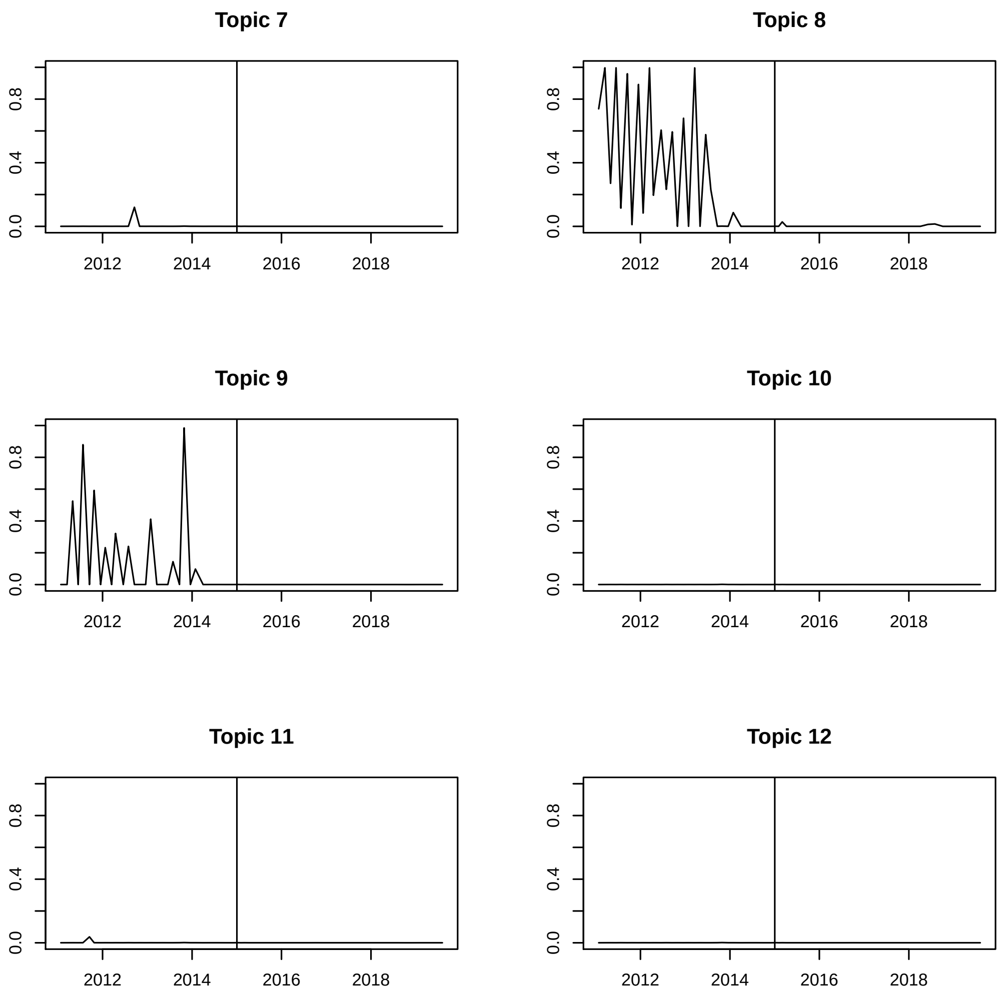


Figure B.1 (Cont.): Importance of Individual Topics in RBI Policy Statements



Notes: The vertical line in the middle corresponds to the switch to Inflation Targeting Regime. The topics and their category are described in Table B.8.