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Does Perception Matter? The Role of Monetary Policy Uncertainty in Policy Transmission

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Abstract

The effectiveness of monetary policy transmission to the macroeconomy is contingent on numerous factors. Policy uncertainty is often considered a major deterrent to smooth monetary policy transmission, which inflicts the pain of frequent changes in expectations by the market players. In this study, I analyze the impact of a perceived monetary policy uncertainty (MPU) index for India, constructed based on news-paper data, on financial markets as well as on monetary policy transmission. The computed MPU index exhibits a negative correlation with the sentiment in Monetary Policy Committee minutes, where higher positive sentiment on the minutes moves along with a lower MPU. The empirical examination using wavelet transformation and spillovers showed that MPU has had significant spillovers in Indian financial markets and is widely correlated to business cycle movements. Finally, the analysis documenting the transmission to the real economy shows that a state of high uncertainty dampens monetary policy transmission and adversely affects consumer confidence, sovereign risk, investment inflows and balance of trade. The results underscore the need for effective communication from the Central Bank and the need to manage expectations in the financial markets through forward guidance, transparency, and accountability.

Keywords: *Monetary Policy Uncertainty, Monetary Policy Transmission, Financial Markets, Central Bank Communication, Sentiment Analysis, Asymmetry, Wavelet Analysis*

JEL Codes: *E43, E44, E52, E58, G14*

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INTRODUCTION

Monetary policy transmission plays a significant role in the functioning of financial markets through managing expectations and liquidity. While the ultimate effects of monetary policy transmission are expected to be visible in the real economy in terms of increasing growth and fall in real interest rates, financial markets and households pick up the intermediate effects immediately. As a result, changes in policy stance and communication are closely monitored and analyzed by market participants. The effectiveness of monetary policy transmission largely depends on the formation of expectations about future policy actions. A well-functioning transmission mechanism relies on clear information flows and optimal portfolio rebalancing based on available resources. However, elevated levels of policy uncertainty can significantly disrupt this process, potentially bringing the mechanism to a halt.

The global economy has witnessed enormous fluctuations in asset prices and volatility while subjected to increased uncertainty. Among the different dimensions of uncertainty, the uncertainty about the policy stance of government or institutions has taken much precedence when compared to the alternatives. The paucity of a quantifiable measure of uncertainty was detrimental to the literature analyzing the impact of uncertainty, and the effects of policy uncertainty on macroeconomy or financial markets were left undocumented for a longer time.

There has been a recent surge in text-based monetary policy uncertainty measures ever since the ground-breaking work by Baker, Bloom and Davis (2016) (BBD hereafter) on economic policy uncertainty. Using the newspaper data, the authors developed quantifiable measures of uncertainty, including category-wise uncertainty measures. The present study derives motivation from this literature in the construction of a Perceived monetary policy uncertainty (MPU) measure based on newspaper data for India. This approach contrasts with the existing literature, which largely focuses on market-based uncertainty measures and their impact on policy transmission (Bauer, 2012).

In the present study, I make use of the perceived monetary policy uncertainty index for India, which is constructed using newspaper data from six leading Indian newspapers between 2010 and 2024. While MPU serves as a prominent measure of uncertainty in the study, I also extracted the sentiment component of the Monetary Policy Committee (MPC) minutes and complemented this data with the measure of uncertainty. In the empirical analysis of transmission, the study first explores the time-varying spillover effects of MPU on the stock, bond and exchange rate markets. The last part of the study documents the asymmetric effects of the presence of MPU on the transmission of traditional monetary policy to the real economy, the external sector, and consumer confidence.

The findings of this study underscore the importance of documenting the effects of Monetary Policy Uncertainty (MPU) and its transmission within the broader economic structure. The constructed MPU Index closely aligns with the sentiment reflected in the Monetary Policy Committee (MPC) minutes, where a more positive tone corresponds with lower uncertainty, while heightened negative sentiment is associated with increased uncertainty. In financial markets, the impact of MPU exhibits time-varying characteristics, particularly evident in the bond market and over lower-frequency cycles. The results highlight the deeper penetration of uncertainty into the slower-moving segments of financial markets, which can significantly influence the structure and performance of India’s financial system.

Furthermore, analysis of the asymmetric effects of MPU reveals that periods of low uncertainty are more favourable for the effective transmission of monetary policy, both to the real economy and the external sector. During periods of low MPU, monetary contraction is linked to higher consumer confidence, an improved balance of trade position, and increased investment inflows. These findings emphasize the need to integrate MPU into traditional analyses of monetary policy transmission and highlight the critical role of uncertainty perceptions in ensuring the optimal functioning of key economic indicators.

THEORETICAL AND EMPIRICAL BACKGROUND

Monetary policy uncertainty (MPU) plays a crucial role in shaping a country's macroeconomic outcomes. The presence of uncertainty is often coupled with larger fluctuations in asset prices and weaker transmission of signals across various economic agents. As quoted by Alan Greenspan, "Uncertainty is not just a pervasive feature of the monetary policy landscape; it is the defining characteristic of that landscape[1]." Through the statement, the former chair of the Fed explicitly recognized the need to examine monetary policy uncertainty while looking at the impact and effectiveness of various policy outcomes.

The emphasis of MPU on financial markets is rooted in the efficient market hypothesis. The hypothesis is based on the belief that financial markets are informationally efficient and asset prices fully reflect all available information at any given time. The presence of uncertainty could alter this belief, and investor behaviour often aligns less with the true reflection of asset prices, making markets less self-sustaining in dealing with new information. While there is a chance for markets to adjust in the long run, monetary policy uncertainty may lead to inefficiencies in pricing due to unpredictable shifts in investor sentiment or incomplete information in the short run. This is particularly true during periods of major economic or financial crises when monetary policy decisions can significantly impact markets.

While market-based uncertainty measures like volatility index, the standard deviation of stock prices, etc., are implicitly being accounted for

[1] https://www.federalreserve.gov/boarddocs/speeches/2004/20040103/default.htm

while dealing with macroeconomic models, the lack of research on the extent of information content in perceived monetary policy uncertainty has distanced academia from documenting the comprehensive effects of uncertainty on markets. BBD (2016) revolutionized the literature on the effects of policy uncertainty on economic outcomes. The EPU index, which was constructed and published for India, has been widely accepted by academia, and research has started focusing on the explicit effects of higher policy uncertainty. One of the earlier studies by Bhagat et al. (2016) identified that gross domestic product and fixed investment are negatively related to EPU, with additional evidence of dampening the stock market and coinciding with high levels of policy uncertainty. Similar results were established by Pratap and Priyaranjan (2023), where policy uncertainty measured through internet search intensity data was found to decrease output and increase inflation through the real options channel. While analyzing the nature of uncertainty shocks through cross-country comparison, Kumar et al. (2021) documented evidence that EPU acts as a supply-side shock for India while a demand-side shock for the US with stronger evidence of uncertainty spillovers from the US to India. The existing literature on text-based measures of monetary policy uncertainty has documented wider implications to the monetary policy literature. The effects are persistent for the macroeconomy as well as on micro-units such as firms. In transmission, MPU has been identified to have detrimental effects on output (Husted et al., 2020), credit risk (Li et al., 2020) and the term structure of interest rates (Tillmann, 2020). Perception-based monetary policy uncertainty showed a negative economic impact on Turkey, while the impact remained relatively high and volatile during the implementation of unconventional monetary policy (Cevik & Erduman, 2020).

The most important aspect of understanding the impact of uncertainty is through examining the channels. Among other indicators, the expectations channel accounts for the larger variations in policy implications as a result of changing uncertainty. The presence of uncertainty exerts significant adverse effects on macroeconomic outcomes (Beckmann & Geiger, 2024; Ciccarelli & Garcia, 2021). Uncertainty creates ambiguity in future rate expectations, pushing businesses and households into the practice of precautionary behaviour where agents delay investments and consumption and take a "wait and see" attitude. The postponement creates a fall in economic activity and demand creation.

The credit spread channel explains a major share of implications related to the functioning of monetary policy uncertainty (Wang et al., 2023; Du & Rousse, 2018). According to the credit spread channel, the presence of uncertainty increases the borrowing costs for businesses and households. Under the presence of policy uncertainty, investors and banks become more cautious while lending. When the future stance of monetary policy and inflation are uncertain, the lenders would demand a risk premium, which widens the yields associated with riskier and risk-free assets, creating a higher risk perception for the economy in the domestic as well as international markets.

The impact of monetary policy communication could be considered as a major advancement in monetary policy literature in the past decade. While prior literature has documented the movements in financial markets owing to changes in monetary policy stances, the recent era has seen much more coordination between policy communication and response in the financial markets. The focus of current literature on monetary policy communication is quite in contrast to the prior belief that markets react well to 'monetary policy surprises. However, communication regarding monetary policy is imperative to ensure efficiency in financial markets. Greater information on how a central bank works helps in managing speculation in the financial markets, supports the future movement of asset prices and reduces overall volatility (Mohan, 2005).

Out of many focus areas, communication also aids in managing uncertainty in the financial markets, as effective communication is expected to drastically alleviate the ill effects of uncertainty or market volatility (Vyshnevskyi et al., 2024). The increased emphasis on monetary policy communication by worldwide central banks could be attributed to various factors. The major reason is that most of the Central Banks are independent bodies; their authority is free of political intervention, and communication ensures accountability in their system. The introduction of inflation-targeting underscored the need to have a clear mandate and steps to reach the policy goal. These measures, coupled with the widening importance of financial markets in developing countries, made it imperative to focus on central bank communication to keep the animal spirits of economic agents high and foster efficient monetary policy transmission. The increasing attention on India's growth and stock markets influenced the policymakers at RBI to focus on the communication aspect of policy decisions. The communication from RBI is found to predict future policy stance along with managing expectations in the stock market (Shrimali & Ahmed, 2025). Prior research has also observed that policy communication effectively reduced policy uncertainty and helped anchor market expectations, especially during the pandemic (Ahmed et al., 2023).

The need to manage expectations and thereby reduce uncertainty has become a central theme during the pandemic. Along with implementing tools like the Asset Purchase Programme (APP), the pandemic also witnessed Forward Guidance as a major measure to communicate the policy stance and thereby manage the expectations of the market. Through this communication measure, the Governor has explicitly assured the financial markets that "the Reserve Bank will maintain comfortable liquidity conditions in sync with the monetary policy stance" of the MPC, thereby complementing the asset purchase programme (Talwar et al., 2021).

The key takeaways from the review of relevant literature could be summarized as follows. Policy Uncertainty has spillovers to the monetary system in general and financial markets in particular. The credibility of a quantitative measure of uncertainty is related to its closer association with the sentiments of the monetary policy communication in that country. However, the way in which monetary policy communication drives monetary policy uncertainty has not been well documented in the literature. Along with this, while there is moderate evidence for the asymmetric effects of uncertainty on the real economy, the empirical evidence is limited to financial markets. The present study attempts to correlate the sentiment part of monetary policy communication with perceived monetary policy uncertainty. To understand the deeper impact of uncertainty on financial markets, the study employs a frequency disaggregated spillover analysis. In the final stage of this study, the asymmetric effects of MPU on monetary policy transmission are documented in various aspects, including consumer confidence, investment inflows, sovereign risk and balance of trade.

Monetary Policy Communication in India

The Reserve Bank of India is envisaged with the task of formulating and implementing monetary policy following the Reserve Bank of India Act 1934. The Act was further amended in 2016 to include "Inflation targeting" as the legal mandate of the Central Bank. The mandate requires the RBI to achieve a medium-term Consumer Price Index (CPI) inflation of 4 per cent, but it also has built-in flexibility with the provision of a 2 per cent tolerance band on both sides, often prompting expectations at times that the central bank might tolerate inflation deviations within a 4 $\pm$ 2% band. This flexible inflation targeting policy recognizes the short-run inflation-growth tradeoff in India, and the tolerance band has been formulated to support the economy during external shocks (Dua, 2020). In 2011, the RBI recognized the Weighted Average Call Money Rate (WACR) as its operating target and the policy repo rate as the only independently varying policy rate.

The amendment also contributed to the creation of a six-member Monetary Policy Committee (MPC), which decides on the monetary policy stance of the country and also communicates the decision to the public. As per the statute, the MPC meets six times a year to discuss and decide on the target policy rate. On the last day of the meeting, the RBI Governor communicates the decision taken by consensus or by majority vote, as the case may be, in a press meeting covered by various print and digital news media and channels. To ensure transparency, the MPC policy statement is released immediately on the RBI website, and the minutes of the meeting two weeks after the decision are publicly accessible.

In addition, the RBI takes steps to manage unforeseen crises through clear communication, assuring a policy response to address the situation swiftly. To ensure the smooth flow of market-sensitive information, the RBI uses embargoed releases through news agencies. Consequently, the speeches of top RBI officials and press releases, which are widely covered by the media, communicate the policy stance and help the financial markets absorb and act on the information.

DATA AND METHODOLOGY

Measurement of Monetary Policy Uncertainty

For the empirical analysis, I use the perceived Monetary Policy Uncertainty Index (MPU) constructed by Sen et. al (2026) based on newspaper data for India. The Index is constructed for the period 2010-2024 at monthly frequency. The Index follows a methodology similar to that of the Economic Policy Uncertainty Index constructed by BBD 2016. The data for index creation is collected from six leading Indian newspapers, viz., Economic Times, Times of India, The Mint, Financial Express, Hindustan Times and Indian Express. The next step was to flag articles that satisfy the criterion introduced by BBD, where each article flagged should jointly fulfil four conditions for inclusion. The conditions are represented by terms such as 1) Uncertainty, 2) Economy, 3) Policy and 4) Categorical terms for monetary policy. Considering the importance of Inflation targeting in India, I modified the inclusion criteria to include words related to inflation, such as "Price level" and "Inflation" in condition 4. In order to ensure that the articles flagged actually represent news on monetary policy uncertainty, following Tillmann (2020), I included an additional criterion that the words related to the uncertainty condition (condition 1) should appear within the proximity of 10 words of the monetary policy condition terms (condition 4). The detailed list of words included in the search is presented in Appendix A.

Once the information on flagged articles was extracted, the frequency was converted into a proportion of the total articles published in that particular newspaper in the respective month. Later, using the standardization procedure by BBD 2016, the perceived MPU index was created with a mean value of 100. A detailed explanation of the construction of MPU is available in Appendix B.

Measurement of Sentiment Score from the Monetary Policy Committee (MPC) minutes

Policy communication by the Central Bank has two major facets. One is the verbal communication done through the press conference in which the Governor communicates the monetary policy stance of the MPC. This communication is widely reported by news media and analyzed by market players to form expectations around the future stance of monetary policy and also to revise their expectations. The second part comes from the formal documentation of the decision, emphasizing key aspects of the meeting and the rationale behind the stance as expressed by all MPC members. The sentiment expressed in the MPC minutes is often analyzed to gauge the central bank's outlook on the economy, whether it is optimistic, cautious, or concerned about inflationary pressures. The choice of words, the frequency of certain emotional or economic terms, and the overall tone of the communication can signal the bank's level of confidence or caution regarding future policy adjustments.

Understanding the sentiment in MPC minutes helps in assessing not only the immediate policy stance but also the likely future trajectory of monetary policy, offering valuable guidance for decision-makers in the financial markets and the broader economy.

To capture the sentiment part of MPC minutes, I used an advanced software called "Linguistic Inquiry and Word Count" (LIWC). The software scientifically estimates the emotional tone, sentiment and psychological meaning of texts by counting the frequency of words in different categories and matching them with the in-built dictionary. LIWC does not just analyze the sentiment (positive/negative); it also measures the cognitive complexity of the text and assigns a numerical score to quantify the emotions. As the MPC minutes are not available for the entire period of analysis, I have collected the minutes for the period October 2016-December 2024, available in bi-monthly frequency (52 documents). The quantitative measure is then correlated with the perceived MPU to confirm that the emotions in the actual statement and the perception formed are in line.

Measurement of Monetary Policy Shock (MPS)

I use an approximation of the standardized Taylor rule (Rohit & Bhat, 2022; Ma & Zhang, 2016) to identify the exogenous monetary policy shocks in our estimation. Under the Taylor rule, the interest rate estimation of a Central Bank will be based on the following equation.

$$r_t = \alpha + \sum_{l=1}^{L} \beta_1 r_{t-1} + \sum_{l=0}^{M} \beta_2 Output\ Gap_{t-1} + \sum_{l=0}^{N} \beta_3 Inflation\ Gap_{t-1} + \varepsilon_t$$

Where r is the target interest rate, L, M, and N are lags selected using information criteria that fit the model the best. The output gap and inflation gap are calculated using the Hodrick-Prescott filter, which decomposes the real values into trend and cyclical components. The Index of Industrial Production (IIP) is used as a proxy for Output, as GDP is not available at a monthly frequency. Inflation Y-O-Y is used to capture the inflation gap. The error term, ε_t~i.i.d. N (0, σ^2), is the exogenous monetary policy shock (MPS), which is an unanticipated deviation from the policy rule. I used the Weighted Average Call Money Rate (WACR) as the proxy for the policy rate.

Transmission of Monetary Policy Uncertainty: A Spillover Analysis

The empirical analysis has two sets of response variables. The first stage of the analysis looks at the transmission of MPU to the stock, bond, and exchange markets. The long-term yields are represented by the 10-year government bond yield. The stock market performance is captured using the log of the closing values of the benchmark Nifty50 (an index of 50 stocks traded on the National Stock Exchange of India). The INR/USD exchange rate (where INR refers to the Indian Rupee) is used as an indicator of the forex market. The evidence for MPU transmission provides a rationale for the state-dependent analysis of monetary policy transmission.

To capture the transmission of MPU, I used the Diebold- Yilmaz dynamic connectedness and spillover analysis (Diebold & Yilmaz, 2009; 2012) to check the magnitude of spillovers from MPU to different financial markets. Output as proxied by the Index of Industrial Production (IIP) and Inflation as proxied by (CPI) were used as control variables in the estimation. The approach is based on vector autoregression and the following forecast error variance decompositions (FEVD) generated from the variables. FEVD decomposes the unobserved variation in a variable into its own shock v/s and the shock spillovers from the other variables in the system. The methodology proposes a quantifiable measure of how much forecast uncertainty or error variance in a system of variables is due to cross-variable shocks. Through this approach, the simplest way of looking at the influence of one variable in predicting another variable is unfolded. A detailed explanation of the modelling part of the relationship is given in Appendix C.

Complex time-series relationships in macroeconomics are often identified across various dimensions of the time frame, and an average estimate often provides limited evidence of the underlying time-dependent relationships. To capture the magnitude of spillovers across different time scales, I transformed the variables using wavelet transformation and analyzed the variables under varying frequencies. The methodology opens up a varied scope of analysis about the time-frequency relationships among variables, identifying short-term and long-term co-movement among variables. Wavelet analysis uses an adaptive, real-time signal extraction procedure, which enables me to understand how changes in MPU are transmitted to the financial market across different frequency scales.

Transmission of Monetary Policy: A State-Dependent Analysis

In the second stage of the analysis, I looked at the transmission of monetary policy to the financial market and real economy, separately analyzing the uncertainty state in the economy. The MPU index has been standardized to have a mean value of 0 and a standard deviation of one. The positive values are marked as periods of high uncertainty, and the negative values are marked as a state of low uncertainty. Later, the monetary policy transmission has been marked to different financial and real economic variables across the two states. The response variables under consideration are 1) Consumer Confidence Index, 2) Sovereign Risk, 3) Total Investment Inflows, 4) Total Exports and 5) Total Imports. The methodology devised is the state-dependent local projection methodology popularised by Auerbach and Gorodnichenko (2012) and later extended by Ramey and Zubairy (2018). Let R_t be the state variable, which takes the value one if the economy is in regime one and zero if the economy is in regime 2, where state 1 depicts high MPU and state 2 depicts low MPU. The value of R_t is expressed as

$$R_t = \begin{cases} 1 \; if \; MPU_t > \tau \\ 0 \; if \; MPU_t < \tau \end{cases}$$

where τ is the threshold value set to 0. As MPU is the standardized Index, the economy is in high intensity if the MPU exceeds the long-run average and vice-versa. The model can be expressed as

$$y_{t+h} = R_{t-1}\left[\alpha_h^R + \beta_h^R MPS_t + (\delta_h^R)' \sum_{s=1}^{q} X_{t-s}\right] + (1 - R_{t-1})\left[\alpha_h^R + \beta_h^R MPS_t + (\delta_h^R)' \sum_{s=1}^{q} X_{t-s}\right] + u_{t+h} \quad (3)$$

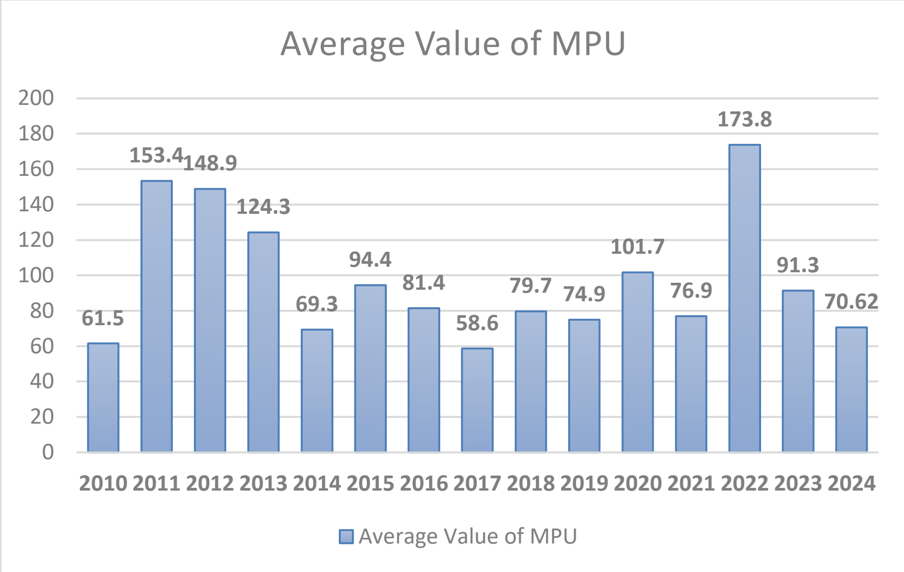
where the first part of the equation with the prefix R_{t-1} reflects the impact of monetary policy when MPU is high, and the second part with the prefix $1 - R_{t-1}$ refers to the response to the monetary policy under low uncertainty. Here, the impact of shocks and the influence of the control variables are allowed to differ across the states. X_t is the vector of all variables, including MPS_t, MPU_t and the controls. The common control variables are IIP and Inflation rate. To ensure robustness, I have also controlled for the Federal Funds Rate and Exchange Rate.

RESULTS AND DISCUSSION

The first part of the data analysis was to construct the monthly newspaper-based Monetary Policy Uncertainty (MPU) Index for the years 2010-2024. As discussed in the data section, the Index has an average value of 100, where values above 100 are considered to be periods of high uncertainty, and values below 100 signify lower uncertainty.

While the overall trends in the constructed MPU are shown in the Appendix (Figure A1), the average values of MPU over the years are plotted in the following Figure 1.

Figure 1: Average Value of MPU



The trend chart reveals that the MPU estimates were considerably high before the Inflation targeting regime, and the estimates became stable during the 2016 period. The COVID period has not witnessed huge spikes in MPU trends, owing to the timely response of the Reserve Bank in terms of unconventional monetary policy measures, including asset purchase programmes and forward guidance. However, the largest spike in MPU is recorded for the year 2022, two years post the crisis. This could be hugely attributed to the 'withdrawal of accommodation' stance by the Central Bank, which could have impacted the financial markets drastically.

The constructed MPU index has a correlation of 0.49 against the Economic Policy Uncertainty Index for India, published and maintained by BBD 2016. While the correlation is moderate, it suggests that the MPU index shares some common ground with the broader EPU but also captures unique dimensions specific to monetary policy. The value also signifies that the MPU index merely does not duplicate the signals captured by EPU, whereas it captures shocks and deviations unique to the perception of monetary policy uncertainty. For example, during the month of November 2016, following demonetization in India, the monthly MPU index was identified to be way less than the EPU index, showing that the move was not recognized as something that would contribute to MPU. However, during the following month, the monthly MPU was at 141, whereas the monthly EPU was at 117, showing how the perceptions of monetary policy uncertainty have formed subsequently. Similarly, for the months following the official adaptation of inflation targeting in August 2016, the MPU index was constantly higher than the EPU index. The evidence suggests that while both MPU and EPU capture perceived uncertainty surrounding policy, the reflections on monetary policy are better captured by the MPU.

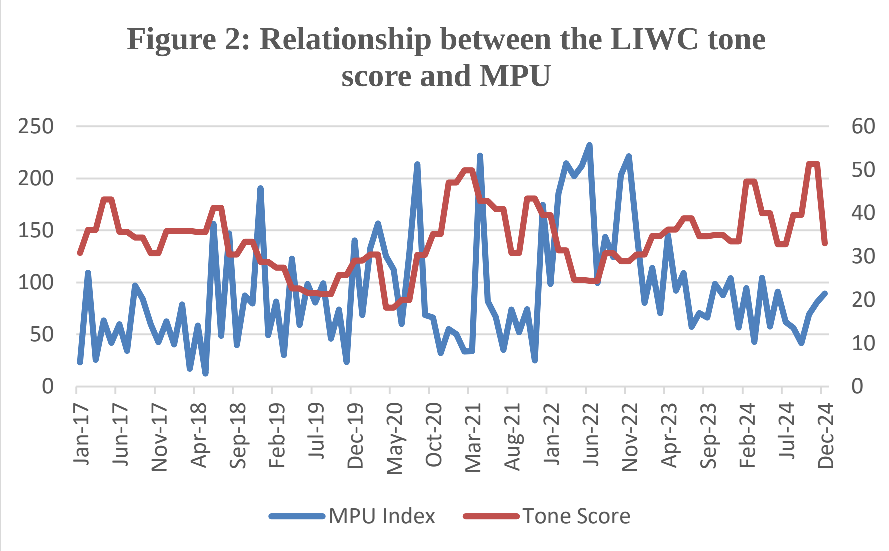
For the analysis, we use the standardized MPU index, which has an average value of 0 and a standard deviation of 1. With respect to the standardized Index, values above zero are marked as periods of high uncertainty and values below zero are considered to be periods of low uncertainty.

Next, I extract the sentiment score from the bi-monthly monetary policy committee (MPC) minutes of the RBI. The Governor's statement after the MPC meeting will be a powerful tool to capture perceptions about monetary policy. However, the formal publication of the minutes is not available for the period before 2020, and hence, I resort to the MPC minutes, which have been available since October 2016. While the MPU index gives the perceived uncertainty surrounding the monetary policy which is reported by newspapers, the basis for the same stems from the statements or stance of the MPC. Intuitively, the more negative the sentiment in the MPC minutes, the higher the MPU will be and vice versa.

The relationship between the MPU index and the 'tone' score generated from MPC minutes is shown in the following Figure 2. The tone score is generated using the Natural language Processing software called Linguistic Inquiry and Word Count (LWIC), which uses advanced built-in dictionaries to extract the underlying sentiment in the given text. The tone variable combines the two dimensions of positive and negative tone into a single summary variable. The algorithm is built so that the higher the number, the more positive the tone, with the score having an average value of 50. Numbers below 50 suggest a more negative emotional tone. A higher tone score refers to more positive emotions in the text. The score is extracted from the bi-monthly minutes of MPC available for the period of analysis till 2024. We can clearly see that there is a clear negative trend between tone and MPU, meaning that the higher the positive emotions in the text, the lower the uncertainty surrounding the monetary policy. The correlation between these two values is **-0.29.**

There are several advantages of using an established dictionary-based measure to capture sentiments compared to certain machine learning-based natural language processing measures. The most crucial advantage lies in the replicability of the estimated values. LIWC software maps words to categories, and the researcher has access to this sensitive information, making replicability, validation, and interpretability better. The approach gives added transparency to the meaning of the quantitative measure. The software also gives granular-level results that complement the tone score by revealing deeper analytical and emotional layers of the text. The approach also gives faster iterations and consistent results over time, which is not sensitive to the training and test data in an NLP approach, making the analysis computationally cost-efficient.

Figure 2: The relationship between the LIWC tone score and MPU



The LWIC also gives separate sentiment scores denoting positive and negative sentiment in the MPC minutes (Appendix Figure 2). The correlation between the positive sentiment and MPU is **-0.2**, and the correlation between the negative sentiment score and MPU is **0.25**. The scores indicate that there is a positive correlation between the negative sentiment score and MPU, reiterating that the more negative emotions in the MPC minutes, the higher the perceived monetary policy uncertainty. On the other hand, a higher positive sentiment score is associated with a lower uncertainty scenario.

Monetary Policy Uncertainty and Financial Markets

In the next step of the analysis, I empirically test the impact of monetary policy uncertainty on Indian financial markets. The analysis intends to extract the direct effects of MPU and document its transmission to the stock, bond, and exchange markets in India. While these markets are largely dynamic, often the problem with time-series analysis is that the relationships could be averaged out over time and might not show up in the analysis, especially if we use slightly low-frequency data. To alleviate this empirical problem, I estimate the time-varying estimates on the relationship between MPU and financial market variables across decomposed time frequencies. This method enabled me to capture signals from MPU to financial markets at various frequencies, which might be hard to account for in the original time series.

As a first step, I transformed the monthly variables in the analysis using the Maximum Overlap Discrete Wavelet Transform (MODWT). Using MODWT, the original time series is decomposed into five series: D1, D2, D3, D4 and D5, where a lower range of wavelength corresponds to the high-frequency component of the signal. The decomposition, therefore, results in six return series, including the original series. I then calculated the pairwise return spillover from MPU to the financial market using the Diebold-Yilmaz spillover index methodology (Diebold & Yilmaz, 2009; 2012). The results are in Table 1.

Table 1: Return Spillover Index - From MPU_STD to Indian financial markets

Scale	Equity	Bond	Exchange Rate	Inflation	IIP
Original Series	6.41	10.95	1.39	7.01	2.51
D1 (2 - 4 months)	3.56	12.27	2.80	7.68	2.96
D2 (4 - 8 months)	3.05	2.81	4.25	2.29	8.09
D3 (8 - 16 months)	10.90	3.13	2.99	4.36	1.92
D4 (16 - 32 months)	20.78	30.89	9.62	23.03	7.24
D5 (32 - 64 months)	9.47	14.16	13.60	6.16	14.48

The results indicate the directional return spillover from MPU to the stock, bond, and exchange markets after controlling for domestic output level measured by the Index of Industrial Production (IIP) and Inflation measured by the Consumer Price Index. The financial market indicators used in the study are the Stock Price Index (NIFTY 50), 10-year government bond yield and INR/USD exchange rate for the three markets, respectively. The data is on a monthly frequency, and as I am looking at the return spillovers, the data has been converted to log value, and the difference has been recorded as returns. To account for seasonality, exchange rate and IIP have been taken as Y-O-Y returns. All variables are, therefore, stationary, which is a precondition for return spillovers. I used the standardized MPU index to capture the spillovers, while the unstandardized Index was used for the robustness (The results are in Appendix Table A1). The six rows represent the spillovers across different time scales, starting with the original spillover in the first row, followed by the most to least frequency scales (D1-D5). The results are based on a monthly Time-Varying Parameter Vector Autoregression (TVP-VAR) with 12 months ahead forecast error variance decomposition. Following the Pareto principle and based on relevant literature, the cut-off value for the presence of spillovers is kept at 10, whereas values above 10 significantly have spillover effects (Chiranjivi & Sensarma, 2023). The results suggest that the spillovers from MPU are significant in the low-frequency bands. The lower frequency spillovers evident in the case of stock, bond and exchange markets are interestingly unavailable in the original time series, emphasizing the rationale for the time-scale decomposition. In the original time series, MPU had significant directional spillovers only visible in the bond market, where it was revealed that, on average, bond markets would significantly react to MPU changes. The MPU-Bond market relationship is the most prominent one, as we can see that the spillovers are evident over a larger spectrum of frequencies than in other markets (D1, D4 and D5). The highest spillover recorded in the lowest frequency bands D4 and D5, shown in Table 1, indicates that the spillovers from MPU to all the variables are more pronounced in the slowchanging aspects of time, including macroeconomic cycles or long-term trends. The results show the long-lasting impression of episodes of uncertainty on macroeconomic activity, which motivates us to attend the next session, where I will look at the impact of MPU on traditional monetary policy transmission.

Monetary Policy Transmission to Macroeconomy: The Role of Monetary Policy Uncertainty

In this section, I try to establish the asymmetric effects of MPU on the traditional monetary policy transmission process by documenting how transmission changes in a state of low v/s high uncertainty. The responses are derived from the real economy, external sector and consumer confidence.

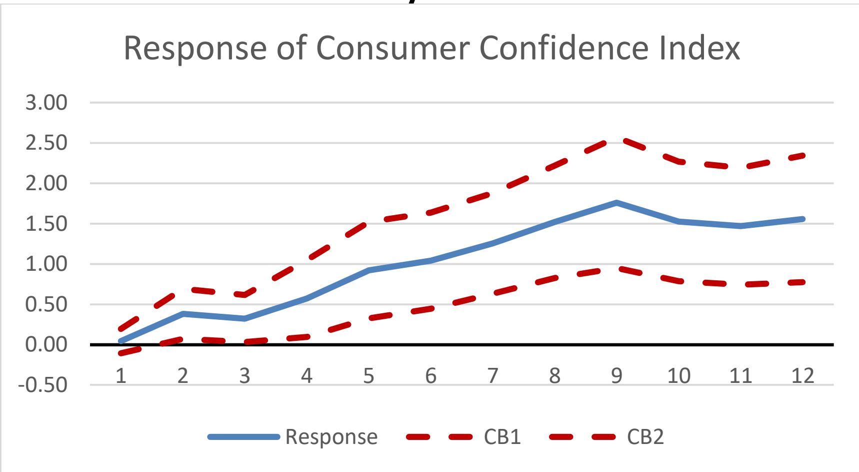
Monetary Policy Transmission and Consumer Confidence.

In the first case, I document the transmission of contractionary monetary policy shocks to the Consumer Confidence in India. As expressed in the previous section, monetary policy shocks are identified using the Taylor rule specification, where an increase is marked as contractionary monetary policy. Consumer confidence is captured through India's Consumer Confidence Index (CCI), published by the RBI. The Index captures the responses of households based on a survey that collects data on the current situation and future expectations of households based on various economic parameters. The variables collected and compiled from the survey are economic situation, income, spending, employment and price level for the current period as compared to a year ago. As the data is only available bi-monthly, I have used two ways of converting it to monthly frequency. The results presented are based on forward filling, which involves repeating the value of CCI in t for the month t+1. The other method was linear interpolation, and from the values, I have confirmed that the results are qualitatively similar.[2]. The

[2] Eg: CCI in Feb 2020 = CCI in Jan 2020 + (CCI in Mar 2020 – CCI in Jan 2020) / 2

response of CCI to one standard deviation shock to Monetary Policy Shock (MPS) is given in Figure 3.

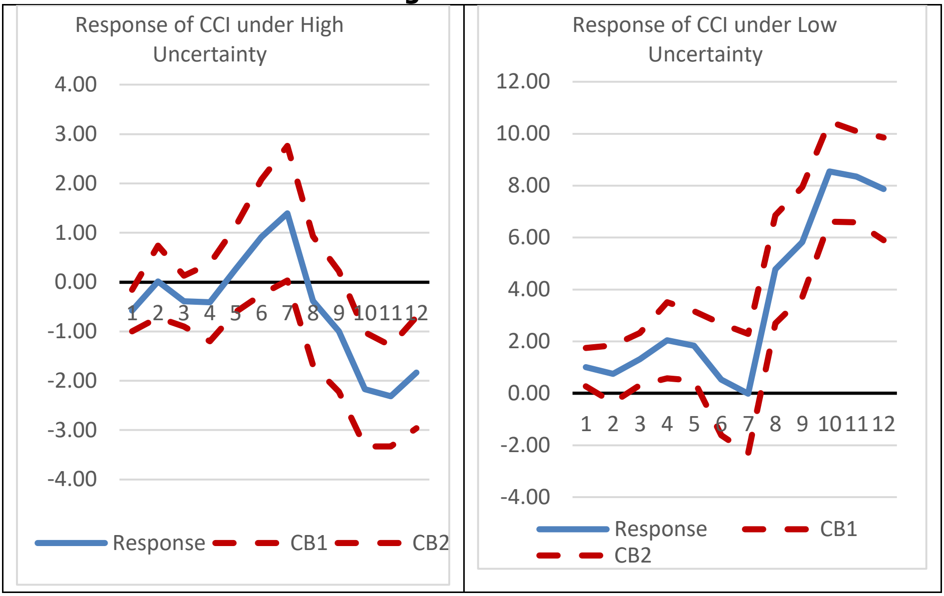
Figure 3: Response of Consumer Confidence Index to Monetary Policy Shock



Note: The response of the Consumer Confidence Index to one standard deviation rise in identified monetary policy shock as captured using local projection. The red dotted lines show the 90 per cent confidence bands.

We can identify that monetary policy shock is associated with a rise in CCI. This can be attributed to the effective management of inflation and the subsequent improvement in purchasing power and economic activity. In the next step, I examined the asymmetric impact of MPU on this transmission. In the following Figure 4, the response on the left shows the response of CCI to MPS under a high uncertainty regime, while the right-hand side response captures the same under a low uncertainty regime.

Figure 4: Asymmetric Response of Consumer Confidence Index to Monetary Policy Shock under high and low uncertainty regime.



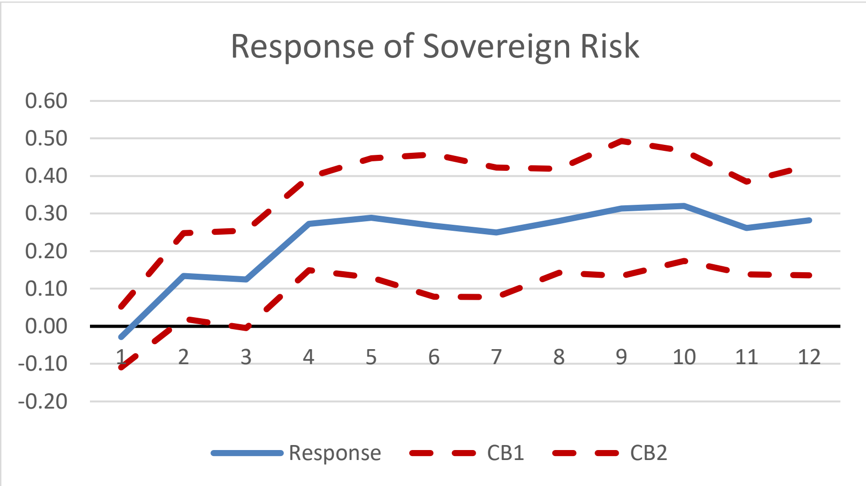
Notes: The bold blue lines show the impulse responses (with standard error bands) of consumer confidence to monetary tightening under high uncertainty (left) and low uncertainty (right) regimes. The lag criterion used is AIC. Newey-West robust standard errors are used in the estimation.

The results show that a high uncertainty regime is not conducive to the regular transmission of monetary policy. Under high uncertainty, the positive effect of monetary contraction on CCI is almost cancelled out, with even evidence for the reversal of the relationship during the later part of the horizon. On the other hand, a low uncertainty regime ensures that monetary tightening is viewed as a response to curb inflation and protect the purchasing power of the consumers. As a result, consumer confidence is fairly secure when the central bank initiates a tightening stance.

Monetary Policy Transmission and Sovereign Risk

The difference/spread between 10-year local bond yields and 10-year global bond yields would return a measure of Sovereign Risk for the country (Park & Mercado, 2014). We measure the spread using the difference between the 10-year treasury bond yields of India and that of the US. A higher spread indicates that the country is relatively riskier for global investors as higher bond yields signal that investors demand a higher risk premium for holding on to longer-term bond yields. The response of sovereign risk to monetary contraction is marked in Figure 5.

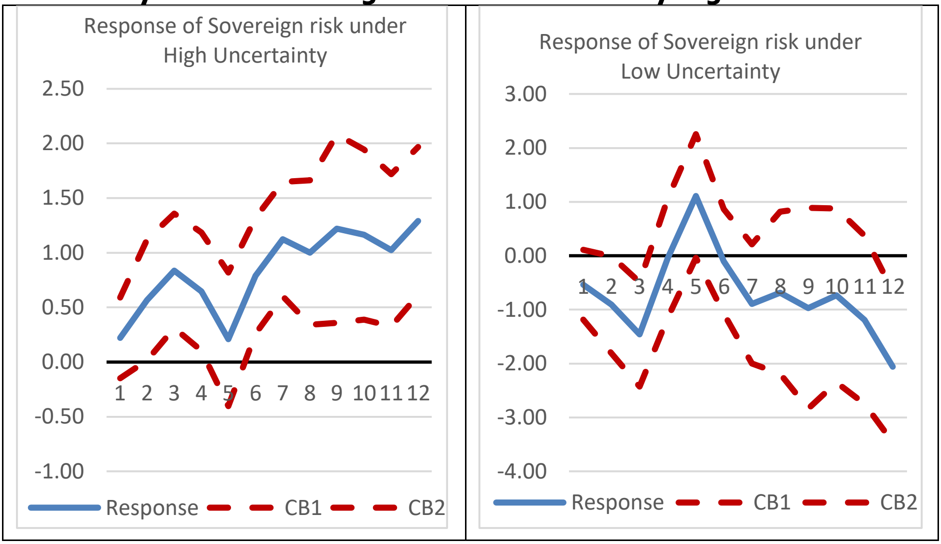
Figure 5: Response of Sovereign Risk to Monetary Policy Shock.



Note: The response of Sovereign Risk to one standard deviation rise in identified monetary policy shock as captured using local projection. The red dotted lines show the 90 per cent confidence bands.

The response shows that monetary contraction is associated with an increase in sovereign risk. The response could be majorly attributed to the negative relationship between market interest rates and bond prices. When the interest rate goes up owing to monetary tightening, this will result in a reduction in price for existing bonds as they bear a low coupon rate. The fall in price increases the yield on the bonds to make them attractive.

Figure 6: Asymmetric Response of Sovereign Risk to Monetary Policy Shock under high and low uncertainty regime.



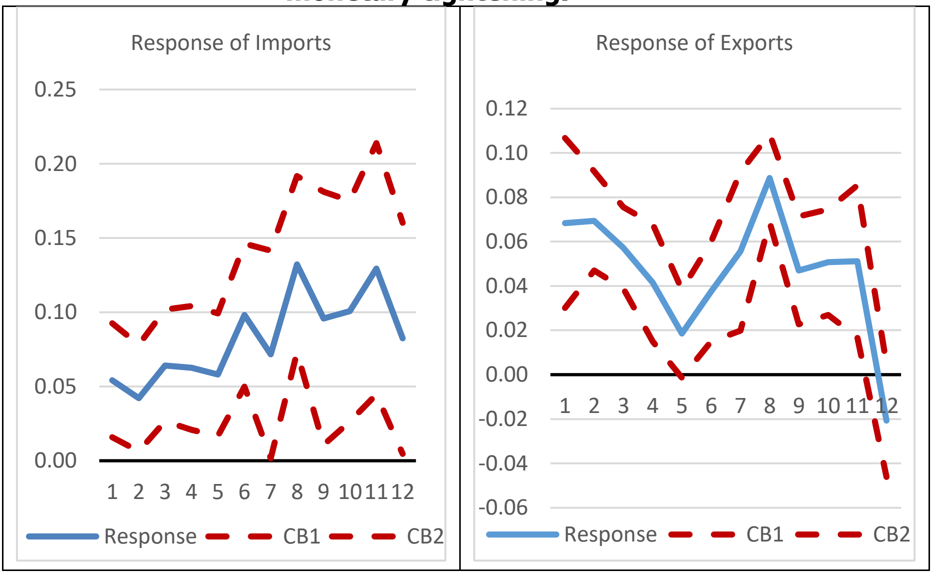
Notes: The bold blue lines show the impulse responses (with standard error bands) of sovereign risk to monetary tightening under high uncertainty (left) and low uncertainty (right) regimes. The lag criterion used is AIC. Newey-West robust standard errors are used in the estimation.

Figure 6 shows the responsiveness of sovereign risk to monetary policy shock under high (left) and low (right) uncertainty regimes. While the response under a low uncertainty regime is not very evident, except for the one period fall during the third month, the results under a high uncertainty regime are quite prominent. The positive response of sovereign risk to monetary tightening under heightened levels of uncertainty signals that the market is viewing the contractionary stance as a response to higher inflation. The persistence of inflation in the economy will lead to inflation risk as well as liquidity risk in the economy, which in turn drives up the bond yields to compensate the bondholders with a higher premium.

Monetary Policy and External Sector

The next part of the analysis deals with the response of the external sector to monetary policy shocks. In this analysis, I also controlled for the US interest rate and the INR/USD exchange rate, along with domestic controls. Figure 7 represents the response of exports and imports to monetary policy shocks.

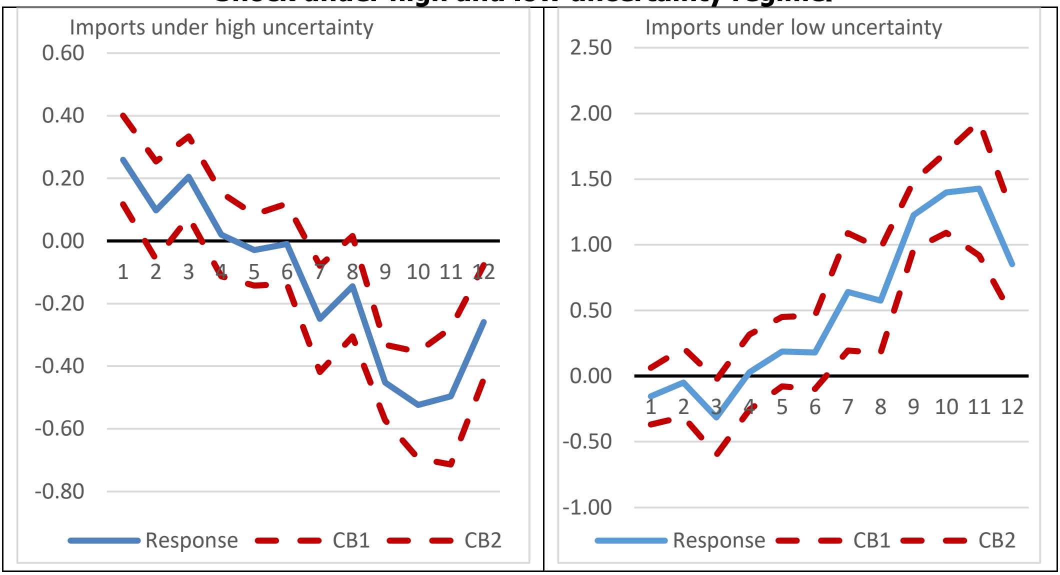
Figure 7: The Response of Imports (left) and Exports (right) to monetary tightening.



Note: The response of the Imports (left) and Exports (right) Index to one standard deviation rise in identified monetary policy shock as captured using local projection. The red dotted lines show the 90 per cent confidence bands.

The results show that both imports and exports increased due to monetary contraction. While these results look slightly counterintuitive, the results can be well attributed to the functioning of different channels in monetary policy transmission. When the interest rates go up, it results in the resurgence of interest rate differential for the country, which would serve as the basis for capital inflows to the country. The rise in capital inflow would result in currency appreciation, and imports become relatively cheaper for the country; hence, imports will increase. The magnitude of the response depends on the elasticity of import demand. On the other hand, we also found evidence for increased exports under monetary contraction. This could be possibly attributed to the competitive pricing of the goods owing to inflation control and the stronger external pull as the domestic demand shrinks in the economy as a result of tightening. However, these results would require a deeper examination to unfold the causes or to grasp a better understanding. The asymmetric effects of monetary contraction under high (left) and low uncertainty (right) for imports (Figure 8) and exports (Figure 9) are given as follows.

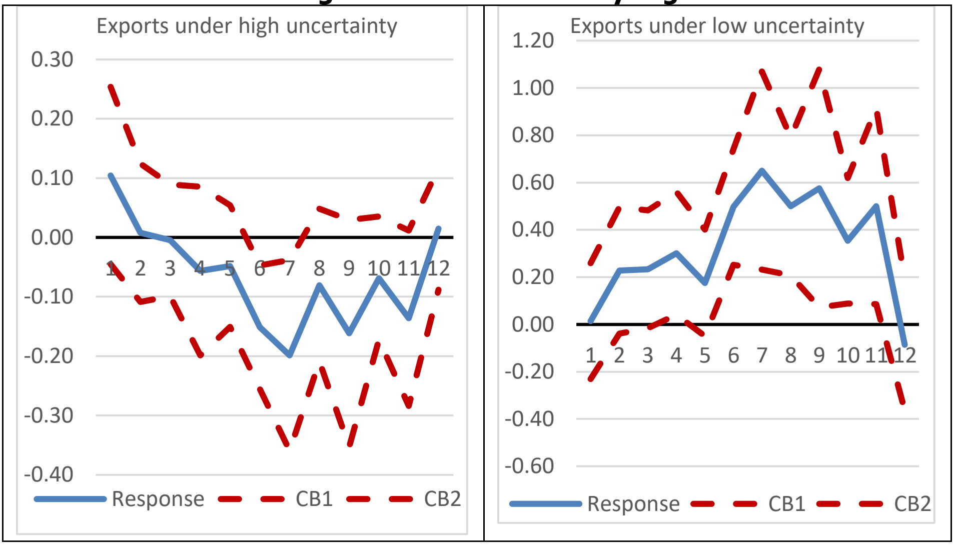
Figure 8: Asymmetric Response of Imports to Monetary Policy Shock under high and low uncertainty regime.



Notes: The bold blue lines show the impulse responses (with standard error bands) of imports to monetary tightening under high uncertainty (left) and low uncertainty (right) regimes. The lag criterion used is AIC. Newey-West robust standard errors are used in the estimation.

In the case of imports, higher uncertainty lowers imports, whereas a low uncertainty environment is better for maintaining stable import demand. An uncertainty-less environment would make investors perceive the tightening stance as good for long-term inflation control, securing their real returns. The interest rate differential will also provide a rationale for further investments in India.

Figure 9: Asymmetric Response of Exports to Monetary Policy Shock under high and low uncertainty regime.

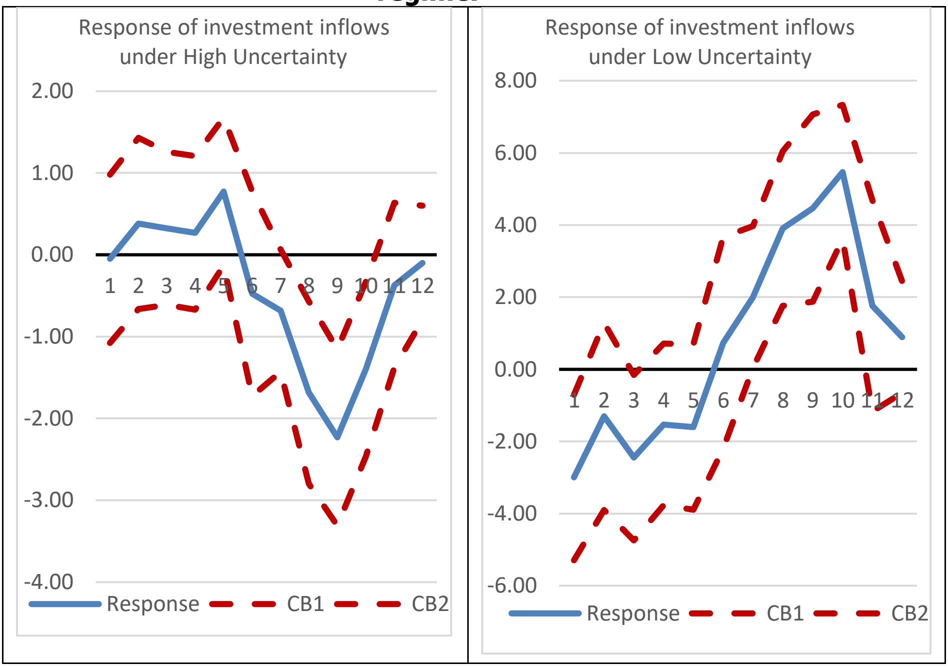


Notes: The bold blue lines show the impulse responses (with standard error bands) of exports to monetary tightening under high uncertainty (left) and low uncertainty (right) regimes. The lag criterion used is AIC. Newey-West robust standard errors are used in the estimation.

On the other hand, when it comes to exports (Figure 8), while the response of exports under high uncertainty is ambiguous, a low uncertainty regime definitely enhances exports even after monetary tightening. This shows that the currency appreciation is offset by increasing competitive prices; more investments create further avenues for export-oriented countries, and the effect could turn positive.

To substantiate the above findings, the final analysis looks at how total investment inflows are affected by uncertainty. Figure 10 examines the asymmetric response of total investment inflows to monetary tightening. Under high uncertainty (left), there is less evidence for investment inflow, and even inflow reduces as interest rate increases. The low uncertainty regime makes investment inflows more responsive to a rise in interest rates, further providing evidence for strengthening currency and price stability.

Figure 10: Asymmetric Response of Total Investment Inflows to Monetary Policy Shock under high and low uncertainty regime.



Notes: The bold blue lines show the impulse responses (with standard error bands) of investment inflows to monetary tightening under high uncertainty (left) and low uncertainty (right) regimes. The lag criterion used is AIC. Newey-West robust standard errors are used in the estimation.

CONCLUSION AND POLICY IMPLICATIONS

Effective monetary policy transmission is the crux of a well-stabilized monetary system in a country. While there are many aspects which could amplify the effects of this transmission, the presence of Monetary Policy Uncertainty has been widely recognized as unfavourable for the system. The study attempted to capture the perceived MPU for India and examined its wider implications for the macroeconomy. I constructed a newspaper-based perceived MPU index for India between 2010 and 2022 to capture the changing uncertainty in the economy whenever monetary policy stance changes. The Index is correlated to the sentiment aspect of monetary policy communication, where positive tone/sentiment in policy communication is negatively related to episodes of heightened uncertainty. Time-scale decomposition of MPU spillovers using Wavelet analysis showed that MPU affects the financial markets significantly in the slowest moving aspects of time, underscoring the impact of MPU on business cycle movements. Finally, using state-dependent local projection, I looked at the diverging effects of monetary policy transmission to the real economy across various uncertain states. The results proved that a state of low uncertainty is conducive for effective monetary policy transmission, or a state of high uncertainty annihilates effective transmission. The study has wider policy implications for the Central Bank. The project contributes to the nascent literature on documenting the impact of MPU on policy transmission. The results suggest the need to consider the level of prevailing uncertainty while making key policy decisions. As effective communication can counter the ill effects of policy uncertainty, it is imperative for Central Bankers to guide the markets through forward guidance, thereby managing long-run expectations in the market.

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APPENDIX

Appendix A: Dictionary used in the measure of MPU_BBD

Condition	Words
Condition 1: Related to Uncertainty	Uncertainty, Uncertain, Uncertainties
Condition 2: Related to Economy	Economy, Economic
Condition 3: Related to Policy	"Regulation" OR "Deficit" OR "Legislation" OR RBI OR "Reserve Bank of India" OR Lawmakers OR "Economic Advisor" OR "PM Office" OR "PMO" OR "PMEAC" OR "Lok Sabha" OR Tax OR "Excise Duties" OR Reform OR "Fiscal Policy" OR "Monetary Policy" OR "Central Bank" OR Parliament OR "Finance Ministry" OR Policymakers OR "Finance Minister" OR "NITI Aayog" OR "Prime Minister's Office" OR Taxes OR Taxation OR "Customs Duties" OR “India”
Condition 4: Categorical terms representing monetary policy	"RBI" OR "Reserve Bank of India" OR “Reserve Bank” OR “Central Bank” OR "Open Market Operations" OR “OMO” OR "Open Market Operation" OR "Quantitative Easing" OR “Asset Purchase Programme” OR “APP” OR “Government Securities Acquisition Programme” OR “G-SAP” OR “G-Sec Acquisition Programme” OR “Long Term Repo Operations” OR “LTRO” OR “Targeted Long Term Repo Operations” OR “TLTRO” OR “Forward Guidance” OR “Monetary Policy” OR “Liquidity” OR “Interest rates” OR “Interest rate” OR “Repo rate” OR “Overnight lending rate” OR “Weighted Average Call Money Rate” OR “WACR” OR “Call rate” OR “Call Money Rate” OR “Subbarao” OR “Rajan” OR “Patel” OR “Das” OR “RBI Governor” OR “Central bank Governor” OR “RBI Chief” OR “Lender of Last Resort” OR “Discount, window” OR “Liquidity Adjustment Facility” OR “LAF” OR “LAF Corridor” OR “The Fed” OR “Federal Reserve” OR “Monetary Policy Committee” OR “MPC”
Additional terms related to monetary policy objective	“Price Level” OR “Inflation” OR “CPI” OR “WPI” OR “Consumer Price Index” OR “Wholesale Price Index” OR “GDP Deflator”

Appendix B: Calculation of MPU using BBD (2016) methodology

- Newspapers analyzed: Economic Times (Including Online), Times of India (Including Online), The Mint, Financial Express, Hindustan Times, Indian Express.
- Period of Analysis- 2012 January to 2022 December
- Let X_{it} be the raw count of articles flagged, and Y_{it} be the total number of articles in newspaper I in month t.
- Step 1: Calculated the Scaled variable S_{it}
  - $S_{it} = \frac{X_{it}}{Y_{it}}$
- Calculate the standard deviation σ_i for each i for the entire time period
- Divide S_{it} with the σ_i to generate the standardized series Z_{it}
- Calculate the average values across i for each time period (N_t)
- Calculate the average of N_t, which is M
- $MPU_t = N_t * \frac{100}{M}$

Figure A1: Trends in Monetary Policy Uncertainty Index

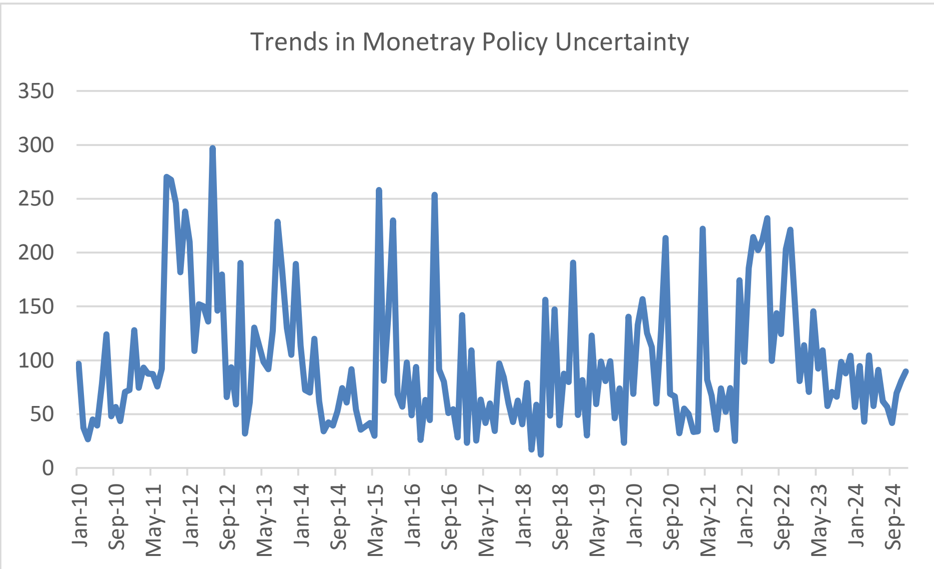

Figure A2: Sentiment score from MPC minutes

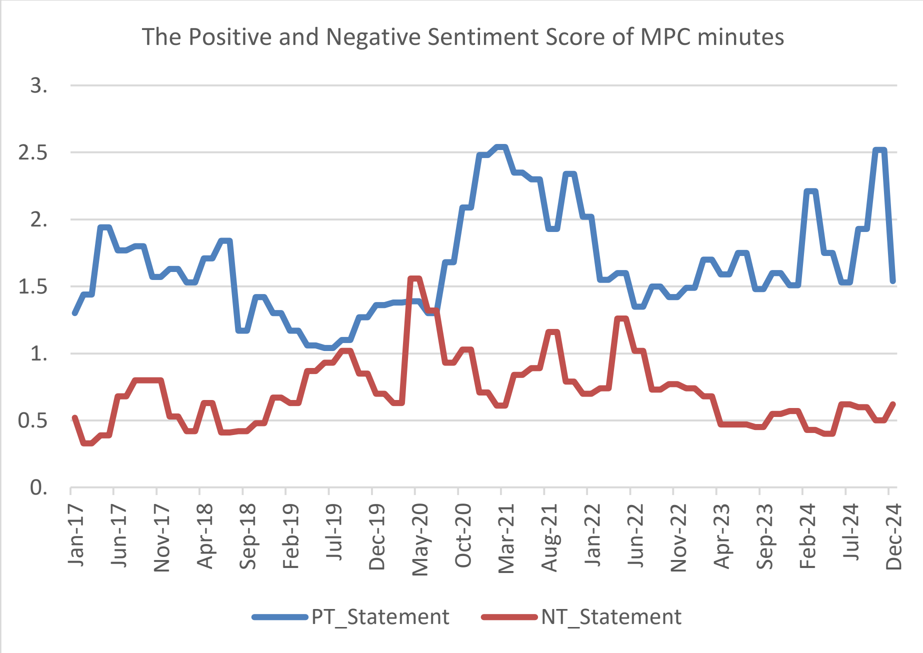

Table A1: Return spillover index from MPU (Unstandardized) to financial markets

Return Spillover Index - From MPU to Indian financial markets					
Scale	**Equity**	**Bond**	**Exchange Rate**	**Inflation**	**IIP**
Original Series	6.24	13.58	1.21	5.61	2.71
D1 (2 - 4 months)	6.12	18.72	2.57	6.43	3.97
D2 (4 - 8 months)	1.73	3.65	2.83	2.21	8.27
D3 (8 - 16 months)	10.52	5.77	2.98	2.62	2.13
D4 (16 - 32 months)	16.24	20.83	16.10	13.66	8.20
D5 (32 - 64 months)	13.97	10.10	4.44	9.88	13.83

Appendix C: Diebold-Yilmaz spillover index calculation

I follow Diebold and Yilmaz (2009, 2012) to measure the spillovers from MPU to the financial markets in India. We begin with a covariance stationary VAR (p) model specified as

$$y_t = \sum_{i=1}^{p} \emptyset_i y_{t-i} + \varepsilon_t \tag{1}$$

where y_t is the vector of endogenous variables, specifically the vector of returns or volatilities of variables in our study. $\emptyset_i$ is the N x N matrix of parameters to be estimated and $\varepsilon_t \sim i.i.d\ (0, \Sigma)$ is the vector of identically and independently distributed errors.

The infinite-order moving average form of Equation (1) can be written as

$$y_t = \sum_{j=0}^{\infty} \theta_j + \varepsilon_{t-i} \tag{2}$$

Where θ_j is the N x N moving average coefficient matrices and is derived as;

$$\theta_j = \sum_{t=1}^{p} \theta_{j-t} \emptyset_t \tag{3}$$

The next step is to decompose the forecast error variance attributable to different shocks. Here, we specifically look at the shocks generated from the MPU on the equity, bond and forex markets in India and establish a H-step ahead forecast. The generalized VAR approach following Diebold & Yilmaz (2012) allows to perform forecast error variance decompositions that are invariant to variable ordering and are as follows;

$$\theta_{ij}^{g}(H) = \frac{\sigma_{ii}^{-1} \sum_{h=0}^{H-1} (e_i' \theta_h \sum e_j)^2}{\sum_{h=0}^{H-1} (e_i' \theta_h \sum \theta_h' e_i)} \tag{4}$$

where Σ is the variance matrix for ε_t, σ_{ii} is the standard deviation of ε_{it}, and e_i is the selection vector with the i^{th} element 1 and zero otherwise.

I further use a normalization technique to redefine the variance decomposition, as the shocks are not orthogonalized in the generalized VAR and hence the sum of the contributions to the variance of the forecast error of a specific variable is not equal to one. The variance decomposition is thus represented as

$$\tilde{\theta}_{ij}^{g}(H) = \frac{\theta_{ij}^{g}(H)}{\sum_{j=1}^{n} \theta_{ij}^{g}(H)} \tag{5}$$

The normalization results in

$$\sum_{j=1}^{n} \tilde{\theta}_{ij}^{g}(H) = 1 \; and \; \frac{\sum_{i=1}^{n} \sum_{j=1, j\neq 1}^{n} \tilde{\theta}_{ij}^{g}(H)}{n} * 100$$

The total spillover index is defined as

$$S^{g}(H) = \frac{\sum_{i=1}^{n} \sum_{j=1, j\neq i}^{n} \tilde{\theta}_{ij}^{g}(H)}{\sum_{i=1}^{n} \sum_{j=1}^{n} \tilde{\theta}_{ij}^{g}(H)} x\ 100 = \frac{\sum_{i=1}^{n} \sum_{j=1, j\neq i}^{n} \tilde{\theta}_{ij}^{g}(H)}{n} * 100 \tag{6}$$

From the total spillover index, we can generate the directional spillover indices indicating the directional spillovers transmitted from variable i to all other variables j and the counterpart, the directional spillovers received by variable i from all the other variables j. However, in my analysis, we are only looking at the directional spillovers from MPU to all other variables and not the spillovers from the rest of the variables to MPU. Hence, the total directional spillovers are represented as

$$S_{.i}^{g}(H) = \frac{\sum_{j=1, j\neq i}^{n} \tilde{\theta}_{ji}^{g}(H)}{\sum_{j=1}^{n} \tilde{\theta}_{ji}^{g}(H)} x100 \tag{7}$$

where $S_{.i}^{g}(H)$ represents the directional spill overs transmitted from variable i to all other variables j.

To identify the spillover from MPU to each of the three Indian financial markets (variable i to each variable j), I further calculate the pairwise spillover.

$$\theta_{ji}^{g} = \frac{\tilde{\theta}_{ji}^{g}(H)}{\sum_{k=1}^{n} \tilde{\theta}_{ik}^{g}(H)} x100 \tag{8}$$

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* Working Paper 296/2026
Women Director Networks and Corporate Social Responsibility of Indian firms
Kavitha Nambiar and Ekta Selarka

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