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[Abstract]

We study the impact of monetary policy announcements on stock returns in India using an event study (ES) and "identification through heteroscedasticity" (IH) methodology with daily data over the 10-year period 2004-2014.This relatively recent IH technique controls for possible feedback relationships between asset prices and monetary policy changes.While the impact is in the expected direction *i.e.*, monetary tightening leads to a decline in stock returns, the results from IH are statistically insignificant, which is also confirmed by the ES approach. However, unanticipated policy announcements seem to have weakly significant impact on the stock index, especially banking stocks. Robustness checks substantiate that policy announcements has little impact on the Indian stock market, unlike several advanced and some emerging economies. Factors such as (a) the dominance of the banking channel; (b) dominance of foreign institutional investors; and (c) relative ineffectiveness of the asset price channel in monetary transmissioncould have contributed to this non-confirmative result.

Keywords: India, Stock Market, Monetary Policy Announcements, Event Study, Identification through Heteroscedasticity

JEL Classification: E44, E52,E58, G14

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Do Monetary Policy Announcements in India have any impact on the domestic Stock Market?

1. Introduction

Among various policies that are regularly announced in the national economic landscape, changes in monetary policy are perhaps most widely deliberated upon and discussed. Any perceptible shift in monetary policy stance usually necessitates a number of discrete changes in key policy rates of small magnitude. Premised on the rational behavior of the stock market, movement in stock prices are deemed to encapsulate all the "news and noise" emanating from policy announcements, release of macroeconomic data and geo-political developments.[1]On the other hand, if one believesthat stock market behavior exhibits irrational exuberance, then there is no guarantee that stock price movements reflect all such information.

Even if torn between the rational behavior of the market and a possible streak of irrationality, financial analysts often tend to emphasize the role of monetary policy in explaining stock price movements,given the more frequent nature of such announcements. Barring the hype associated with policy meetings,[2] it is useful to examine what would be the temporal sequence of the impact of policy changes on the stock market in the context of an emerging economy like India.

From an eclectic sense, monetary policy, as an arm of economic stabilization policy, seeks to influence the course of key macroeconomic indicators *viz*., output, inflation and unemployment. Unlike fiscal policy, however, the impact of monetary policy on these variables is largely indirect. The propagation of monetary policy shocks work through financial markets in influencing real economic activity. In this regard, theinitial impact of monetary policy is expected to be on short term interest rates which *inter alia*influencetrading volume and asset

[1]Berg (2012) notes that technology shocks account for more than 22% of the movements in stock prices in the euro area while monetary shocks contribute less than 5%. Stock prices are also found to respond significantly to technology news shocks over a period.

[2] Media hype on stock market's expectation from monetary policy gains fever pitch on days preceding policy announcements. For example, in reporting the rate cut by the Reserve Bank of India (RBI), a headline in the Economic Times on March 19, 2013 observed: "RBI's mid-quarter monetary policy matches rate cut expectation but market crash".

pricesbydirectly affecting systemic liquidity. Moreover,policy signalsalso trigger market expectations about evolving asset price dynamics.

Specifically, how does monetary policy affect stock prices? Several channels have been emphasized in the literature. First, an increase in interest rate would lower the present value of future earning flows and depress equity markets *via* Tobin's q - the market value of a firm's assets relative to their replacement costs (Tobin, 1978; Ehrmann and Fratzscher, 2004). Second, higher real interest rates make investments other than stocks, such as bonds, more attractivewhich would then necessitate an increase inthe required return on stocks thereby reducing its price. Third, as stocks are viewed as relatively risky investments, investors generally demand anequity premium for holding stocks. Therefore,the expected yield on stocks *ceteris paribus* can rise only through a decline in the current stock price(Bernanke, 2003).Cumulatively, the price and return on stocks significantly affect individual consumption and investment behavior through the wealth effectwhich, at a macro level, have an impacton overall economic activity(Bernanke and Kuttner, 2005).

There are, however, two major empirical difficulties in delineatingthe relationship between stock prices and monetary policy in the empirical literature. First, the simultaneity or endogeneity problem arise from the joint determination of monetary policy and stock prices, as the former can instantaneously react to changes in the latter. Second, the problem of omitted variable could occur as stock returns and monetary policy may jointly react to some other variables, including economic news, which would cause a bias even if there is no endogeneity problem. Together, these two factors could complicate the identification of the responsiveness of stock prices to monetary policy (Rigobon and Sack, 2004).

In the empirical literature, there are three broad strands in discerning the stock market - monetary policy relationship. First, the relationship is studied in a vector autoregression (VAR) framework comprising some monetary policy indicator, stock prices and related variables. Second, event-based studies look for a temporal pattern of stock price movements to monetary policy announcements. Third, the response of stock prices to policy announcements is explained in terms of the heteroscedasticity of monetary policy shocks in the recent literature (Rigobon and Sack, 2004).

This paper uses the event study (ES) and identification through heteroscedasticity (IH) approach to study the impact of monetary policy announcements on stock returns in the Indian context. While there are relatively few studies which have analyzed the interaction between monetary policy announcementsand stock price movements in India, nearly all have addressed this issue in a VAR framework with few adopting an ES approach.

Besides the paucity of research, the Indian case-study is also compelling for several reasons. First, India is the third largest economy in terms of purchasing power parity and was one of the fastest growing economies in the world with an average real GDP growth of 7.3% over the 10 year period 2004-14. Second, it has a well-regulated financial system which emerged relatively unscathed from the global financial crisis. Third, although a primarily bank-based system, India has developed a vibrant stock market, through significant institutional and technological reforms while developing best practices in corporate governance, in order to diversify resource mobilization for the industrial sector and corporate entities. Illustratively, average daily turnover in the stock market forboth the Bombay Stock Exchange (BSE) and the National Stock Exchange (NSE) together stood at Rs. 133 billion(USD 2.2 bn) while market capitalization was placed at Rs.74,153 billion (USD 1233.8 bn) for BSE and Rs.72,777billion (USD 1210.9 bn) for NSE as on March 2014. Finally, India is making a transition since 1991 from a largely regulated to a market economy with greater emphasis on a market-oriented approach to monetary policy formulation while developing various segments of the financial market. As a result, the transmission mechanism of monetary policy is still evolving which merits greater research attention. Based on these considerations, we take India as a case-study in exploring the linkages between monetary policy announcements and the stock market.

Rest of the paper is structured in the following manner. Section 2 provides a brief review of the empirical literature on the stock market-monetary policy relationship. Section 3 presents the data and the methodology of the empirical exercise. Results and its policy implicationsare discussed in Section 4. The concluding observations are set out in Section 5.

2. Related Empirical Literature

The interactions between monetary policy and the stock market has been a vastly proliferating field of empirical research pursued along alternative methodological grounds, as mentioned earlier. Early research based on VAR methodology (Jensen *et al*., 1996; Thorbecke,

1997; Jensen and Mercer, 2002) found that monetary easing (tightening) exerted a large and statistically significant positive (negative) effect on stock returns in advanced economies. In a generalized VAR framework where the impulse responses are invariant to the ordering of variables, Ewing (2001) found that shocks to monetary policy is very significant in explaining the variance decomposition of stock returns. On the contrary, Laopodis (2006) found inconclusive evidence while examining the dynamic linkages between the federal funds rate and the S&P500 index for 1970-2003; dividing the period into three monetary policy regimes. For the 1990s period in particular, the study found no consistent relationship between actions taken by the Fed and the response of the stock market.

Among studies based on the event-study approach, Bernanke &Kuttner (2005) reported a stock price multiplier for unexpected changes in monetary policy of about 4.7 for the US economy (1989-2002) noting that although it is not negligible in magnitude, such changes account for a small portion of the overall variability of the stock market. To ensure that the results did not depend on a few unusual observations or "outliers," the days with the most extreme or unusual market movements were omitted from the sample which led to a smaller estimate of 2.6. These results were broadly consistent with the earlier VAR-based studies which, however, did not differentiate between anticipated and unanticipated policy changes. Bernanke &Kuttner, however, noted that monetary policy, although important, contributes very little in day-to-day stock price fluctuations. In the context of Thailand, Vithessonthi*et al*. (2012) examined the effect of monetary policy on stock returns for the period 2003-2009 using market and firm level data. Based on market level data,while the expected change in the repurchase rate had a negative effect on stock returns, unexpected changes were found to have no effect contrary to Bernanke &Kuttner.

In examining the potential impact of unanticipated monetary policy shocks on the volatility of stock returns, Bomfim (2003) found evidence of “pre-announcement” effects only when the majority of policy decisions were taken at the FOMC's regularly scheduled meetings and inferred that such decisions tend to boost volatility. Gospidonov and Jamali (2015) reports a significant response of stock returns and volatility to monetary policy shocks in a bivariate VAR-GARCH model which is attributed to market participants’ uncertainty regarding the monetary policy stance.

Using a novel approach of identification *via*heteroscedasticity,[3]Rigobon and Sack (2004) found that the S&P index declinedby 1.7% as a result of unanticipated increase of 25-basis point in the short-term interest rate derived from the Eurodollar futures market. However, other studies using the same methodology have shown mixed results. While studies on Europe, United Kingdom and Turkey found statistically significant impact of short-term interest rates on stock markets (Kholodilin*et al*., 2009; Corolla, 2006; and Duran *et al*.,2012, respectively), those on Hungary, Germany and Poland reported contrary findings (Rezessy, 2005; Corolla, 2006; and Serwa, 2006; respectively). Thus, there is no unanimity on the results within the IH approach.

In the Indian context, few studies focus exclusively on the relationship between monetary policy and stock markets. Sasidharan (2009) examined stock market behavior using non-parametric methods on days preceding and succeeding the announcement of monetary policy and rejected any systematic difference in the pattern of returns between expansionary and contractionary policy and on days corresponding to policy announcements. Based on an event-study approach, Agarwal (2007) examined the impact of monetary policy announcements on cross-sectional daily returns of NSE'sNIFTYand inferred that the market is slow in incorporating the content of policy announcements; which is indicative of weak-form efficiency of the Indian stock market.

In the context of assessing monetary policy transmission on a wider spectrum of financial markets in India, Bhattacharyya and Sensarma (2008) found negligible impact of monetary policy changes on the stock market in a structural VAR framework based on monthly data over the period 1996-2006. Using a similar modelling approach but based on daily data for a more recent period 2005-2012, Ray and Prabu (2013) reiterates the limited impact of policy rates on the stock market. In this paper, we use the framework of Rigobon and Sack (2004) in gauging the impact of monetary policy announcements on the stock market.

[3]This approach allows for identification of the parameter of interest under a weaker set of assumptions than required under the event-study approach common in the literature. The event-study approach turns out to be an extreme case of the heteroscedasticity-based estimator. Thus, the latter estimator can be used to test whether the stronger assumptions under the event-study approach are valid, and, correspondingly, the extent to which the event-study estimates are biased (Rigobon, 2003).

3. Data and Methodology

3.1 *Data*

Before proceeding with the empirical exercise, a few caveats on the variables are in order. First, while most studies on the US use federal funds futures datafor extracting the unanticipated component of policy announcements, there is no similar information available for India.[4]Given this constraint, we use the91-day Treasury bill rate as a proxy for capturing the surprise effect of monetary policy actions (Duran *et.al.,* 2012; Rezessy,2005). Anticipated changes in monetary policy actions are already factored inby the market in Treasury bill yields and any change after the policy announcement reflects the unanticipated component of policy.[5]Moreover, the 91-day Treasury bill rate is most liquid atthe short end of the money market and are also least influenced by the uncertainty regarding the timing of policy decisions.[6] While another alternative could have been the inter-bank call money rate, it is largelyinfluenced by the daily liquidity flows under the liquidity adjustment facility (LAF) and may not fully reflect market expectations on thefuture pathof interest rates.Second, we have taken two key benchmark indicesrepresenting the stock market*viz*., (a) NSE's CNX Nifty; and (b) BSE Sensex. Moreover, in view of the fact that India has primarily a bank-based financial system, we have also added a sectoral index for banking stocks –Bankex for our empirical exercise.[7]

We have considered the 10 year period from April 2004to March 2014.[8]Over this period, the frequency of monetary policy announcements have changed significantly. What was essentially a half-yearly policy shifted to a quarterly schedule from 2005; furthermore, since 2011, mid-quarter policy announcements were made a regular feature, making the number of

[4] Some of the ticker services do a poll of select market analysts about the anticipated course of monetary policy actions (*viz*., a change in repo rate or cash reserve ratio). However, such polls have an inherent bias as it is based primarily on bankers' opinion and are derived from very small sample size (often on a self-selection basis).

[5]An unchanged policy can also represent a surprise to the market which would then get reflected in yields(Rezessy, 2005).

[6]In general, monetary policy announcements are made at 11 AM while the stock market closes at 3.30 PM. Unscheduled policy announcements were made after closure of market hours during the sample period.

[7] See Shah *et al*. (2008) for a discussion on Indian stock markets and these indices.

[8]The Indian financial year is April-March.

plannedpolicy dates eight in a year. There were, however, instances of intermittent policy announcements between scheduled meetings, particularly during the peak of the global financial crisis and subsequent to the "taper tantrum" episodeof May 2013. During the sampleperiod, there were 72 policy announcementsof which 20 were made on non-scheduled policy dates (Table 1).[9] These days are considered as policy days while the previous market day is considered as a non-policy day.

Table 1: Monetary Policy Announcements
(April 2004 – March 2014)

Policy Dates	Observations	Direction	Observations	Timing	Observations
Scheduled	52	Tightening	36	Within market hours	58
Non-scheduled	20	Easing	18	After market hours	14
		No Change	18		
Total	**72**		**72**		**72**

3.2 *Event Study (ES) and Identification through Heteroscedasticity (IH)*[10]

Since monetary policy changes affect the stock market and *vice versa*, followingRigobon and Sack (2004), the relationship can be described by two simultaneous equations

$$\Delta i_t = \beta \Delta s_t + \gamma z_t + \varepsilon_t (1)$$

$$\Delta s_t = \alpha \Delta i_t + z_t + \eta_t (2)$$

Here, Equation (1) is the monetary policy reaction function whereby the changes in the monetary policy or short-term interest rate (i_t) respond to the stock market index and a set of variables z, where z can be observed or omitted variables. Equation 2 is the asset price equation and models the variationin the stock market indices as a function of changes in the short-term interest rate and the variable z. The shock to monetary policy is denoted by (ε_t) and the shock to the stock market is denoted by (η_t).

[9]Non-scheduled policy announcements nearly always take financial markets by surprise and are often followed by dramatic swings in asset prices.

[10]For the detailed methodology, please see Rigobon and Sack (2004).

3.2.1 *Event Study*

Given the simultaneity problem, the estimation of equation 2 with OLS will be biased and the mean of estimated parameters would be given by

$$E(\alpha^*) = \alpha + (1 - \alpha\beta)\frac{\beta\sigma_\eta + (\beta + \gamma)\sigma_z}{\sigma_\varepsilon + \beta^2\sigma_\eta + (\beta + \gamma)^2\sigma_z} (3)$$

In order to avoid the simultaneity problem, the event study method estimates equation 2 only for days when there was a monetary policy decision. In the literature, it is assumed that within the policy day, the effects of the asset price shock and the common shocks (simultaneity and omitted variables problem) on the monetary policy decision are negligible. Since India does not have anovernight ratefutures market, we are not able to make any distinction between expected and unexpected changes in monetary policy rates as detailed above, unlike the literature on advanced countries (*eg*.Rigobon and Sack, 2004; Bernanke and Kuttner, 2005). Hence, our method measure the impact of monetary policy changes (both expected and unexpected) on the stock market only using equation 2 on the sample consisting of policy days (P). The desired coefficient is given by

$$\alpha_{es}^* = (\Delta i_P' \quad \Delta i_P)^{-1}(\Delta i_P' \quad \Delta s_P) (4)$$

3.2.2 *Identification through Heteroscedasticity*

The IH methodology requires increase in variance on policy days when compared with non-policy days unlike the ES method, which imposes strong assumptions. In this approach, we divide our period into two sub samples *i.e*., policy days (P) and non-policy days (NP). Policy days are those when decisions are announced by the RBI while non-policy day refers to the previous day. The only assumption required is that the variance of monetary policy shock increase from non-policy days to policy days, while there is no systematic change in the variances of other shocks from non-policy days to policy days i.e., $\sigma_\epsilon^P > \sigma_\epsilon^{NP}$; $\sigma_\eta^P = \sigma_\eta^{NP}$ and $\sigma_z^P = \sigma_z^{NP}$ and that the parameters of the equations (1) and (2) are stable across the two subsamples (Rigobon and Sack, 2004). The reduced form equations of equation (1) and (2) is given by

$$\Delta i_t = \frac{[(\beta + \gamma)z_t + \beta\eta_t + \varepsilon_t]}{(1 - \alpha\beta)} (1a)$$

$$\Delta i_t = \frac{[(1+\alpha\gamma)z_t + \eta_t + \alpha\varepsilon_t]}{(1-\alpha\beta)} (2a)$$

The difference in the covariance matrix between the policy day (P) and the non-policy days (NP) then can be shown as:

$$\Delta\Omega = \Omega_P - \Omega_{NP} = \lambda\begin{bmatrix}1 & \alpha \\ \alpha & \alpha^2\end{bmatrix}; where, \lambda = \frac{\sigma_\varepsilon^P - \sigma_\varepsilon^{NP}}{(1-\alpha\beta)^2} (5)$$

From the above equation (5), we can estimate the desired parameter α using instrumental variables (IV) approach as well as by the generalized-method-of-moments (GMM) method. In this study, we use both the approaches to estimate the impact of monetary policy announcements on stock prices. Since ES method has strong assumptions such as variance of the monetary policy shock to be infinitely large, we test the validity of ES estimates using the Hausmanspecification test.

3.2.3*IH using IV approach*

First, we group the changes in the two variables in the two subsamples *i.e.*, policy days (P) and non-policy days (NP) into one vector with dimension of 2Tx1, where T is the number of policy days in the subsample. Since the number of observation is same for policy days and non-policy days, by combining them, the total observation becomes 2T. The new vectors Δi and Δs are given by

$$\Delta i \equiv [\Delta i_P^{'} \quad \Delta i_{NP}^{'}]' (6)$$

$$\Delta s \equiv [\Delta s_P^{'} \quad \Delta s_{NP}^{'}]' (7)$$

The two instruments for estimating the IV approach (Rigobon and Sack 2004)are

$$w_i \equiv [\Delta i_P' \quad -\Delta i_{NP}']' (8)$$

$$w_s \equiv [\Delta s_P^{'} \quad -\Delta s_{NP}^{'}]' (9)$$

Here, the instrumental variable $w_i$is correlated with the dependent variable Δi but is neither correlated with $z_t$norη_t. It is correlated with Δi because the greater variance in sub-sample P implies the positive correlation between ($\Delta i\ '_P$) and ($\Delta i\ '_P$) of $w_i$whichmore than outweighs the negative correlation between ($\Delta i\ '_{NP}$) and ($\Delta i\ '_{NP}$) of w_i(Rigobon and Sack, 2004).

It is neither correlated with $z_t$nor η_t because the positive and negative correlation cancels each other out (Foley-Fisher *et.al.,* 2013).

Given the two instruments, α which measures the impact of monetary policy on the stock market can be estimated by either of the following equations:

$$\alpha_1^{*i} = (w_i^{'} \quad \Delta i)^{-1}(w_i^{'} \quad \Delta s)(10) \qquad \text{or}$$

$$\alpha_2^{*s} = (w_s^{'} \quad \Delta i)^{-1} \ (w_s^{'} \quad \Delta s) \qquad (11)$$

3.2.4*IH using GMM*

Equation (5) can also be estimated using the GMM technique which gives an efficient estimate as it considers all the three moment conditions simultaneously.Rigobon and Sack (2004) showed that the estimate can be obtained by minimizing the following loss function:

$$[\alpha_{GMM}^{*}, \quad \lambda^{*}] = \arg\min \left[\sum_{t-1}^{T} b_t\right]^{'} W_T \left[\sum_{t-1}^{T} b_t\right] (12)$$

The two-step GMM model is estimated first by using the identity weighting matrix and, in the second step,by the optimal weighting matrix W_T, which is the inverse of the estimated covariance matrix of the moment conditions

4. Empirical Results and Implications

4.1.1 *Both scheduled and non-scheduled policy announcements*

We estimated the impact of policy announcementson the stock market indices through equation 10 and equation 12. Table 2 reports the preconditions for applying the IH method, *viz*., volatility of the policy rate should be greater on policy dates than that on non-policy dates. Moreover, the correlation between the policy rate and the stock market have the expected sign (negative) on policy datesfor all three indices while it is positive for the Sensex and Nifty on non-policy dates. The positive correlation between stock indices and the policy rate for non-policy dates could be attributed to other unidentified shocks.

Table 2: Variance, Covariance and Correlation on Policy and Non-Policy Dates						
	Standard deviation of asset prices		Covariance/ Correlation with policy rate			
	Non-policy dates	Policy dates	Non policy dates		Policy dates	
			Covariance	Correlation	Covariance	Correlation
Policy rate (91 day Tbill Rate)	9.96	25.78	-	-	-	-
Sensex	2.83	2.49	3.06	0.11	-1.66	-0.03
Nifty	2.86	2.52	2.58	0.09	-1.06	-0.02
Bankex	3.22	3.47	-0.16	-0.01	-7.72	-0.09

We also use Levene's (1960) test to further confirm the assumption of IH method(Table 3). The test shows that the variance of monetary policy changes increases significantly from non-policy dates to policy dates,while the variance of stock market indices does not change significantly. This shows that the effect of the increase invariance in equation 2 only weakly affects the variance of policy rates(Foley-Fisher *et.al.,* 2013).

Table 3:Levene Test of Equal Variance		
	Test Statistic based on Mean	P-value
Policy rate (91 day Tbill Rate)	4.218	0.042
Sensex	0.004	0.952
Nifty	0.029	0.865
Bankex	0.503	0.479

Note**:** Results based on median and 10 per cent trimmed mean for policy rate was significant at 0.055 per cent and other variables were insignificant.

Table 4 reports the results of the impact of monetary policy on stock market from two methods, *viz*., ESand IH.[11]The results indicate that monetary policy have a negative impact on allthree stock index but are statisticallyinsignificant. This finding is in line with those for Germany, Hungary and Poland cited above, as also for the US based on an ESapproach (Rolley and Sellon, 1998; Bomfim and Reinhart, 2000). The IH method using GMM and IV approach provides consistently higher impact than the ES method. Specifically, the bankex index shows the higher impactof monetary policy changes as banks need to manage their balance sheet

[11]The model has been estimated using ivreg2 of Stata (Baum *et al*, 2007).

mismatches between interest sensitive assets and liabilities (Kim *et.al.,* 2013). Furthermore, the over-identification test statistic of GMM estimate indicates the validity of the instruments used.[12] However, the Hausman test statisticsfails to reject the null hypothesis that policy rate can be treated as exogenous thus supporting ES estimates[13]rather than IH method.

Table 4: Impact of Monetary Policy on Stock Prices: IV versus ES and GMM Results

	IV coefficients	ES coefficients	Test of ES versus IV#	GMM coefficients	Over Identification Test (GMM)*	Test of GMM versus ES
Sensex	-0.008 (0.59)	-0.002 (0.83)	0.324	-0.008 (0.64)	0.665	0.469
Nifty	-0.006 (0.68)	-0.002 (0.89)	0.419	-0.006 (0.72)	0.677	0.555
Bankex	-0.014 (0.47)	-0.012 (0.46)	0.826	-0.013 (0.54)	0.741	0.878

Note: #: Hausman Test for validity of the underlying assumptions of the event study (ES) estimator tested against instrumental variable (IV) approach. The standard p-values are given in this column.
* : P-value of Hansen's J chi square value is given in this column.

4.1.2*Non-scheduled announcements*

As discussed in the brief survey of literature, most studies find significant impact for the unanticipated component of monetary policy. In the Indian context, given data limitations, one way of testing this proposition is to examine the effect of non-scheduled policy announcements on the stock indices. Markets generally react to theunexpected component of policy announcements, given that asset prices only react to new information consistent with the efficient markets hypothesis (Kuttner, 2001).In order to test this proposition, we re-estimated the impact on stock market indicesbased on policy surprises during the sample period (Table 1).

Table 5confirms the preconditions for applying the IH method. Moreover, the correlation between the policy rate and the stock market have the expected sign (negative) on policy datesfor all three indices while they are all positive on non-policy dates. As mentioned earlier, the positive correlation on non-policy dates is due to other unidentified shocks.

[12]We also conduct Stock and Yogo's test (2005) and find evidence that our instruments are not weak.

[13]Event-study estimates of response of asset prices to monetary policy contain a significant bias although this bias is fairly small and the OLS approach tends to outperform in an expected squared error sense the heteroscedasticity-based estimator for both small and large sample sizes (Rosa, 2011).

Table 5: Variance, Covariance and Correlation on Unannounced Policy and Non-Policy Dates						
	Standard deviation of asset prices		Covariance/ Correlation with policy rate			
	Non-policy dates	Policy dates	Non policy dates		Policy dates	
			Covariance	Correlation	Covariance	Correlation
Policy rate (91 day T bill Rate)	12.25	22.65	-	-	-	-
Sensex	4.26	2.75	18.21	0.35	-11.46	-0.18
Nifty	4.14	2.63	17.62	0.35	-10.36	-0.17
Bankex	3.85	3.56	14.38	0.31	-23.48	-0.29

Table 6 reports the results of the impact of non-scheduled policy announcements on stock market from IHand ES. The results indicate that monetary policy have a negative, *albeit* statisticallyinsignificant impact, for ES and IH using IV method. The Hausman test statistic rejects the null hypothesis at 10% in favor of IH using IV method. In IH method using GMM, we find weakly significantimpact of unanticipated monetary policy announcement on the Sensex and Bankex.[14]As mentioned earlier, the impact on Bankex is higher than the Sensex which further corroborates the dominance of the banking channel in the monetary transmission mechanism. Furthermore, the over-identification test statistic of GMM estimate indicates the validity of the instruments used. However, theHausman test statistics of GMM versus ES was not found to be significant.

Table 6: Impact of Unannounced Monetary Policy on Stock Prices : IV versus ES and GMM Results						
	IV coefficients	ES coefficients	Test of ES versus IH #	GMM coefficients	Over Identification Test (GMM)*	Test of GMM versus ES
Sensex	-0.08 (0.19)	-0.022 (0.40)	0.054	-0.068* (0.09)	0.311	0.105
Nifty	-0.078 (0.20)	-0.020 (0.43)	0.055	-0.065 (0.12)	0.293	0.110
Bankex	-0.103 (0.11)	-0.046 (0.17)	0.074	-0.092* (0.08)	0.553	0.053
Note: #: Hausman Test for validity of the underlying assumptions of the event study (ES) estimator tested against instrumental variable (IV) approach. The standard p-values are given in this column. * : P-value of Hansen's J chi square value is given in this column.						

[14] Chun-Li (2014) finds stock returns responding significantly to surprise monetary policy shocks based on informative FOMC statements.

4.2 *Robustness*

4.2.1*Three day window*

As a robustness check, we also estimated the IH method using a three day data window.[15]In this window also, all the estimators show expected direction of impact*i.e*., increase in the short-term interest rates actually lead to a decline instock market indices, but arestatistically insignificant. As in the unanticipated policy announcements, the ES estimates in thethree day window shows significant impact on Bankex at 5% indicating that banking stocks are very sensitive to changes in monetary policy decisions (Table 7). The over-identification test of GMM also validates the instruments used in the estimation.

Table 7: Impact of Monetary Policy on Stock Prices: IV versus ES and GMM Results(3 day window)

	IV coefficients	ES coefficients	Test of ES versus IH #	GMM coefficients	Over Identification Test (GMM)*	Test of GMM versus ES
Sensex	-0.009 (0.32)	-0.006 (0.32)	0.343	-0.009 (0.38)	0.228	0.546
Nifty	-0.009 (0.38)	-0.006 (0.36)	0.403	-0.008 (0.43)	0.185	0.586
Bankex	-0.019 (0.13)	-0.018** (0.05)	0.873	-0.019 (0.19)	0.593	0.883

Note: #: Hausman Test for validity of the underlying assumptions of the event study (ES) estimator tested against instrumental variable (IV) approach. The standard p-values are given in this column.
* : P-value of Hansen's J chi square value is given in this column.

4.2.2*MIBOR*

We have already argued that in the absence of a reliable indicator of future expectation on monetary policy (absence of any futures market in the money market), we have taken the 91-day T-Bill rate. As an alternative to T-Bill rates, we use another benchmark rate for the money market. In particular, we have taken daily data on FIMMDA-NSE[16] Mumbai Inter-bank Offer Rate (MIBOR) for maturity of 3 months as in T-Bills. The MIBOR rates are based on data obtained by conducting a poll to get reference rates on offer prices from thirty market

[15]In our sample, however, there were three occasions when the policy rates have been changed twice within a span of two to three days. Therefore, we were not able to define policy date and non-policy date without the overlapping of dates. Hence, we have excluded these overlapping dates from our sample.

[16]Fixed Income Money Market and Derivatives Association of India – National Stock Exchange.

participants(both banks and primary dealers) and are, therefore, representative of market expectations.

We estimate the IH method using the data on MIBOR instead of T-Bills as the proxy for the policy rate (Table 8).As with T-Bills, the results indicate statisticallyinsignificant but negative impact on stock indices.The IH method using GMM and IV approach provides consistently higher estimated impact than the ES method. The Hausman test statisticshows that the ES estimates are preferable over IH method.

Table 8: Impact of Monetary Policy (MIBOR) on Stock Prices: IH versus ES and GMM Results

	IV coefficients	ES coefficients	Test of ES versus IH #	GMM coefficients	Over Identification Test (GMM)*	Test of GMM versus ES
Sensex	-0.036 (0.74)	-0.012 (0.48)	0.797	-0.035 (0.75)	0.654	0.821
Nifty	-0.011 (0.92)	-0.008 (0.65)	0.977	-0.015 (0.89)	0.678	0.957
Bankex	-0.027 (0.84)	-0.016 (0.49)	0.909	-0.027 (0.83)	0.726	0.910

Note: #: Hausman Test for validity of the underlying assumptions of the event study (ES) estimator tested against instrumental variable (IV) approach. The standard p-values are given in this column.
* : P-value of Hansen's J chi square value is given in this column.

Thus, most of the results tend to substantiate that domestic monetary policy have little announcement impact on Indian stock indices (similar to Agarwal, 2007), notwithstanding some evidence to the contrary forBankex.

4.3 *Implications*

How do we see the results? We have already indicated earlier that a number of studies reported an insignificant impact of monetary policy on stock markets. While our paper adds to this literature, we do find evidence of weakly significant impact of unexpected policy announcements particularly on banking stocks. We provide some conjectures on the interpretation of the results in the Indian context.

First, the small and medium enterprises (SMEs), which constitute the bulwark of the industrial sector, continue to rely solely on bank finance as they have limited access to the stock

market (Bhattacharyya and Sensarma, 2008). Although market capitalization has scaled dizzy heights in recent years, the stock market remains a platform of resource mobilization, mainly for AAA rated corporate entities. As a result, the Indian financial system primarily remains a bank-based system in which monetary policy impulses mainly works through the banking channel(RBI, 2007; Aleem, 2010). The higher and somewhat (weak) significantimpact of monetary policy on banking stocks (BANKEX) may be a pointer in this direction. As monetary policy decisions tend to affect the profitability of banks through balance sheet adjustments, valuation of banking stocks in the stock market provide an assessment of its impact.

Second, during the period of our study, the extent of uncertainty about Indianmacroeconomic fundamentals was rather low. This is notwithstanding the fact that India was affected by the global financial crisis through trade, finance and confidence channels. With an average growth of above 7% and an inflation of around 6%, the Indian economy showed remarkable resilience amidst the global meltdown. In such a relatively stable macro-environment, the extent of surprises on the policy front was few and far between. This could have led to the insignificance of the results.

Third, the Indian stock market is quite open and globalized despite a phased and calibrated move towards capital account convertibility. Foreign Portfolio Investors (FPIs) play a crucial role in stock price movements. Illustratively, around65% of the FPIs' ownership is concentrated in 71large and mid-cap MSCI India stocks. As a result, the impact of large FPI selling in equity markets could be sizable. More importantly, investment in Indian market may be more linked to FPIs' global portfolio diversification strategies which are governed by global monetary policy developments and liquidity conditions. In that sense, domestic monetary policy can have limited influence on FPIs' investment decisions in India.This further strengthens the common perception that while domestic monetary policy have a localized impact, stock market developments are more driven by global factors in an increasingly interconnected world.

Fourth, India has adopted a conservative approach to prudential regulation of banks which helped the banking sector escape the pitfalls of the global financial crisis. In particular, there are limits to banks' investment in the equity market.[17] Thus, commonality of players in the money and stock market may be limited. It is, therefore, likely that the interpretation of monetary

[17]Direct exposure in equities is restricted to 20% of net worth of a bank.

policy actions by the major players in the money market (*viz*., banks) and the major players in the stock markets (*viz*., FPIs and mutual funds) could be quite different.

Finally, the role of the stock market in capital formation in the country, both directly and indirectly, continues to be less significant. As a result, the impact of changes in stock prices on consumption and investment was found to be much smaller than in economies with market-based financial systems (Ludwig and Slok, 2004). The household sector holds a very small share of its savings in stocks; consequently, the wealth effect is limited. Illustratively, over the 10-year period 2004-14, the household sector had an average share of only 4.6% of its net financial savings in stocks and debentures. Singh (2012) finds that a 10% increase in real stock wealth raises consumption demand by a mere 0.3%, which is consistent with the fact that stock wealth have a relatively low share in the asset portfolio of households. Such wealth effect does not have a large and persistent effect on consumption demand since consumers do not perceive changes in stock wealth to be enduring.Consequently, the asset price channel of monetary transmission is weak in influencing spending and investment decisions in the economy (Aleem, 2010).

5. Concluding Observations

This paper tried to examine the impact of monetary policy announcements on stock indices in the Indian context. Unlike several studies, we find no statistically significant impact of monetary policy announcements on stock indices, although there is some evidence that policy surprises matter. The results, although somewhat non-confirmative, are not unprecedented in the literature. Ourfindings may be attributed to several factors *viz*, (i) dominance of the bank lending channel in monetary transmission; (ii) few policy surprises in a relatively stable macro-environment; (iii) limited influence of domestic monetary policy on FPIs; (iv) absence of commonality among players in stock and other financial market segments; and (v) the relative ineffectiveness of the asset-price channel of monetary transmission. Nevertheless, we add some caveats to our findings. With the overnight weighted average call money rate and subsequently the 14 day term repo rate being chosen as the explicit operating target of monetary policy in the revised operating procedure of monetary policy (RBI, 2014), we hope a futures term money market would evolve. Active trading of a futures index (similar to the Fed Funds Futures) would provide the mechanismto estimatethe unanticipated component of monetary policy shocks. Moreover, while it is entirely feasible that the impact of policy announcements on daily data is

not evident, it could have some impact on a smaller window of about 15-20 minutes immediately after the announcement. Pending the availability of such intensive high-frequency data, any assessment of the impact of monetary policy on financial market behavior would remainimperfectand, at best, partial.

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