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Monetary Policy Announcements and Market Interest Rates in Pakistan: An Event Study Approach

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1. INTRODUCTION

The short term interest rates in the market are directly affected by the decision of Monetary Policy Committee. But, it also depends upon the expectations of market participants. If they have forward-thinking then their expectations towards policy rate will affect money market rates. It is an important aspect of MP transmission. The Participants of the market may predict the upcoming policy decisions if they have good understanding of MP. So, we can say that money market interest rates have some information about upcoming policy rate changes.

This fact has laid down the groundwork for a rich literature investigating the role of information in financial markets and macroeconomic announcement is an integral part of this information. Monetary policy announcement is one of the important macroeconomic announcements. FOMC (Federal Open Market Committee) has conducted eight regular meetings since 1981 in USA according to the pre-defined schedule. Similar is the case of UK and other developed economies. Many studies have analysed the effect of these meetings on market interest rates. In Pakistan, these meetings were conducted on irregular intervals but from 2005 onwards, monetary policy committee of the central board is conducting regular meetings. No one has analysed the impact of monetary policy announcements on market interest rates using event study methodology in Pakistan.

Andersen and Bollerslev (1998), Jones, Lamont, and Lumsdaine (1998), Berry and Howe (1994), Mitchell and Mulherin (1994), Ederington and Lee (1993), Cutler, Poterba, and Summers (1989), Roll (1988), Bomfim and Reinhart (2000), Kuttner (1999), Roley and Sellon (1998), Thornton (1998), Jensen and Johnson (1995) and Reinhart and Simin (1997) measured the financial market's reaction to monetary policy actions by following event study approach.

This study is an effort to add to the literature enlightening the impact of monetary policy announcements on interest rates by analysing the Pakistani markets. Pakistan is an

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emerging market and not been much studied. This study will be a value addition in this regard.

The objective of this study is to analyse the impact of monetary policy announcements on market interest rates at nine different maturities (1/Week, 2/Week, 1/Month, 3/Months, 6/Months, 9/Months, 1/Year, 2/Years and 3/Years) in Pakistan. As a first step of my analysis, We examined the impact of MP announcements on market interest rates at different nine maturities by using daily data from Jan. 2005 to Mar 2011 on discount rate and Karachi Inter Bank Offered Rate (KIBOR) by using event study methodology. The source of this daily data is State Bank of Pakistan. We constructed the economic impact of event by using market interest observed over relatively short time period. An 11-days event window (–5, 0, +5) with an estimation window of 250 days is applied for each event/announcement [MacKinlay (1997)]. Abnormal Rates were calculated by taking the difference of normal/forecasted rates and actual interest rates at different maturities prevailing in the market. So, the normal/forecasted rates were estimated by using GARCH and ARIMA (p,d,q) on the estimation window. Breusch Pagen ARCH Test was applied at the market interest rates of all maturities and GARCH model was applied for forecasting of six maturities (1/Week, 2/Week, 1/Month, 3/Months, 6/Months, 9/Months) having ARCH effect at 0.05. No ARCH effect was observed by applying Breusch Pagen ARCH Test at last three maturities (1-Year, 2-Years and 3-Years). ARIMA (p,d,q) was applied to measure the normal/forecasted rates at last three maturities. After finding the abnormal rates and their day-wise and event-wise aggregation, t-test was applied to check the null hypothesis that event has no impact on the market interest rates at nine different maturities.

2. LITERATURE REVIEW

Cook and Hahn (1989) is the prior study on the linkage between policy rate and the market interest rates using event study methodology. They used the following ordinary least squared to analyse the effect of policy rate in USA on market interest rates at different maturities on and around the day of change.

$$\Delta R_t = \beta_1 + \beta_2 \Delta REF_1 + \mu_t$$

He concluded with the reverse proportion of rates and maturity.

Pederson (1997) concluded with a significant effect of Danish discount rate on the market rates. He further analysed a decline in this effect with maturity. Hardy (1998) reported the similar results and further decomposed the policy rates in expected and un-expected interest rates and then analysed their impact. This impact became stronger with this decomposition of policy rates into anticipated and un-anticipated rates. Hardy (1998) also reported sequentially smaller effects with the increase in asset's maturity.

Andersen and Bollerslev (1998), Jones, Lamont, and Lumsdaine (1998), Berry and Howe (1994), Mitchell and Mulherin (1994), Ederington and Lee (1993), Cutler, Poterba, and Summers (1989), Roll (1988), Bomfim and Reinhart (2000), Kuttner (1999), Roley and Sellon (1998), Thornton (1998), Jensen and Johnson (1995) and Reinhart and Simin (1997) measured the financial market's reaction to monetary policy actions by following event study approach.

Patelis (1997) conducted an event study by using Vector Autoregressive (VAR) model and arrived at the results, those were alike. He also reported a low illuminating power of MP. Conver, Jensen and Johnson (1999) analysed sixteen industrial economies and founded that markets also reacted to US monetary environment as well as local.

Jochen, Geoffery and Natalia (2005) studied the behaviour of emerging bond markets as a respond of macroeconomic announcements and concluded that all announcements had an impact on market interest rates volatility. Kashyap and Wilcox (1993) and Bernank and Blinder (1992) analysed a strong impact of a tightening the monetary policy on highly bank-dependant borrowing firms as the overall supply of credit is affected.

Agha, Ahmed, Mubarik and Shah (2005) analysed the transmission Mechanism of monetary policy in Pakistan by using Vector Autoregressive (VAR) and concluded that the linkage of monetary policy with the real sector is direct; that is, through the bank lending channel.

Thorton (1998) used event study methodology to study the impact of Federal Fund Rate (FFR) on the market interest rates by analysing only the event day. He concluded that market participant's expectations have more weightage in case of longer maturities and the direct liquidity is the major factor in case of short rates. Garfinkel and Thorton (1995) concluded that short term market interest rate is a good indicator of MP than the FFR. Dale (1993) analysed the reaction of market interest rates at seven different maturities against change in policy rate by using event study approach. He reported a significant impact on these interest rates having maturities from one month to five years and for both expected and un-expected rates.

Thorton (1986 and 1994), Cook and Hahn (1988), Rudebuch (1995), Dueker (1992), Paquet and Perez (1995) and Kuttner (2000) conducted the same studies with the findings of linkage between changes in policy rates and market interest rates in united states.

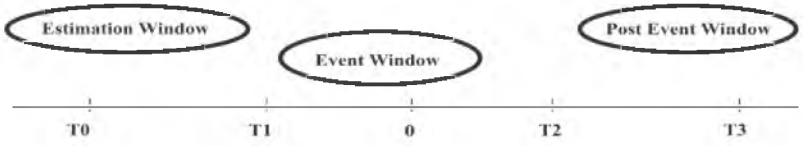
We will discuss Study Design and Methodology in Section 3. Section 4 will comprise of Data Analysis and Results and we will conclude it in Section 5.

3. METHODOLOGY

We used the event study approach with the following three steps;[1]

3.1. Event Window for the Study

The study constructed the economic impact of event by using market interest rates observed over relatively short time period. The time line for our event study is illustrated below;



Time Line for an Event Study

[1]Kaketsis and Sarantis (2006).

The Estimation and event windows should not overlap. If the event window is included in estimation of normal rates, then normal and abnormal rates both would capture the event impact. This would be problematic because the assumption of this methodology is that the event impact is captured by the abnormal returns only.

An 11-days event window (–5, 0, +5) with an estimation window of 250[2] days is used for each event/announcement [MacKinlay (1997)].

3.2. Determining the Impact of Intervention Rate

One method to determine the effect of policy rate on market interest rate is to run the following regression;

$$\Delta R_t = \propto_1 + \propto_2 \Delta(Intv) + \mu_t$$

Where:

$\Delta R_t \rightarrow$ is the change in interest rates prevailing in the market at specific time t;
$\Delta(Intv) \rightarrow$ is the respective change in policy rate at specific time t;

Here only the change in rates within event window will be used for this regression analysis. Estimation and Post event windows will not be included in this regression analysis. Dale (1993) and Kaketsis and Sarantis (2006) pointed out that for obtaining unbiased results of co-efficient β, other external factors should be included in this regression. As these missing explanatory variables can be qualitative, so it will be very difficult, if not impossible, to measure their impact in this regression analysis. They further pointed out that this analysis is limited with the number of observations only in event window so the results will not be significant. Cook and Hahn (1989) have used same regression analysis by using following equation;

$$\Delta R_t = \beta_1 + \beta_2 \Delta REF_1 + \mu_t$$

But, Dale (1993) suggested the mean responses of abnormal change and their aggregation within and across the event window which we applied here in our study.

3.3. Significance of Results

Kaketsis and Sarantis (2006) proposed not to compare policy rate changes directly with the rates observed over the sample. In case of event studies MacKinlay (1997) proposed the following three steps for measuring the significance of results.

3.3.1. *Calculating the Abnormal Rate*

The abnormal rates were calculated by taking the difference of actual interest rates and normal/forecasted rates at different maturities prevailing in the market within the event window. So, the normal/forecasted rates were estimated by using GARCH and ARIMA (p,d,q) on the estimation window after finding out the ARCH effect in market

[2]1st estimation window was for 94 days and 2nd for 195 days due to data structure while remaining estimation windows were for exact 250 days.

interest rate at each maturity. Breusch Pagen ARCH Test was applied at the market interest rates of all maturities. GARCH model was applied on the market interest rate having ARCH effect. In case of having no ARCH effect, unit root test was applied to check the stationary and then ARIMA (p,d,q) was applied for the forecasting of normal rates.

3.3.2. *Abnormal Rate-Aggregation*

Abnormal Rates must be aggregated across the days within event window (–5, –4, –3, –2, –1, 0, +1, +2, +3,+4, +5) and across the events.

3.3.2.1. Day-wise Aggregation

Let (–5, –4, –3, –2, –1, 0, +1, +2, +3,+4, +5) days are surrounding within event day. Aggregated Abnormal Rate (AAR) is here defined as the cumulative abnormal rate on the *nth* event for the *ith* market:

$$AAR_{in} = \sum_{\tau-5}^{\tau+5} AAR_{in}$$

Average of AAR_{in} is calculated as follows:

$$\overline{AAR_{in}} = \frac{1}{11}\sum_{\tau-5}^{\tau+5} AAR_{in}$$

3.3.2.2. Aggregation Across Event Window

As we were interested in the overall significance of results so we aggregated the abnormal returns across event windows.

We calculated CAC (Cumulative Abnormal Rate) for the interest rate *i* across all the events;

$$CAR_{in} = \sum_{n=1}^{N} AR_{in}$$

Then its average is calculated as follows:

$$\overline{CAR_{in}} = \frac{1}{N}\sum_{n=1}^{N} CAR_{in}$$

3.3.3. *Hypothesis Testing*

The study applies t-test to check the null hypothesis that event has no impact on the market interest rates by assuming that rates are distributed normally with zero mean. Jarque-Bera state and their respective p-values shows the normality of data (Table 1).

Table 1

Descriptive Statistics Sample: 1/02/2005 3/31/2011

	OW	TWW	OM	THM	SM	NM	OY	TWY	THY
Mean	10.52	10.44	10.69	10.99	11.23	11.50	11.68	11.92	12.12
Median	10.15	9.88	9.97	10.30	10.55	10.75	10.92	11.16	11.39
Maximum	15.68	14.91	14.90	15.52	15.76	16.02	16.11	16.19	16.30
Minimum	2.40	3.09	4.22	5.07	5.80	6.12	6.41	6.79	7.18
Kurtosis	4.18	3.17	2.62	2.56	2.58	2.52	2.57	2.51	2.52
Jarque-Bera	351.04	121.59	76.53	26.70	17.61	21.54	17.56	24.49	24.63
P-Value	**0.00***	**0.00***	**0.00***	**0.00***	**0.00***	**0.00***	**0.00***	**0.00***	**0.00***
Sum	23,986	23,814	24,382	25,056	25,608	26,213	26,630	27,177	27,641
Sum Sq. Dev.	10,750	11,453	11,586	11,239	10,394	10,693	10,233	9,627	9,126
Observations	2280	2280	2280	2280	2280	2280	2280	2280	2280

Following are the hypotheses of our study;

H_0: Abnormal Rates = Zeero

H_1: Abnormal Rates ≠ Zeero

4. ESTIMATION AND DISCUSSION OF RESULTS

Figures 1 and 2 shows that reaction of market rates is event specific and using regression analysis is unwise. So, here measuring the average change in abnormal rates within and across the event window will clarify the results.

Fig. 1. Event-wise Abnormal Rates

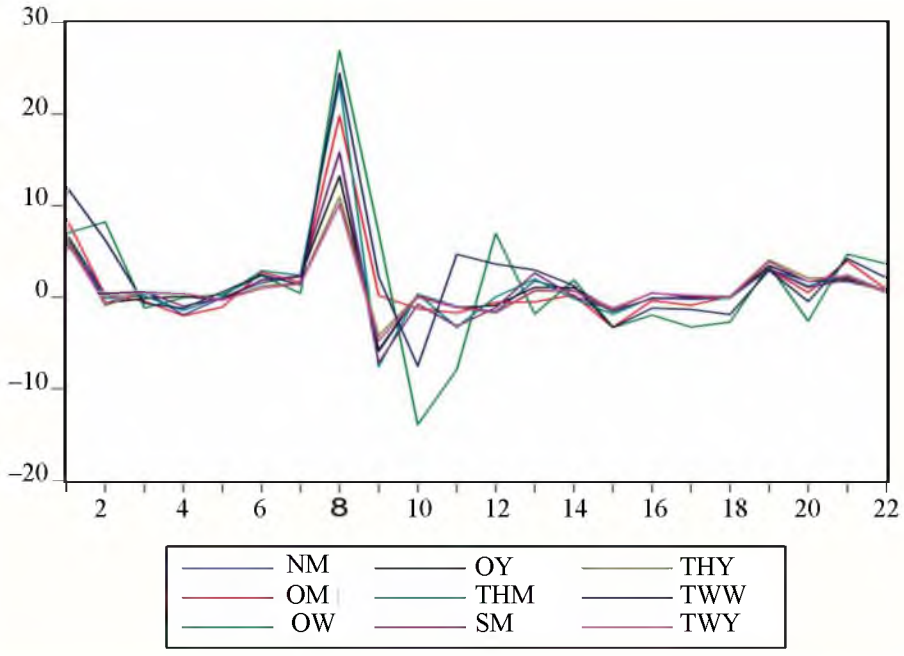
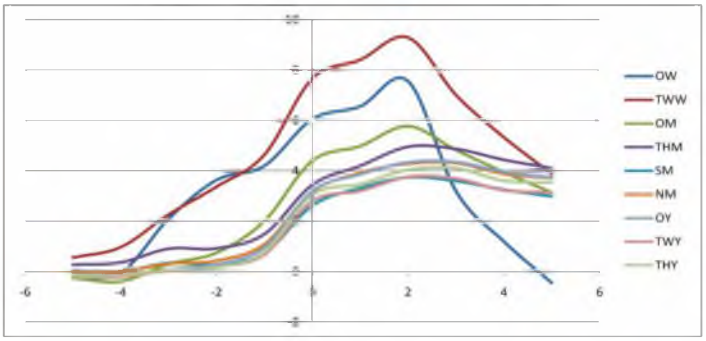


Fig. 2. Day-wise Abnormal Rates



The abnormal rates were analysed from two dimensions; within event window (where abnormal returns were analysed at (–5, –4, –3, –2, –1, 0, +1, +2, +3,+4, +5) and across the event window. Abnormal Rates were calculated by taking the difference of actual interest rates and normal/forecasted rates at different maturities prevailing in the market within the event window. So, the normal/forecasted rates were estimated by using GARCH and ARIMA (p,d,q) on the estimation window. Breusch Pagen ARCH Test was applied at the market interest rates of all maturities and GARCH model was applied for forecasting of six maturities (1/Week, 2/Week, 1/Month, 3/Months, 6/Months, 9/Months) having ARCH effect at 0.05 (Table 2).

Table 2

Breusch-Pagan ARCH Test

Adjusted Sample : Jan 04, 2005 to Mar 31, 2011 Included observations: 2278 after adjustments			
1-Week ARCH (1) Effect:			
F - Stat	51.90508	P - Value	0.00000
		P - Value (Chi-Squ)	**0.00000**
2-Week ARCH (1) Effect:			
F - Stat	31.07646	P - Value	0.00000
		P - Value (Chi-Squ)	**0.00000**
1-Month ARCH (1) Effect:			
F - Stat	16.17531	P - Value	0.00006
		P - Value (Chi-Squ)	**0.00006**
3-Month ARCH (1) Effect:			
F - Stat	8.80197	P - Value	0.00304
		P - Value (Chi-Squ)	**0.00305**
6-Month ARCH (1) Effect:			
F - Stat	8.33394	P - Value	0.00393
		P - Value (Chi-Squ)	**0.00394**
9-Month ARCH (1) Effect:			
F - Stat	4.13689	P - Value	0.04207
		P - Value (Chi-Squ)	**0.04205**
1-Year ARCH (1) Effect:			
F - Stat	1.91624	P - Value	0.16641
		P - Value (Chi-Squ)	0.16626
2-Year ARCH (1) Effect:			
F - Stat	0.05537	P - Value	0.81399
		P - Value (Chi-Squ)	0.81389
3-Year ARCH (1) Effect:			
F - Stat	0.08780	P - Value	0.76702
		P - Value (Chi-Squ)	0.76690

No ARCH effect was observed by applying BreuschPagen ARCH Test at last three maturities (1-Year, 2-Years and 3-Years). So, ARIMA (p,d,q) was applied to measure the normal/forecasted rates at last three maturities. Before moving towards the ARIMA (p,d,q) process, unit root tests were applied to clear the order of (d).

All of the market interest rates having no ARCH effect (1-Year, 2-Years and 3-Years) were integrated of orders one (Table 3).

Table 3

Test for Stationarity

	AD test Statistics		*Phillips-Perron Test Statistics*		*Kwiatkowski-Phillips-Schmidt-Shin test statistic*	
	Null Hypothesis: Variable is Nonstationary		Null Hypothesis: Variable is Nonstationary		Null Hypothesis: Variable is Stationary	
Maturities	*At Level*	*At 1st Diff.*	*At Level*	*At 1st Diff.*	*At Level*	*At 1st Diff.*
1-Year	–2.1238	*–22.15845	–2.2449	*–41.81464	4.1012	***0.211026**
2-Year	–2.1001	*–22.20074	–2.2820	*–45.64057	4.0319	***0.232992**
3-Year	–2.1595	*–28.31471	–2.2587	*–46.20714	3.9336	***0.230053**
	Test critical values					
1% Level	–3.4330		–3.4330		0.74	
5% Level	–2.8626		–2.8626		0.46	
10% Level	–2.5674		–2.5674		0.35	

*Implies that the co-efficient is significant at 0.05 probability level.

- AR(p) denotes auto-regressive model of order (p) as is mentioned below;

$$Y_t = \beta_0 + \sum_{\tau i=1}^{p} \varphi_i Y_{t-i} + \mu_t$$

- MA(q) denotes moving-average equation/model of order (q) as is mentioned below:

$$Y_t = \mu_t + \varepsilon_t + \sum_{i=1}^{q} \theta_i \varepsilon_{t-i}$$

- Autoregressive Moving Average (p, q) at univariate time series:

$$Y_t = \beta_0 + \varepsilon_t + \sum_{\tau i=1}^{p} \varphi_i Y_{t-i} + \sum_{i=1}^{q} \theta_i \varepsilon_{t-i}$$

ARIMA model is fitted on basis of following criteria:

(1) Where BIC value will be lower (Schwarz criterion),
(2) Where Adjusted R-Squared will be higher,
(3) Where Standard Error of Equation (SEE) will be lower,
(4) Correlogram and Q-Stat: Both show the pattern left in the ACF and PACF of the residuals. For model selection criteria, residual should be white noise.

We used 1st three criteria to find out the order of ARIMA (p,d,q).

The Detailed calculation is provided in Tables 4, 5 and 6 for ARIMA ordering on the basis of this criterion.

Table 4

ARIMA Model Fitting (One Year Maturity)

MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC	MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC
1st Meeting dt: 4/11/2005	(1, 1 , 0)	–0.00311	0.03739	–3.65875	2nd Meeting dt:7/21/2005	(1, 1 , 0)	–0.00475	0.07885	–2.19832
	(1, 1, 1)	*0.11011*	*0.03521*	*–3.74053*		(1, 1, 1)	0.04263	0.07697	–2.22461
	(2, 1, 0)	–0.01317	0.03771	–3.60286		(2, 1, 0)	0.12254	0.07388	–2.30646
	(0, 1, 1)	–0.00270	0.03733	–3.66252		(0, 1, 1)	–0.00493	0.07868	–2.20301
	(0, 1, 2)	–0.01375	0.03753	–3.61387		*(0, 1, 2)*	*0.12964*	*0.07322*	*–2.32484*
3rd Meeting dt: 1/26/2006	(1, 1 , 0)	0.05257	0.03629	–3.75834	4th Meeting dt: 7/31/2006	*(1, 1 , 0)*	*0.00012*	*0.04356*	*–3.39314*
	(1, 1, 1)	0.05431	0.03626	–3.74213		(1, 1, 1)	–0.00393	0.04365	–3.37106
	(2, 1, 0)	0.05437	0.03626	–3.74220		(2, 1, 0)	–0.00390	0.04365	–3.37109
	(0, 1, 1)	*0.05812*	*0.03619*	*–3.76421*		(0, 1, 1)	0.00000	0.04356	–3.39303
	(0, 1, 2)	0.05432	0.03626	–3.74214		(0, 1, 2)	–0.00343	0.04364	–3.37156
5th Meeting dt: 1/18/2007	(1, 1 , 0)	–0.00335	0.04081	–3.52376	6th Meeting dt: 8/1/2007	(1, 1 , 0)	0.00130	0.01743	–5.22561
	(1, 1, 1)	*0.03625*	*0.03999*	*–3.54598*		*(1, 1, 1)*	*0.00614*	*0.01738*	*–5.21242*
	(2, 1, 0)	–0.00741	0.04089	–3.50168		(2, 1, 0)	0.00158	0.01742	–5.20785
	(0, 1, 1)	–0.00334	0.04081	–3.52377		(0, 1, 1)	0.00209	0.01742	–5.22641
	(0, 1, 2)	–0.00718	0.04089	–3.50191		(0, 1, 2)	0.00247	0.01742	–5.20874
7th Meeting dt: 2/1/2008	*(1, 1 , 0)*	*0.01631*	*0.02196*	*–4.76326*	8th Meeting dt: 5/23/2008	(1, 1 , 0)	0.05143	0.02713	–4.34041
	(1, 1, 1)	0.01237	0.02200	–4.74122		(1, 1, 1)	0.11675	0.02618	–4.39371
	(2, 1, 0)	0.01392	0.02198	–4.74279		*(2, 1, 0)*	*0.17637*	*0.02528*	*–4.46360*
	(0, 1, 1)	0.01569	0.02197	–4.76263		(0, 1, 1)	0.02945	0.02744	–4.31750
	(0, 1, 2)	0.01189	0.02201	–4.74072		(0, 1, 2)	0.15008	0.02568	–4.43218
9th Meeting dt: 7/30/2008	*(1, 1 , 0)*	*0.03994*	*0.13434*	*–1.14078*	10th Meeting dt: 11/13/2008	*(1, 1 , 0)*	*0.05168*	*0.13715*	*–1.09929*
	(1, 1, 1)	0.03861	0.13443	–1.12135		(1, 1, 1)	0.04967	0.13730	–1.07913
	(2, 1, 0)	0.03783	0.13449	–1.12053		(2, 1, 0)	0.04901	0.13735	–1.07843
	(0, 1, 1)	0.03640	0.13459	–1.13710		(0, 1, 1)	0.04775	0.13744	–1.09515
	(0, 1, 2)	0.03432	0.13473	–1.11689		(0, 1, 2)	0.04537	0.13761	–1.07460
11th Meeting dt: 1/31/2009	(1, 1 , 0)	0.04996	0.13629	–1.11197	12th Meeting dt: 4/21/2009	*(1, 1 , 0)*	*0.11599*	*0.05944*	*–2.77146*
	(1, 1, 1)	*0.14079*	*0.12961*	*–1.19441*		(1, 1, 1)	0.11288	0.05955	–2.74990
	(2, 1, 0)	0.04709	0.13649	–1.09091		(2, 1, 0)	0.11268	0.05955	–2.74967
	(0, 1, 1)	0.04546	0.13661	–1.10725		(0, 1, 1)	0.10427	0.05984	–2.75829
	(0, 1, 2)	0.04507	0.13664	–1.08879		(0, 1, 2)	0.10849	0.05970	–2.74496

Continued—

Table 4—(*Continued*)

13th Meeting dt: 8/17/2009	*(1, 1 , 0)*	*0.06695*	*0.05589*	*–2.89482*	14th Meeting dt: 9/29/2009	*(1, 1 , 0)*	*0.06842*	*0.05623*	*–2.88274*
	(1, 1, 1)	0.06320	0.05600	–2.87277		(1, 1, 1)	0.06501	0.05633	–2.86104
	(2, 1, 0)	0.06322	0.05600	–2.87279		(2, 1, 0)	0.06488	0.05633	–2.86089
	(0, 1, 1)	0.06268	0.05602	–2.89026		(0, 1, 1)	0.06282	0.05640	–2.87675
	(0, 1, 2)	0.06258	0.05602	–2.87211		(0, 1, 2)	0.06354	0.05637	–2.85946
15th Meeting dt: 11/25/2009	(1, 1 , 0)	0.04566	0.03085	–4.08306	16th Meeting dt: 1/30/2010	(1, 1 , 0)	0.06085	0.02734	–4.32512
	(1, 1, 1)	*0.08420*	*0.03022*	*–4.10624*		*(1, 1, 1)*	*0.12196*	*0.02643*	*–4.37435*
	(2, 1, 0)	0.04320	0.03089	–4.06244		(2, 1, 0)	0.07131	0.02718	–4.31826
	(0, 1, 1)	0.04139	0.03092	–4.07859		(0, 1, 1)	0.04549	0.02756	–4.30889
	(0, 1, 2)	0.04036	0.03094	–4.05948		(0, 1, 2)	0.05817	0.02738	–4.30422
17th Meeting dt: 3/27/2010	*(1, 1 , 0)*	*0.00415*	*0.02010*	*–4.93963*	18th Meeting dt: 5/24/2010	*(1, 1 , 0)*	*0.00811*	*0.01955*	*–4.99544*
	(1, 1, 1)	0.00051	0.02014	–4.91794		(1, 1, 1)	0.00438	0.01959	–4.97364
	(2, 1, 0)	0.00055	0.02014	–4.91797		(2, 1, 0)	0.00419	0.01959	–4.97345
	(0, 1, 1)	0.00384	0.02011	–4.93931		(0, 1, 1)	0.00723	0.01956	–4.99455
	(0, 1, 2)	0.00069	0.02014	–4.91811		(0, 1, 2)	0.00334	0.01960	–4.97260
19th Meeting dt: 8/2/2010	(1, 1 , 0)	0.00060	0.02484	–4.51686	20th Meeting dt: 9/29/2010	(1, 1 , 0)	0.04327	0.02037	–4.91382
	(1, 1, 1)	–0.00330	0.02489	–4.49491		*(1, 1, 1)*	*0.06328*	*0.02015*	*–4.91691*
	(2, 1, 0)	–0.00332	0.02489	–4.49490		(2, 1, 0)	0.06235	0.02016	–4.91592
	(0, 1, 1)	*0.00068*	*0.02484*	*–4.51694*		(0, 1, 1)	0.03176	0.02049	–4.90187
	(0, 1, 2)	–0.00330	0.02489	–4.49491		(0, 1, 2)	0.05140	0.02028	–4.90430
21st Meeting dt: 30-Nov-2010	*(1, 1 , 0)*	*0.00457*	*0.03144*	*–4.04528*	22nd Meeting dt: 29-Jan-2011	(1, 1 , 0)	0.01679	0.03243	–3.98347
	(1, 1, 1)	0.00448	0.03144	–4.02714		*(1, 1, 1)*	*0.01777*	*0.03241*	*–3.96642*
	(2, 1, 0)	0.00286	0.03147	–4.02551		(2, 1, 0)	0.01652	0.03243	–3.96514
	(0, 1, 1)	0.00380	0.03145	–4.04451		(0, 1, 1)	0.01462	0.03246	–3.98126
	(0, 1, 2)	0.00208	0.03148	–4.02474		(0, 1, 2)	0.01503	0.03246	–3.96363

Italic values shows ARIMA model fitting.

Table 5

ARIMA Model Fitting (Two Years Maturity)

MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC	MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC
1st Meeting dt: 4/11/2005	(1, 1 , 0)	–0.00567	0.03312	–3.90086	2nd Meeting dt:7/21/2005	(1, 1 , 0)	0.00048	0.07660	–2.25630
	(1, 1, 1)	*0.20247*	*0.02950*	*–4.09478*		(1, 1, 1)	0.01565	0.07602	–2.24958
	(2, 1, 0)	–0.01844	0.03263	–3.89216		*(2, 1, 0)*	*0.09572*	*0.07291*	*–2.33267*
	(0, 1, 1)	–0.00571	0.03460	–3.81418		(0, 1, 1)	–0.00171	0.07679	–2.25159
	(0, 1, 2)	–0.01270	0.03472	–3.76957		(0, 1, 2)	0.09465	0.07300	–2.33081
3rd Meeting dt: 1/26/2006	(1, 1 , 0)	0.07223	0.03842	–3.64436	4th Meeting dt: 7/31/2006	*(1, 1 , 0)*	*0.01682*	*0.04245*	*–3.44470*
	(1, 1, 1)	*0.10590*	*0.03772*	*–3.66328*		(1, 1, 1)	0.01308	0.04253	–3.42286
	(2, 1, 0)	0.08980	0.03805	–3.64544		(2, 1, 0)	0.01394	0.04252	–3.42374
	(0, 1, 1)	0.10218	0.03779	–3.67718		(0, 1, 1)	0.01663	0.04246	–3.44451
	(0, 1, 2)	0.10560	0.03772	–3.66295		(0, 1, 2)	0.01358	0.04252	–3.42336
5th Meeting dt: 1/18/2007	*(1, 1 , 0)*	*–0.00350*	*0.03788*	*–3.67270*	6th Meeting dt: 8/1/2007	(1, 1 , 0)	0.01554	0.01789	–5.17285
	(1, 1, 1)	–0.00757	0.03796	–3.65062		*(1, 1, 1)*	*0.02471*	*0.01781*	*–5.16416*
	(2, 1, 0)	–0.00755	0.03796	–3.65063		(2, 1, 0)	0.01809	0.01787	–5.15739
	(0, 1, 1)	–0.00351	0.03788	–3.67270		(0, 1, 1)	0.01929	0.01786	–5.17666
	(0, 1, 2)	–0.00750	0.03795	–3.65068		(0, 1, 2)	0.02181	0.01783	–5.16119
7th Meeting dt: 2/1/2008	(1, 1 , 0)	0.03402	0.01620	–5.37205	8th Meeting dt: 5/23/2008	(1, 1 , 0)	0.13902	0.02374	–4.60711
	(1, 1, 1)	*0.05761*	*0.01600*	*–5.37873*		(1, 1, 1)	0.22064	0.02259	–4.68865
	(2, 1, 0)	0.04536	0.01610	–5.36581		*(2, 1, 0)*	*0.26479*	*0.02194*	*–4.74698*
	(0, 1, 1)	0.04452	0.01611	–5.38298		(0, 1, 1)	0.08294	0.02450	–4.54401
	(0, 1, 2)	0.04985	0.01606	–5.37053		(0, 1, 2)	0.21231	0.02271	–4.67803
9th Meeting dt: 7/30/2008	(1, 1 , 0)	0.01011	0.13363	–1.15142	10th Meeting dt: 11/13/2008	(1, 1 , 0)	0.01575	0.13699	–1.10169
	(1, 1, 1)	*0.01445*	*0.13333*	*–1.13776*		*(1, 1, 1)*	*0.01975*	*0.13671*	*–1.08772*
	(2, 1, 0)	0.01368	0.13338	–1.13699		(2, 1, 0)	0.01848	0.13680	–1.08642
	(0, 1, 1)	0.00811	0.13376	–1.14940		(0, 1, 1)	0.01309	0.13717	–1.09900
	(0, 1, 2)	0.01086	0.13357	–1.13413		(0, 1, 2)	0.01502	0.13704	–1.08291
11th Meeting dt: 1/31/2009	(1, 1 , 0)	0.01386	0.13605	–1.11548	12th Meeting dt: 4/21/2009	(1, 1 , 0)	0.09291	0.05662	–2.86873
	(1, 1, 1)	*0.14058*	*0.12701*	*–1.23497*		*(1, 1, 1)*	*0.09520*	*0.05655*	*–2.85321*
	(2, 1, 0)	0.01589	0.13591	–1.09950		(2, 1, 0)	0.09177	0.05666	–2.84943
	(0, 1, 1)	0.01133	0.13622	–1.11292		(0, 1, 1)	0.07952	0.05704	–2.85408
	(0, 1, 2)	0.01435	0.13601	–1.09793		(0, 1, 2)	0.08703	0.05680	–2.84423

Continued—

Table 5—(*Continued*)

13th Meeting dt: 8/17/2009	*(1, 1 , 0)*	*0.04025*	*0.05211*	*–3.03464*	14th Meeting dt: 9/29/2009	*(1, 1 , 0)*	*0.04072*	*0.05209*	*–3.03566*
	(1, 1, 1)	0.03752	0.05219	–3.01375		(1, 1, 1)	0.03833	0.05215	–3.01512
	(2, 1, 0)	0.03767	0.05218	–3.01391		(2, 1, 0)	0.03820	0.05216	–3.01500
	(0, 1, 1)	0.03586	0.05223	–3.03008		(0, 1, 1)	0.03621	0.05221	–3.03097
	(0, 1, 2)	0.03745	0.05219	–3.01367		(0, 1, 2)	0.03783	0.05217	–3.01460
15th Meeting dt: 11/25/2009	*(1, 1 , 0)*	*0.04031*	*0.02328*	*–4.64678*	16th Meeting dt: 1/30/2010	(1, 1 , 0)	0.01000	0.02402	–4.58375
	(1, 1, 1)	0.03646	0.02332	–4.62473		*(1, 1, 1)*	*0.02194*	*0.02387*	*–4.57784*
	(2, 1, 0)	0.03703	0.02331	–4.62532		(2, 1, 0)	0.01055	0.02401	–4.56626
	(0, 1, 1)	0.03770	0.02331	–4.64406		(0, 1, 1)	0.00856	0.02404	–4.58229
	(0, 1, 2)	0.03872	0.02329	–4.62708		(0, 1, 2)	0.01124	0.02401	–4.56696
17th Meeting dt: 3/27/2010	*(1, 1 , 0)*	*0.00857*	*0.01945*	*–5.00564*	18th Meeting dt: 5/24/2010	(1, 1 , 0)	0.01325	0.01915	–5.03653
	(1, 1, 1)	0.00662	0.01947	–4.98563		(1, 1, 1)	0.01016	0.01918	–5.01536
	(2, 1, 0)	0.00489	0.01949	–4.98389		(2, 1, 0)	0.00982	0.01919	–5.01501
	(0, 1, 1)	0.00820	0.01946	–5.00527		*(0, 1, 1)*	*0.01397*	*0.01915*	*–5.03726*
	(0, 1, 2)	0.00426	0.01949	–4.98326		(0, 1, 2)	0.01009	0.01918	–5.01528
19th Meeting dt: 8/2/2010	*(1, 1 , 0)*	*–0.00069*	*0.02497*	*–4.50637*	20th Meeting dt: 9/29/2010	(1, 1 , 0)	0.05227	0.02116	–4.83690
	(1, 1, 1)	–0.00456	0.02502	–4.48446		(1, 1, 1)	0.09249	0.02071	–4.86222
	(2, 1, 0)	–0.00455	0.02502	–4.48447		*(2, 1, 0)*	*0.10392*	*0.02058*	*–4.87489*
	(0, 1, 1)	–0.00078	0.02497	–4.50628		(0, 1, 1)	0.03389	0.02137	–4.81770
	(0, 1, 2)	–0.00456	0.02502	–4.48447		(0, 1, 2)	0.08128	0.02084	–4.84995
21st Meeting dt: 30-Nov-2010	(1, 1 , 0)	0.00472	0.03169	–4.02970	22nd Meeting dt: 29-Jan-2011	(1, 1 , 0)	0.01780	0.03324	–3.93395
	(1, 1, 1)	0.01266	0.03156	–4.01966		(1, 1, 1)	0.02898	0.03305	–3.92735
	(2, 1, 0)	*0.01270*	*0.03156*	*–4.01971*		*(2, 1, 0)*	*0.03059*	*0.03302*	*–3.92901*
	(0, 1, 1)	0.00317	0.03171	–4.02814		(0, 1, 1)	0.01316	0.03332	–3.92924
	(0, 1, 2)	0.01029	0.03160	–4.01727		(0, 1, 2)	0.02706	0.03308	–3.92537

Italic values shows ARIMA model fitting.

Table 6

ARIMA Model Fitting (Three Years Maturity)

MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC	MP Announcements	ARIMA (p,d,q)	Adjusted R2	SEE	SIC
1st Meeting dt: 4/11/2005	(1, 1 , 0)	–0.01098	0.03874	–3.58745	2nd Meeting dt:7/21/2005	(1, 1 , 0)	0.00901	0.08281	–2.10046
	(1, 1, 1)	*0.23889*	*0.03362*	*–3.83337*		(1, 1, 1)	0.04069	0.08147	–2.11093
	(2, 1, 0)	–0.01779	0.03752	–3.61289		(2, 1, 0)	0.12130	0.07792	–2.19999
	(0, 1, 1)	–0.01085	0.03927	–3.56122		(0, 1, 1)	0.00321	0.08296	–2.09688
	(0, 1, 2)	–0.02208	0.03948	–3.51248		*(0, 1, 2)*	*0.12088*	*0.07791*	*–2.20057*
3rd Meeting dt: 1/26/2006	(1, 1 , 0)	0.07005	0.04135	–3.49739	4th Meeting dt: 7/31/2006	(1, 1 , 0)	0.02754	0.01966	–4.98393
	(1, 1, 1)	*0.13492*	*0.03988*	*–3.55165*		*(1, 1, 1)*	*0.06383*	*0.01929*	*–5.00392*
	(2, 1, 0)	0.09261	0.04084	–3.50391		(2, 1, 0)	0.04755	0.01946	–4.98668
	(0, 1, 1)	0.10955	0.04046	–3.54080		(0, 1, 1)	0.03972	0.01954	–4.99654
	(0, 1, 2)	0.13033	0.03999	–3.54636		(0, 1, 2)	0.05311	0.01940	–4.99254
5th Meeting dt: 1/18/2007	(1, 1 , 0)	–0.00083	0.03691	–3.72472	6th Meeting dt: 8/1/2007	(1, 1 , 0)	0.01605	0.01925	–5.02695
	(1, 1, 1)	–0.00482	0.03698	–3.70271		*(1, 1, 1)*	*0.03887*	*0.01902*	*–5.03238*
	(2, 1, 0)	–0.00411	0.03697	–3.70341		(2, 1, 0)	0.02136	0.01919	–5.01432
	(0, 1, 1)	*–0.00076*	*0.03691*	*–3.72479*		(0, 1, 1)	0.02128	0.01919	–5.03229
	(0, 1, 2)	–0.00481	0.03698	–3.70271		(0, 1, 2)	0.03201	0.01909	–5.02527
7th Meeting dt: 2/1/2008	(1, 1 , 0)	0.02754	0.01966	–4.98393	8th Meeting dt: 5/23/2008	(1, 1 , 0)	0.02991	0.02789	–4.28476
	(1, 1, 1)	*0.06383*	*0.01929*	*–5.00392*		(1, 1, 1)	0.10223	0.02683	–4.34419
	(2, 1, 0)	0.04755	0.01946	–4.98668		*(2, 1, 0)*	*0.15540*	*0.02603*	*–4.40523*
	(0, 1, 1)	0.03972	0.01954	–4.99654		(0, 1, 1)	0.01767	0.02807	–4.27222
	(0, 1, 2)	0.05311	0.01940	–4.99254		(0, 1, 2)	0.13268	0.02637	–4.37869
9th Meeting dt: 7/30/2008	(1, 1 , 0)	0.00985	0.13503	–1.13044	10th Meeting dt: 11/13/2008	(1, 1 , 0)	0.01479	0.13757	–1.09318
	(1, 1, 1)	0.01194	0.13489	–1.11450		*(1, 1, 1)*	*0.01644*	*0.13746*	*–1.07682*
	(2, 1, 0)	*0.01197*	*0.13489*	*–1.11453*		(2, 1, 0)	0.01606	0.13748	–1.07643
	(0, 1, 1)	0.00800	0.13516	–1.12857		(0, 1, 1)	0.01240	0.13774	–1.09076
	(0, 1, 2)	0.01018	0.13501	–1.11273		(0, 1, 2)	0.01390	0.13764	–1.07424
11th Meeting dt: 1/31/2009	(1, 1 , 0)	0.01399	0.13635	–1.11110	12th Meeting dt: 4/21/2009	*(1, 1 , 0)*	*0.13825*	*0.04968*	*–3.13047*
	(1, 1, 1)	*0.14393*	*0.12705*	*–1.23436*		(1, 1, 1)	0.13478	0.04978	–3.10840
	(2, 1, 0)	0.01477	0.13629	–1.09385		(2, 1, 0)	0.13479	0.04978	–3.10842
	(0, 1, 1)	0.01171	0.13650	–1.10879		(0, 1, 1)	0.12354	0.05010	–3.11354
	(0, 1, 2)	0.01381	0.13636	–1.09287		(0, 1, 2)	0.13153	0.04987	–3.10466

Continued—

Table 6—(*Continued*)

13th Meeting dt: 8/17/2009	*(1, 1 , 0)*	*0.06720*	*0.04619*
	(1, 1, 1)	0.06343	0.04628
	(2, 1, 0)	0.06343	0.04628
	(0, 1, 1)	0.06304	0.04629
	(0, 1, 2)	0.06321	0.04629
15th Meeting dt: 11/25/2009	(1, 1 , 0)	0.03374	0.02303
	(1, 1, 1)	*0.04222*	*0.02293*
	(2, 1, 0)	0.03382	0.02303
	(0, 1, 1)	0.02798	0.02310
	(0, 1, 2)	0.03341	0.02303
17th Meeting dt: 3/27/2010	(1, 1 , 0)	0.01046	0.02080
	(1, 1, 1)	0.00939	0.02081
	(2, 1, 0)	0.00679	0.02084
	(0, 1, 1)	*0.01112*	*0.02079*
	(0, 1, 2)	0.00715	0.02083
19th Meeting dt: 8/2/2010	*(1, 1 , 0)*	*–0.00154*	*0.02598*
	(1, 1, 1)	–0.00550	0.02603
	(2, 1, 0)	–0.00542	0.02603
	(0, 1, 1)	–0.00164	0.02598
	(0, 1, 2)	–0.00541	0.02603
21st Meeting dt: 30-Nov-2010	(1, 1 , 0)	0.01384	0.03307
	(1, 1, 1)	*0.01943*	*0.03298*
	(2, 1, 0)	0.01873	0.03299
	(0, 1, 1)	0.01094	0.03312
	(0, 1, 2)	0.01602	0.03304

Italic values shows ARIMA model fitting.

–3.27606	14th Meeting dt: 9/29/2009	*(1, 1 , 0)*	*0.06769*	*0.04613*	*–3.27876*
–3.25398		(1, 1, 1)	0.06392	0.04622	–3.25668
–3.25398		(2, 1, 0)	0.06392	0.04622	–3.25668
–3.27161		(0, 1, 1)	0.06359	0.04623	–3.27437
–3.25374		(0, 1, 2)	0.06367	0.04623	–3.25642
–4.66820	16th Meeting dt: 1/30/2010	(1, 1 , 0)	0.00034	0.02552	–4.46231
–4.65897		*(1, 1, 1)*	*0.01869*	*0.02529*	*–4.46279*
–4.65024		(2, 1, 0)	0.00273	0.02549	–4.44666
–4.66226		(0, 1, 1)	–0.00008	0.02553	–4.46189
–4.64982		(0, 1, 2)	0.00255	0.02550	–4.44648
–4.87189	18th Meeting dt: 5/24/2010	(1, 1 , 0)	0.00964	0.02086	–4.86571
–4.85276		(1, 1, 1)	0.00657	0.02089	–4.84457
–4.85014		(2, 1, 0)	0.00603	0.02090	–4.84402
–4.87255		*(0, 1, 1)*	*0.01032*	*0.02085*	*–4.86640*
–4.85050		(0, 1, 2)	0.00633	0.02090	–4.84433
–4.42718	20th Meeting dt: 9/29/2010	(1, 1 , 0)	0.08047	0.02095	–4.85707
–4.40519		(1, 1, 1)	0.11470	0.02056	–4.87697
–4.40526		*(2, 1, 0)*	*0.12227*	*0.02047*	*–4.88556*
–4.42708		(0, 1, 1)	0.05409	0.02125	–4.82879
–4.40528		(0, 1, 2)	0.09801	0.02075	–4.85828
–3.94416	22nd Meeting dt: 29-Jan-2011	(1, 1 , 0)	0.03068	0.03460	–3.85360
–3.93179		(1, 1, 1)	0.03703	0.03449	–3.84213
–3.93109		*(2, 1, 0)*	*0.03871*	*0.03446*	*–3.84388*
–3.94123		(0, 1, 1)	0.02427	0.03472	–3.84701
–3.92833		(0, 1, 2)	0.03570	0.03451	–3.84074

Table 4

Table 4

Table 5

Table 5

Table 6

Table 6

After calculating the normal/forecasted rates, Aggregated Abnormal Rate (AAR) was calculated as 28.8731 (Table 7 and Figure 3) which shows a positive impact of Monetary Policy announcement on market interest rates. Table 7 shows that there is significant impact of monetary policy on market interest rates within event window form τ-3 to τ+5. Then we analysed the impact of events one by one and Cumulative Abnormal Rate (CAR) was calculated as 28.8731 (Table 8 and Figure 4). Table 10 shows that 19 of 22 events had significant impact on market interest rates at different nine maturities (1/Week, 2/Week, 1/Month, 3/Months, 6/Months, 9/Months, 1/Year, 2/Years and 3/Years).

Table 7

Rates and Individual Day Significance: Jan. 05 to Mar. 11

Days in Eventn Window	Actaul Rate	Normal/Forcasted Rate	Abnormal Rate	AAR	t-value
–5	260.7811	260.8040	–0.0229	–0.0229	–0.2522
–4	260.9136	260.8736	0.0399	0.0170	0.2946
–3	261.6519	260.9367	0.7152	0.7322	**2.4615***
–2	262.1000	260.9869	1.1131	1.8453	**2.4190***
–1	262.8748	261.0326	1.8421	3.6875	**3.6238***
0	265.1158	261.0715	4.0443	7.7318	**7.0607***
1	265.7656	261.1072	4.6583	12.3901	**7.9881***
2	266.4433	261.1392	5.3042	17.6943	**8.2626***
3	265.6098	261.1690	4.4408	22.1351	**11.9749***
4	264.8452	261.1967	3.6485	25.7836	**9.7664***
5	264.3126	261.2231	3.0895	28.8731	**6.7177***

Table 8

Rates and Event Wise Significance: Jan. 05 to Mar. 11

Days in Eventn Window	Actaul Rate	Normal/Forcasted Rate	Abnormal Rate	CAR	t-value
Event 1	75.3522	67.9443	7.4080	7.4080	**18.0585***
Event 2	100.8250	99.3769	1.4481	8.8561	**2.0305***
Event 3	102.2111	102.2166	–0.0055	8.8506	(0.0391)
Event 4	114.2944	115.0654	–0.7709	8.0797	**(3.6975)***
Event 5	115.2628	115.4023	–0.1396	7.9401	(1.4245)*
Event 6	111.2650	109.2789	1.9861	9.9262	**14.0075***
Event 7	112.7933	111.0624	1.7309	11.6571	**12.4643***
Event 8	140.1200	122.2642	17.8558	29.5129	**13.7039***
Event 9	147.7550	150.6632	–2.9082	26.6047	**(2.7448)***
Event 10	164.3444	166.8517	–2.5072	24.0975	**(2.3678)***
Event 11	156.8222	158.5994	–1.7772	22.3203	**(2.5528)***
Event 12	150.8872	150.5597	0.3276	22.6478	0.5155
Event 13	139.3917	138.3434	1.0483	23.6961	**3.2203***
Event 14	141.5072	140.8013	0.7059	24.4020	**5.2880***
Event 15	139.8756	141.9715	–2.0960	22.3060	**(10.5819)***
Event 16	137.5650	137.8600	–0.2950	22.0110	–1.6912
Event 17	138.0600	138.6838	–0.6238	21.3872	**(2.6103)***
Event 18	135.9483	136.4884	–0.5401	20.8471	**(2.4462)***
Event 19	138.8070	135.4828	3.3243	24.1713	**38.5478***
Event 20	141.1389	140.3797	0.7592	24.9305	**2.3864***
Event 21	146.1483	143.3243	2.8241	27.7546	**11.7370***
Event 22	150.0389	148.9204	1.1185	28.8731	**4.9310***

Fig. 3. AAR Withing Event Window

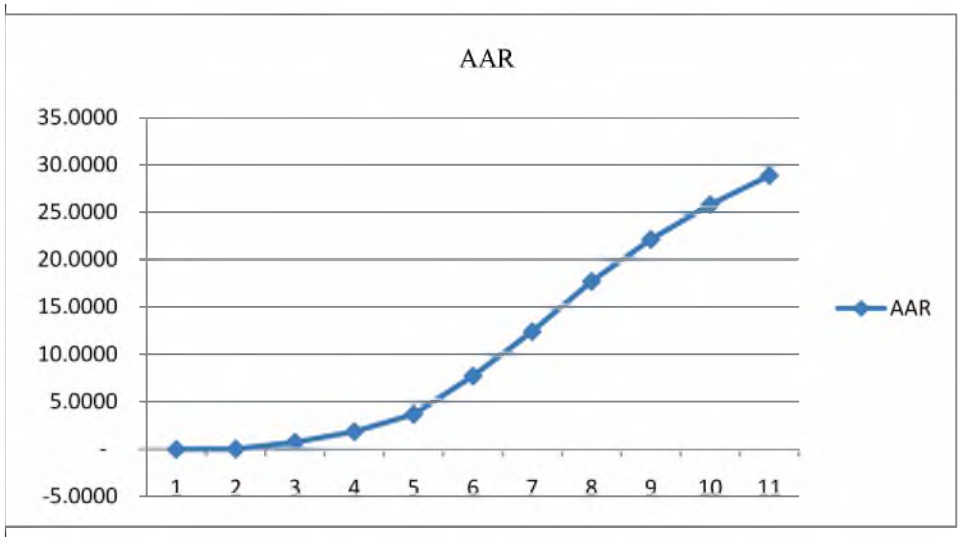
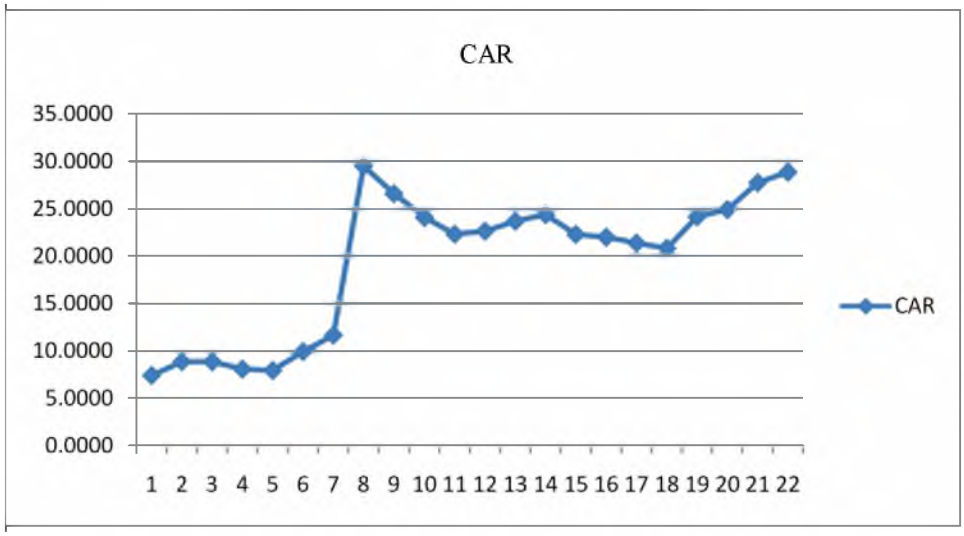


Fig. 4. CAR Across Event Window



5. CONCLUSION

This study investigated the impact of MP announcements on market interest rates at different nine maturities (1/Week, 2/Week, 1/Month, 3/Months, 6/Months, 9/Months, 1/Year, 2/Years and 3/Years) in Pakistan. The Event window of 11 days and an estimation window of 250 days were constructed. ARCH effect is analysed in market interest rates at each maturity by using Breusch Pagen ARCH Test. Furthermore, GARCH model was applied where ARCH effect was observed to forecast the normal rate. The study could not find significant ARCH effect in market interest rates at (1/Year, 2/Years and 3/Years) maturities and ARIMA model was applied to calculate the normal rates from estimation

window (t-250). The AAR and CAR at 28.8731 showed an impact of monetary policy announcements on market interest rates at different nine maturities. The null hypothesis of zero abnormal rates was rejected since the results were found in critical region under normal distribution. Our results are in line with Pederson (1997), Patelis (1997), Hardy (1998), Kaketsis and Sarantis (2006). A positive change was observed for three days before and after MP announcements. At 4th day, there was a slight positive change at 1st maturity (1-Week) and rates were normal at 5th day at 1st maturity. However, these rates were normal after 5th day at all of the remaining maturities. It looks that the market participants anticipates the bank's changes in policy rate quickly.

REFERENCES

Kaketsis, A. and N. Sarantis (2006) The Effects of Monetary Policy Changes on Market Interest Rates in Greece: An Event Study Approach. *International Review of Economics and Finance* 15, 487–504.

Agha, Ahmed, Mubarik, and Shah (2005) Transmission Mechanism of Monetary Policy in Pakistan. *SBP-Research Bulletin* 1:1.

Andersen, Torben G. and Tim Bollerslev (1998) Intraday Activity Patterns Macroeconomic Announcements, and Longer-run Dependencies. *Journal of Finance* 53.

Bernanke, Ben S. and Alan S. Blinder (1992) The Federal Funds Rate and the Channels of Monetary Transmission. *American Economic Review* 82:4, 901–21.

Berry, Thomas D. and Keith M. Howe (1994) Public Information Arrival. *Journal of Finance* 49, 1331–1346.

Bomfim, Antulio N. and Vincent R. Reinhart (2000) Making News: Financial Market Effects of Federal Reserve Disclosure Practices (Manuscript). Federal Reserve Board.

Cook, T. and T. Hahn (1988) The Information Content of Discount Rate Announcements and Their Effect on Market Interest Rates. *Journal of Money, Credit and Banking* 20, 167–180.

Cook, T. and T. Hahn (1989) The Effect of Changes in the Federal Funds Rate Target on Market Interest Rates in the 1970s. *Journal of Monetary Economics* 24, 331–351.

Cutler, David M., James M. Poterba, and Lawrence H. Summers (1989) What Moves Stock Prices? *Journal of Portfolio Management* 15, 4–12.

Dale, S. (1993) The Effect of Changes in the UK Rates on Market Interest Rates since 1987. *Manchester School* 41 (Suppl.), 76–94.

Dueker, M. J. (1992, July/August). The Response of Market Interest Rates to Discount Rate Changes. *Federal Reserve Bank of St. Louis Review*, 78–91.

Ederington, Louis H. and Jae Ha Lee (1993) How Markets Process Information: News Releases and Volatility. *Journal of Finance* 48, 1161–1191.

Garfinkel, R. and D. L. Thornton (1995) The Information Content of the Federal Funds Rate: Is It Unique? *Journal of Money, Credit and Banking* 27, 838–847.

Hardy, D. C. (1998) Anticipation and Surprises in Central Bank Interest Rate Policy. *IMF Staff Papers* 45, 647–671.

Jensen, G. R. and R. R. Johnson (1995) Discount Rate Changes and Security Returns in the US, 1962–1991. *Journal of Banking and Finance* 19, 79–95.

Jochen, Geoffery and Natalia (2005) The Impact of Macroeconomic Announcements on Emerging Markets Bonds. International Monetary Fund. (WP/05/83).

Jones, Charles M., Owen Lamont, and Robin L. Lumsdaine (1998) Macroeconomic News and Bond Market Volatility. *Journal of Financial Economics* 47, 315–337.

Kashyap, Anil K, Jeremy C. Stein, and David W. Wilcox (1993) Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance. *American Economic Review* 83:1, 78–98.

Kuttner, K. N. (2000) Monetary Policy Surprises and Interest Rates: Evidence from the Fed Funds Futures Market. Federal Reserve Bank of New York. (Staff Paper).

Kuttner, Kenneth N. (1999) Monetary Policy Surprises and Interest Rates: Evidence from the Fed Funds Futures Market. Manuscript, Federal Reserve Bank of New York.

MacKinlay, A. C. (1997, March) Event Studies in Economics and Finance. *Journal of Economic Literature* 35, 13–39.

Mitchell, Mark L. and J. Harold Mulherin (1994) The Impact of Public Information on the Stock Market. *Journal of Finance* 49:3, 923–950.

Paquet, A. and T. Pe´rez (1995) La Re´action du Marche´ Financier Face a` Diffe´rentes Sources de Signal de la PolitiqueMone´taire au Canada. *Canadian Journal of Economics* 28, 808–821.

Patelis, A. D. (1997) Stock Return Predictability: The Role of Monetary Policy. *Journal of Finance* 52, 1951–1972.

Pedersen, S. L. (1997) Market Reactions to Changes in the Danish Discount Rate. *Denmarks National Bank Monetary Review,* 3rd Quarter.

Reinhart, Vincent R. and Timothy Simin (1997) The Market Reaction to Federal Reserve Policy action from 1989 to 1992. *Journal of Economics and Business* 49:2, 149–168.

Roley, V. Vance and Gordon H. Sellon, Jr. (1998) Market Reaction to Monetary Policy Non-announcements. Federal Reserve Bank of Kansas City. (Research Working Paper 98-06).

Roll, Richard (1988) R2. *Journal of Finance* 43, 541–566.

Rudebusch, G. D. (1995) Federal Reserve Interest Rate Targeting, Rational Expectations, and the Term Structure. *Journal of Monetary Economics* 35, 245–274.

Thornton, D. L. (1994) Why Do T-bill Rates React to Discount Rate Changes? *Journal of Money, Credit and Banking* 26, 839–849.

Thornton, D. L. (1986) Discount Rate and Market Interest Rates: Theory and Evidence. *Federal Reserve Bank of St. Louis Review*, 5–21.

Thornton, D. L. (1998) Tests of the Market's Reaction to Federal Funds Rate Target Changes. *Federal Reserve Bank of St. Louis Review*, 27–36.