Stock Market's Reaction to Monetary Policy Announcements in India

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Abstract

The paper examines stock market behaviour on days preceding and succeeding the announcement of a change in the monetary policy stance. Market's plausible reactions are tested using nonparametric statistics. The tests reveals that there is no systematic pattern in its reaction, neither towards the type of policy stance (expansionary or contractionary), nor during the days corresponding to the 'event'.

A financial market will be declared information efficient depending on the speed with which it incorporates information correctly in its prices. There are three qualifying words here. First, information: correct, relvant information as against noise and fad. Second, speed: the information should get incorporated immediately. Third, price: the information not only gets discounted in the prices, but valuation should be at the 'correct' price. Then generating excess returns from trends and patterns, or from any other publicised information is near impossibility. For arbitraguers are not in the market for nothing. And we have one too many of them in the market. This is the basis of efficient markets hypothesis (EMH) and this provides us with an elegant framework for testing a market's efficiency.

This paper examines the issue of semi-strong efficiency of the Indian stock market, with respect to monetary policy announcement.

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1 Monetary Policy and Equity Markets

Monetary policy is a major lever through which the short-term macro fine-tuning is made possible. It influences stock market in three ways. First, it directly effects trading in securities by affecting liquidity available for speculative activities. Second, it influence the expectations in the market through policy signalling. Third, it affects the present value of the future flow of earnings, and the earning flow itself, and hence influence equity prices. This can happen though the various channels of the monetary transmission mechanism (MTM), such as the credit market channel, interest channel or even the stock market channel – the latter, probably being an area which is relatively under-explored. But, the direct impact of a monetary policy stance on the equity markets can sometimes be hazy, because at times the policy itself could be a reaction to the market and become endogenous.

With regard to MTM channels Bernanke (2003) shows that the effect of monetary policy on the markets through real interest rate is very little. Instead, the reaction is driven by affecting the expected future excess returns and to some extent by expected future dividends. When it comes to the credit market channel, a contractionary policy affects those firms who are highly bank dependent borrowers, as banks reduce their overall supply of credit (Kashyap et al., 1993). This is on two accounts: First, with rising interest rates the present value of collaterals will fall adversely affecting their balance sheets. Second, though information asymmetries prevail in the market, at times, divulging information pays. For instance, during times of credit squeeze banks tend to limit their credit lines. In such periods, firms with less publicly available information may find it difficult to access bank loans (Gertler, 1994).

So a major conditioning factor here is the firm–specific attributes. That is, monetary policy affect each firm differently depending on their firm specific and industry specific characteristics, and therefore the equity prices will react accordingly. Thorbecke (1997) shows that response of stock returns to monetary policy is larger for small firms. Ehrmann and Fratzscher (2004) shows that the effect on financially constrained firms is much larger — the impact on firms with low cash flows and low debt to capital ratio is twice as much as those with high cash flow and debt. Similarly, sectors which are cyclical and capital intensive react two to three times more than non-cyclical industries. He also shows that monetary policy works its way into equity markets through "shocks". For S&P 500 an unexpected tightening of 50 basis points can decrease the return by 3% on the day of the announcement.

2 Event Studies

The semi–strong form efficiency states that investors cannot make excess returns using any publicly available information. Since, the moment the information becomes public it gets immediately incorporated in the prices. This makes an investor unable to gain by using this information to predict the returns. After Fama (1991) such studies are increasingly called as event studies.

The usual purpose for which an event study is employed in the finance literature is to measure the effect of an event of interest on the value of the firm. Given the neoclassical assumptions about the market, one expects the market prices to react correctly and immediately to the event.

One of the first studies in this regard was by Dolley (1933), who examined the price effects of stock splits. But, the methodology of event study as we see today saw its beginnings, more or less, in Fama et al. (1969).

Some of the major event studies relating monetary policy and equity markets are by Thorbecke (1997), Bomfim (2001), Lobo (2000), Kuttner (2001) etc.

Thorbecke (1997) examined the reaction of the markets on days when changes to Federal fund rates are announced for the period 1987 to 94. He finds the US equity index reacts significantly to policy announcements. Lobo (2000) showed that in the US market for the period 1990-1998, the impact of a monetary tightening was much stronger than monetary easing. Bomfim (2001) finds that volatility is lower on days before the monetary policy announcement and increases substantially after the decision is made. Kuttner (2001) saw that during a policy announcement markets are reacting to the unexpected component in the policy, which has yet not been discounted. Ehrmann and Fratzscher (2004) also analysed the market by separating out the surprise component. He measures surprise as the difference between the announcement of the Fed, particularly FOMC(Federal Open Market Committee) decision and the market expectation. The data from Reuters Poll - a survey conducted among market participants on Fridays before each FOMC meeting - was used here to arrive at the market expectation.

Agrawal (2007) recently examined the impact of announcements by the Reserve Bank of India on the Indian market. He examines 6 announcements affecting CRR between April 2006 and July 2007, classified as 'good news' and 'bad news'. A hike in CRR is considered as a bad news, and a good news is when, contrary to popular belief to control inflation, RBI leaves CRR unchanged. The study takes an event window of 31 days — 15 days before the event and 15 days after it. The data used is the cross-sectional daily returns of the 50 stocks constituting Nifty. Abnormal returns is taken as the residual of the Sharpe-Linter market model of modelling cross-sectional returns as a function of the market return (daily returns of the index. Here, CNX Nifty). He shows that cumulative average abnormal returns (CAAR)[1] does not normalize after the event, indicating that market is slow in incorporating the content of the monetary policy announcements. This, he argues, is evidence for weak form inefficiency. Though a very interesting study, one can point out some caveats. The impact of monetary policy on different sectors will be different. So, it would have added to the analysis if one could group the firms based on some criteria for such a disaggregated analysis. But, to see the impact of the policy on the market, examining the index is better since it evens out different firm level information reaching the market and reflects only those which affects all the firms together. With regard to the event window, such a large window assumes that policy announcement is the only additional information that has happened during the event. The study defines 'good news' as a policy announcement which was in contradiction to the market-wide expectations. That is, though the market expects the policy to be contractionary to curb inflation, it was actually left unchanged. Therefore, the study is actually looking at the unexpected component with respect to good news. The result that the market reacts positively before the announcement, therefore, would imply that markets are efficient in the sense that the information was anticipated correctly.

3 Data and Methodology

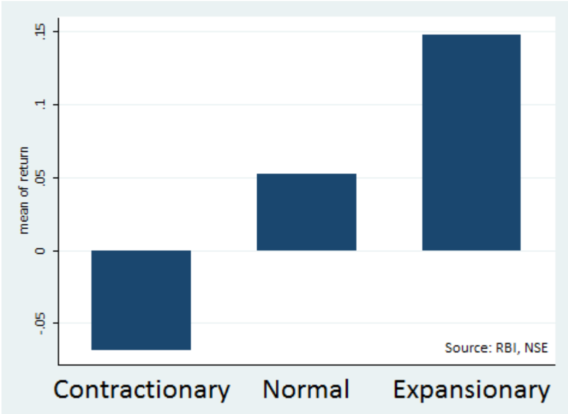
We examine the trading days for the period from 1996 January to 2008 April, when there has been a change in the monetary policy stance. We primarily focus at the three major tools in the hands of RBI namely, Cash Reserve Ratio, Bank Rate, and Reverse repo rate; through which it affects the liquidity in the system (through CRR) and signals the interest rate in the economy (through Bank Rate) and adjusts short term liquidity (reverse repo rate). The policy announcement dates were compiled from the Annual Reports of Reserve Bank of India from 1996-97 to 2007-2008. All together we analyse 57 policy announcements occurring during this period.

We classify the policy date as expansionary or contractionary. The classification is made as follows: If

$$y_0^i - y_{-1}^i > 0; Contractionary$$

[1]Abnormal returns is taken as the residual of the Sharpe-Linter market model of modelling cross-sectional returns as a function of the market return, averaged over the period of the event - 31 days.

Figure 1: Mean Daily Returns Across Events



$$y_0^i - y_{-1}^i < 0; Expansionary$$

Where, y_0^i is the current policy stance and y_{-1}^i is the policy stance in the previous period. y is the policy variable and the superscript i differentiates policy instrument.

If the date of policy announcement is t, we examine the market behavior for the just preceding and succeeding the policy announcement. That is, our event window is $t-1$ to $t+1$, where t is the date of policy announcement.

We examine the impact of monetary policy announcements on the stock market during the event window to examine semi-strong efficiency of the Indian stock market. We first examine the impact of policy announcements during the event window using exploratory data analysis, and the results are later tested using nonparametric tests.

4 Exploratory Data Analysis

An expansionary policy announcement is good news for the market as it reduces the cost of funds and/or increases the liquidity available for investment as well as trading. As mentioned before, the event window is three days – constituting the day before announcement $(t-1)$, the day of announcement(t) and the day after announcement $(t+1)$, respectively.

From figure 1 we can see that within the event window, market gives a negative return during a contractionary policy announcement and a high positive return, compared to a normal trading day, during an expansionary policy announcement.

The day preceding an expansionary policy announcement gives the highest positive returns (0.39%). On the day of an expansionary policy announce-

Table 1: Mean Daily Returns During the Event of Monetary Policy

Day	Contractionary	Expansionary
$t-1$	-0.29	0.39
t	-0.12	-0.05
$t+1$	0.18	0.07
Non-event days	0.05	0.05

Figure 2: Mean Returns During Expansionary Policy

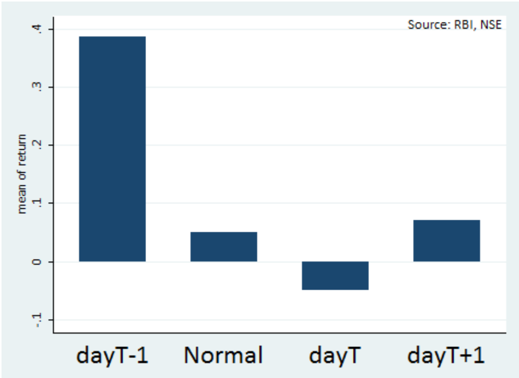
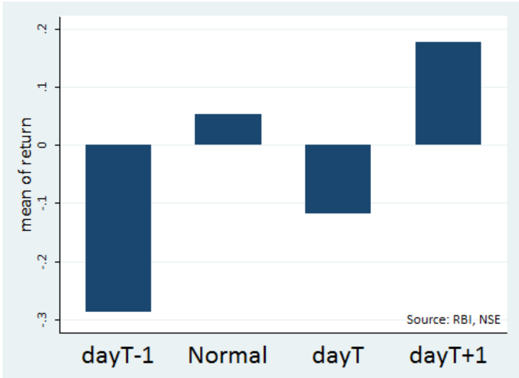


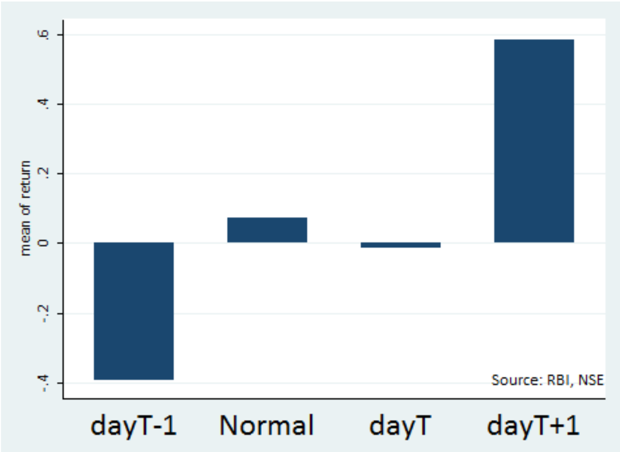
Figure 3: Mean Returns During Contractionary Policy



ment we find negative returns of -0.05%, which reverts to a positive 0.07% the next day. Probably this is an indication of overreaction during the run-up towards policy, which is corrected for in the coming days. High negative returns are witnessed during the day before a contractionary policy announcement (-0.29%). Compared to this the mean return on the day of a contractionary policy announcement is smaller (-0.12%). Like in expansionary policy, we again witness a reversal of sign after the day of announcement (0.18%). A graphical representation of the two events are given in figures 2 and 3.

The high (low) returns prior to an expansionary (contractionary) policy announcement would imply that markets anticipate the policy stance. Then rational traders might be taking a trading strategy in which they go long (short) in anticipation of an expansionary (contractionary) policy announcement. And sell (buy) the day after an expansionary (contractionary) policy announcement is made. As long as any trading rule can fetch excess returns, the market is inefficient according the Efficient Markets Hypothesis.

Figure 4: Mean Returns During Contractionary Policy: The Period Since Weak-form Efficiency(since June 2003)

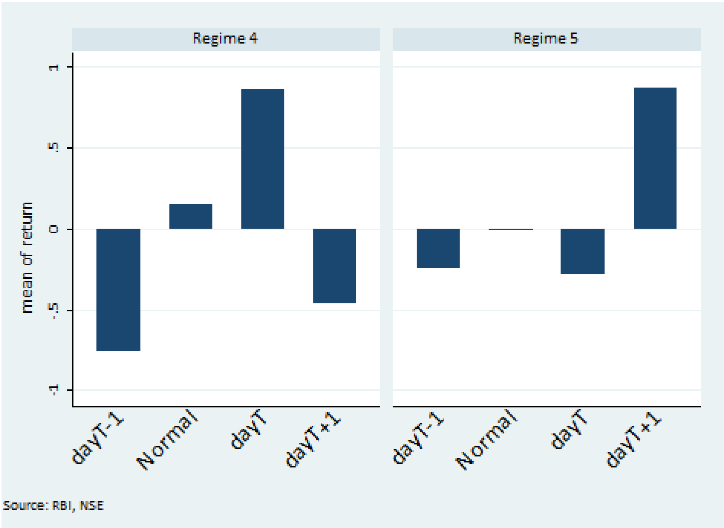


4.1 Impact Across Structural Breaks

Weak form efficiency is a precondition for testing semi-strong efficiency. Sasidharan (2009) using Bai-Perron method for identifying endogenous multiple structural changes showed that for the period 1991 to 2008 there are 4 major structural breaks in the Nifty series. The period for structural breaks are December 1994, July 1999, June 2003, January 2006. This implies there are 5 regimes of structural changes, because for m breaks there are $m+1$ regimes. Examining weak-form efficiency for these periods, it was shown that the market became weak-form efficient only since the third structural break beginning in June 2003. Therefore, we test for semi-strong efficiency for monetary policy announcements only for the weak-form efficient period. We have a total of 21 events during this period , of which 20 pertains to contractionary policy event and only 1 corresponding to an expansionary policy event. Therefore, we examine only the impact of contractionary policy beginning from the fourth regime.

Aggregating the two regimes, we see that during a contractionary policy event, there are large negative mean daily returns before the announcement; near zero returns on the day of announcement and excessive positive returns the day after. That is, we see a reversal in sign (see figure 4). For a much disaggregated analysis, we separate the two regimes and examine the event. Graphical summary of this is provided in figure 5. Though we do see a reversal in sign, the pattern is quite different. In regime4, we see high negative returns on the day before announcement and high positive returns on the day of announcement. But, immediately the day after, the mean returns revert

Figure 5: Mean Returns During Contractionary Policy in Regimes 4 and 5



in sign to negative. Whereas in the case of regime4, negative returns are observed on $t-1$ and t. But, turns positive the day after the announcement.

Is the reversal in sign just a random occurrence, or is it consistent across all the observations? Looking at table 2 we can see that only 2 out of 5 observations had a reversal in sign from positive to negative between t and $t+1$in the fourth regime. In the case of the fifth regime, only 6 out 14 observations had a reversal in sign from negative to positive. Which implies that there is a high possibility that our estimator of mean could be highly influenced by extreme values or size of the observation, than by systematic patterns. We use nonparametric methods to test this. We resort to nonparametric methods for two major reasons. First, low sample size. Second the distribution of returns is suspected to follow a stable paretian distribution (Sasidharan, 2009). The property of infinite population variance for this class of distribution makes variance based estimators unrelaible (Fama, 1965)).

5 Nonparametric Analysis

Owing to the small sample size problem and non-normality of the distribution, we use nonparametric techniques to test the plausible hypothesis that has emerged from exploratory data analysis. These hypothesis are:

1. Returns during an expansionary policy event is greater than a contractionary policy

Table 2: Returns During Contractionary Policy: Regimes 4 and 5

t-Date	$t-1$	t	$t+1$	t-Date	$t-1$	t	$t+1$
11-09-04	1.19		0.39	31-01-07	-0.56	-1.02	1.33
26-10-04	-1.27	1.35	0.16	13-02-07	-3.13	-0.34	0.06
28-04-05	-1.11	0.30	-2.02	31-07-07	-0.12	1.98	-4.12
25-10-05	-2.02	0.97	-0.40	30-10-07	3.51	-0.63	0.54
24-01-06	-0.58	0.83	1.11	17-04-08	0.16	1.44	1.57
08-06-06	-2.65	-4.87	5.08	29-04-08	-0.43	2.06	-0.57
25-07-06	1.38	1.81	2.26	11-06-08	-1.14	1.64	0.35
31-10-06	0.79	-0.67	0.61	24-06-08	-1.88	-1.78	1.46
06-12-06	0.37	0.005	-0.01	29-07-08	0.47	-3.34	2.91
				30-07-08	-3.34	2.91	0.45

2. During an expansionary policy event, returns are highest on day $t-1$ compared to $t+1$

3. During a contractionary policy event, returns are lowest on day $t-1$ compared to $t+1$

4. There is a reversal in sign after the day of announcement during a contractionary policy event

Nonparametric tests are primarily designed to check for consistency in the patterns of observation, when it is difficult to make a scientific judgment regarding it. They are more concerned about the direction of the observation than its size. Here we use Wilcoxon rank sum (Mann-Whitney) test amd Wilcoxon signed rank test. We first explain the procedure of Wilcoxon signed rank test. The approach for testing it is as follows: We take D_i as

$$D_i = r_{t-1} - r_{t+1} \tag{1}$$

and take as our model

$$D_i = \theta + e_t \tag{2}$$

where e_t is the unobservable random variable and our parameter of interest θ is the unknown 'information effect' on the returns, due to the new information. We test the null hypothesis:

$$H_0 : \theta = 0$$

To test, we take the absolute differences $|D_1|, |D_2|, ..., |D_n|$, where n is the number of policy announcement. Then rank this from least to greatest.

Define ψ as

$$D_i > 0 \Rightarrow \psi_i = 1 \tag{3}$$
$$D_i < 0 \Rightarrow \psi_i = 0 \tag{4}$$

Our test statistic is defined as:

$$T^+ = \sum_{i=1}^{n} R_i \psi_i \tag{5}$$

where R_i denotes the rank of $|D_i|$.

T^+ is known as the positive signed rank of D_i.

$$D_i > 0 \Rightarrow T^+ = R_i \tag{6}$$
$$D_i < 0 \Rightarrow T^+ = 0 \tag{7}$$

Therefore, T^+ is the sum of positive signed ranks (Hollander and Wolfe, 1973).

For testing the H_0 against the alternative $\theta > 0$, at significance level α; Reject H_0 if

$$T^+ \geq t(\alpha, n)$$

Therefore, the null hypothesis we test is that there are no differences in returns and any we see is just random, since difference D_i is equal to

$$D_i = \theta + e_t$$

We can also test the null hypothesis that two population locations are the same using Wilcoxon rank sum test.

Suppose our sample 1 consists of returns during $t-1$ and sample 2 consists of returns during $t+1$. We merge the two samples together and then rank it. Let us denote the sum of ranks for sample 1 as R_1, which we can take as our test statistic R. A small value of R indicates that most of the smaller observations are in sample 1, and larger observations in sample 2. But we need to prove that R is small. If our null is true then it implies that each possible ranking is equally likely. For example, assume that there are 3 observations in each of the two samples. So we have altogether 6 observations which can be arranged in ${}^6C_3$ ways, i.e., 20 different ways. From this a sampling distribution of R can be drawn. We can compute the probability of each rank appearing in the sampling distribution to be as $Freq/{}^nC_r$. For sample sizes greater than 10, sampling distribution of R can be approximated to a normal distribution (Keller, 2001). The test statistic is given by:

$$Z = \frac{R - E(R)}{\sigma_R} \tag{8}$$

Table 3: Wilcoxon Rank Sum Test: Equality of Returns Across Contractionary and Expansionary Policy

Policy	Obs	Rank sum	Expected
Contrac.	70	5128	5390
Expan.	83	6653	6391
Total	153	11781	11781
Var.	74561.67		
Z	-0.959		
$Prob > \|z\|$	0.3373		

Where,

$$E(R) = \frac{n_1(n_1 + n_2 + 1)}{2} \tag{9}$$

$$\sigma_R = \sqrt{n_1 n_2 (n_1 + n_2 + 1)12} \tag{10}$$

5.1 Results

We first test the hypothesis of equality of returns during expansionary and contractionary policy events using Wilcoxon rank sum test. From the test-statistics reported in table3 we can see the test statistic is not significant at 5% level, and therefore the null hypothesis of equality of returns during the two event windows cannot be rejected.

Next we test whether during an expansionary policy event, returns are highest on day $t-1$ compared to $t+1$. The signed rank test we perform failed to reject that a difference exists, as can be seen from table4. The same test was performed to test for the hypothesis that during a contractionary policy event, return are lowest on day $t-1$ compared to $t+1$. Like in the previous two tests we could not find statistical evidence in support for this hypothesis as well (table5).

The fourth hypothesis we test is that reversal of sign during a contractionary policy event. To test this hypothesis we use a modified version of Fisher's sign test. For this, we define ψ_i as 1 if we see a reversal in sign after the day of announcement during regime4. That is, $\psi_i = 1$ if $r_t > 0$ but $r_{t+1} < 0$.

We define B as

$$B = \sum_{i=1}^{n} \psi_i \tag{11}$$

Table 4: Signed rank test: Equality of Returns Across Contractionary and Expansionary Policy

Sign	obs	Rank sum	Expected
Positive	15	246	248
Negative	16	250	248
All	31	496	496
Variance	2604		
Z	-0.039		
$Prob > z$	0.9687		

Table 5: Signed rank test: Equality of Returns Across Contractionary and Expansionary Policy

Sign	Obs	Rank sum	Expected
Positive	11	122	162.5
Negative	14	203	162.5
All	25	325	325
variance	1381		
Z	-1.090		
$Prob > z$	0.275		

The test statistic B* is defined as:

$$B* = \frac{B - (n/2)}{(n/4)^{1/2}} \tag{12}$$

Reject null hypothesis of no reversal in sign if $B* \geq Z_{\alpha/2}$

The computed $B* = -0.8$. Therefore we do not reject the null hypothesis that there is no reversal in sign.

Similarly, the test was repeated for regime 5. But, we redefined ψ_i as $\psi_i = 1$ if $r_t < 0$ but $r_{t+1} > 0$.

For regime 5, $B* = -0.5714$. Therefore, we do not reject the null hypothesis of no reversal in sign.

Recap : Based on our exploratory data analysis we arrived at four plausible hypothesis concerning the relationship between the event of monetary policy announcement and stock market's behaviour to it. The results from nonparametric tests reveal that there is no systematic difference in the stock market behaviour across the day of events or policy. The results also imply that the reaction of the stock market to monetary policy announcement cannot be generalisable as having any systematic patterns.

6 Conclusion

Financial markets are at the core of monetary transmission mechanism. Therefore, we expect monetary policy announcements to have significant impact on the stock market. The focus here has been to see how the markets react to a widely known event, having an economy wide impact. In an efficient market, the prices react instantly to a new information. A market riding on stale information is informationally inefficient. In the case of monetary policy announcement, markets anticipate an announcement to be forthcoming and, ideally it should be reacting to the unexpected component in the announcement. Any overreaction or under-reaction will be corrected following the information about the unexpected component.

With only exploratory data analysis it would have made us conclude that the pattern exhibited by returns is indicative that the markets anticipate the policy stance in advance and is reacting accordingly, since we see negative (positive) excess returns before an contractionary (expansionary) policy announcement. One might have had the evidence of returns reverting in sign the day after an announcement, indicating that markets overreact on and prior to announcement which is adjusted for in the coming days, implying that the market do not continue to ride in the direction of stale information. Such a pattern could be in the direction of semi–strong efficiency. Traders who anticipate the direction of, say, contractionary policy announcement will short–sell before the announcement expecting the market to react downwards following a contractionary policy announcement. If the markets moves down further after the announcement then buying back the shares after the event would have been a profitable trading strategy . Instead, the buying pressure on the market after the event gives a fillip to the prices (which we see as positive returns). A trader reaching late in the market to trade in the direction of the policy would probably find a market moving against his expectation. This can be in line with the semi-strong efficiency of the Efficient Markets Hypothesis.

But, with a non-normal data parametric inferences can be highly misleading. Therefore, our exploratory data analysis was tested using nonparametric tests. Nonparametric tests have the advantage that they are distribution free and can be applied to small samples. The nonparametric tests we used – Wilcoxon rank sum test, Wilcoxon signed rank test and Fishers sign test have the added advantage that they are primarily testing for consistency in behaviour. Unlike the arithmetic average, they are not influenced by the size of single observation. Rather they are more concerned with the direction.

The nonparametric tests rejected any consistent behaviour across the periods of policy and type of policy. That is, it rejected any systematic difference in the return behaviour between expansionary and contractionary policy, as well as the days corresponding to the policy announcement event. The contradictory results with exploratory data analysis could be due to distributional properties of returns. Being a Paretian distribution, it is possible that we observe large changes during short periods of time. Therefore, there will be a few large values of returns which can severely influence the direction of the parameters. Together, the results would imply that there is no consistent, systematic effect of monetary policy announcements immediately on the Indian stock market. This makes our conclusion on semi-strong efficiency difficult for several reasons. First, it could be that market is too noisy to separate out the impacts of specific events. But a highly noisy market is inefficient. Second, it could be that each policy event have differing impacts on expectations. That is, the impact on expectations of a contractionary policy to prick an asset price bubble will be different from one which is directed at controlling rising inflation. If that is the case, one will not see any consistent patterns through which monetary policy effects stock market.

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