

The Effect of Policy Rate Changes on Bank Stock Returns in Pakistan

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Abstract

Objective of this study is to analyze the impact of policy rate changes on bank stock returns in Pakistan by using daily stock returns from 1998 to 2011. We used event study approach by constructing the estimation window of 250 days and an event window of 31 days (15 pre-event days, event day and 15 post event days). The daily stock returns from 1998 to 2011 have been used to analyze the impact of policy rate changes by State Bank of Pakistan (SBP) on banking stock returns. The study used ARIMA model to estimate the normal returns by using estimation window of 250 days.¹ Since Monetary Policy committee decides changes in policy rate, we have used date of MP Committee meeting as an event. Reportedly, 35 meetings were conducted during study period from Jan 1998 to Dec 2011. Abnormal returns are calculated by taking the difference of actual daily stock returns and estimated daily stock returns. Abnormal daily stock returns are aggregated as cumulative abnormal returns (CAR). The CAR at 0.6340 showed a significant impact of policy rate changes on banks stock returns. The study finds 31 out of all 35 events have significant impact on banks stock returns and returns were normal at 4th day of MP announcement. Further, we analyzed the impact with respect to expansionary and contractionary monetary policy and observed that the highest positive impact on banks stock returns was due to expansionary monetary policy.

JEL Classifications: E44, E52, E58, G21

Keywords: bank stock returns, monetary policy, event window, policy rate changes

1. Introduction

Monetary Policy committee (PMC) mentions the goals of monetary policy as to achieve the maximum level of employment, output and modest long term interest rates through controlling money supply. But, Board does not explain the linkage of monetary policy announcement and other macroeconomic variables. Interestingly, these announcements do not affect these variables directly. Only a small portion of aggregate lending and borrowing is on policy rate. Bernanke (2004)

¹ In case of 1st event dt: July 01, 1998; the estimation window was of only 114 days as I collected the data of stock prices from Jan 01, 1998 to Dec 31, 2011.

reported that from macroeconomic perspective, the long term interest rates (Rates on treasury bonds, treasury notes, home mortgage and corporate bond) are most significant than Federal Fund Rate, because businesses and households made their spending and business decisions on the basis of these long term interest rates. Even the monetary policy committee doesn't determine these long term interest rates directly but it has significant influence over these rates through the formation of expectations by private sector about the upcoming monetary policy actions. These expectations play an important role in determination of long term interest rates, asset prices, stock returns and yields.

Bernanke and Kuttner (2005) analyzed the immediate and direct impact on these announcements on financial markets. Any change by the monetary policy board of respective country will hit the value of financial assets, and then will affect spending decision of the nation. Increase in interest rates will increase the firm's cost and cash outflow of the firm. Increase in cash outflow will decrease the firm's profit and dividend, which will ultimately hit the stock prices/stock returns. In this way, the board achieves the ultimate goals of monetary policy through the linkage of macroeconomic variables and balance sheet/income statement items of the business.

Modern financial literature focuses on the fact that stock returns are affected by the arrival of new information and announcements especially macro-economic announcements. Monetary Policy Announcement (MPA) is one of the major macro-economic announcements of the country, so financial economists are trying to find out the impact of MPA on various markets including stocks, bonds and forex. Federal Open Market Committee (FOMC) has been conducting eight regular scheduled meeting in America since 1981 and these meetings have also been conducting in UK and other developed countries in the same frequency. But, there is no evidence of such regular meetings in Pakistan before 2005. MPC of the central board started to conduct these meetings at regular interval from 2005 and this is good sign for Pakistan. State Bank of Pakistan is now in a position to review the economy on quarterly basis and can use policy rate, one of the important monetary policy tools, to control the economy through maintaining the supply of money in Pakistan. SBP control the economy with the help of all the commercial banks in Pakistan, so policy rate hits the operations of the banking business. Decrease in policy rate will increase the advances on the assets side of balance sheets of commercial banks. As advances are the major source of income for the commercial banks, so it will help the banks in generating more revenue. More revenue means more profit, more dividend and more stock return. So, we can say that policy rate effect the banking stock returns in Pakistan. Bernanke and Kuttner (2005) provided the linkage between monetary policy and the returns in equity market. They pointed out that the decision of investor depends upon the expected changes. As concern to the Pakistani market and this linkage, nobody has evaluated this impact of policy rate changes on the stock returns of banking sector in Pakistan. This impact will improve the understanding of MP transmission.

Madura and Schnusenberg (2000) analyzed the linkage between funds rate targets and banks stock returns. They reported an inverse relationship by using event study methodology. Rahman and Mohsin (2011a) used event study methodology to analyze the impact of monetary policy on stock returns in Pakistan and observed the significant impact of monetary policy announcements on stock returns. They decomposed interest rates into expected and un-expected interest rates by using Hodrick Prescott filter, because future contracts bases on short term money market interest rates were not available in KSE from the period of their study. They reported the long run relationship between stock returns and un-anticipated interest rates while short run between stock returns and anticipated interest rates by using Engle-Granger co-integration test.

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), Roley and Sellon Jr. (1998), Thornton (1998), and Reinhart and Simin (1997) measured the financial market's reaction to monetary policy actions by following event study approach.

Rapallo (1998) analyzed the significant relationship between monetary policy changes and European stock returns. They used structured VAR model and also assimilated the country specific factors in the model.

We can categorized the studies regarding the impact of monetary policy on different financial markets into following three categories by analyzing the studies by Cook and Hahn (1988, 1989), Chen, Mohan, and Steiner (1999), Thorntan (1998), Bernanke and Kuttner (2005), Thorbecke's (1997), Lobo (2002), Kuttner (2001) and Guo (2004);

1. Proxies for Monetary Policy;
 - a. Federal Fund Rate target,
 - b. Reserves (Non-borrowed),
 - c. Discount Rate,
 - d. Policy Rate.
2. Methodology;
 - a. Event Study,
 - b. VAR,
 - c. GARCH.
3. Financial Instruments/Assets;
 - a. Bank Stock,
 - b. Stock (General),
 - c. Bonds (on different interest rates),
 - d. Foreign Exchange,
 - e. Real Estate.

Smirlock and Yawitz (1985) also used event study to analyze the impact of monetary policy on stock returns as well as on market interest rates at different maturities by using pre-79 and post-79 data in America. They concluded with no significant impact of monetary policy announcements before 1979 but they reported a negative reaction of both stock and bond market by increasing discount rates and positive reaction by decreasing discount rates. Born and Moser (1990) analyzed the reaction of bank stock returns to Fed's change in discount rate by using event study, using the announcement day as event day. They concluded that the decreasing trend was observed in bank stock by the increase in discount rate both pre and post event.

This study will be a contribution in financial literature by providing the empirical evidence on the linkage between policy rate changes and banks stock returns in Pakistan. Objective of this paper is to analyze the impact of policy rates changes on stock returns of banking sector in Pakistan. We used event study approach and monetary policy announcements were taken as event day. Estimation window of 250 days and an event window of 31 days were constructed. Abnormal returns were calculated by taking the difference of actual stock returns and normal stock returns. Normal stock returns were estimated by using ARIMA (p,d,q) model. ARIMA model was fitted by following the Adjusted R², SER, and Schwarz criteria. We preferred BIC (Schwarz criteria) in case of having difference between these three criteria. Then abnormal returns were aggregated from two dimensions; i.e. event-wise and day-wise analysis.

We applied t-test to test the null hypothesis of zero abnormal returns in banking sector of Pakistan. As SBP changes the policy rates in monetary policy meetings, so the followings will be our hypothesis for event study approach;

H₀: There is no significant impact of monetary policy announcement on banks stock returns,

H₁: There is significant impact of monetary policy announcement on banks stock returns.

At the end, we analyzed the impact of policy rate changes with respect to expansionary and contractionary monetary policy.

Next section will discuss the methodology, Section 4 is on Estimation and Discussion of Results and finally we will conclude in section 5.

2. Method

We evaluated the impact of change in policy rate by State Bank of Pakistan (SBP) on the bank stock returns of Pakistan. Our population was all of the commercial banks existing in the Pakistan and we selected 13 commercial banks those represents almost entire banking sector of Pakistan. We collected the daily stock prices of 13 selected commercial banks from Jan 01, 1998 to Dec 31, 2011.² Then stock returns were calculated from these stock prices by continuous compounding method as follows,

$$R_t = \ln(P_t/P_{t-1})$$

State Bank of Pakistan announces the policy rate as their monetary policy decision taken by the monetary policy committee in their meeting. SBP started to conduct regular monetary policy meeting from 2005 onwards as no meeting was conducted during 2003 and 2004. Now, SBP is conducting 4 to 5 meetings at almost equal interval for proper monitoring and implementing the policy rates. By following Rahman and Mohsin (2011a, 2011b), we applied the event study approach to capture this impact of policy rate change on the stock returns of banking sector in Pakistan. Monetary policy announcement is taken as event to capture the impact of policy rate change as policy rate changes at each monetary policy meeting.

2.1 Time Line for the Study

The following time line (Figure# 1) will be used for our study;



Time Line for an Event Study

Figure 1. Time Line for the Study

² Data of some banks, which started their business after 1998, were taken from their dates of commencement of business.

Event window should be separated from estimation and post-event window. Basic assumption of this methodology is that event impact is captured by abnormal returns only. Due to this assumption, event window should not overlap the estimation window because in case of this overlapping, event impact will also be captured by normal returns and this will be very problematic for calculating the event impact. We constructed the estimation window of 250 days and the event window of 31 days (MacKinlay 1997). Event window is further bifurcated as 15 pre-event days, 1 event day and 15 post event days.

2.2 Capturing the Event Impact

In case of event study approach, MacKinlay (1997) suggested the following steps for capturing the event impact;

2.2.1 Abnormal Returns

Abnormal returns were calculated by taking difference of normal returns and actual returns from 1998 to 2011. Normal Returns were estimated by using the ARIMA (p,d,q) model on estimation window of 250 days.³ This forecasting through ARIMA model is an integral part of our study.

2.2.1.1 ARIMA Model Fitting

ARIMA model was fitted by using following criteria;

1. BIC (Schwarz Criterion), relatively smaller value,
2. SER/SEE, relatively smaller value,
3. Adjusted R², relatively higher value.

As ARIMA was fitted on the basis of above mentioned criteria, so we used E-Views for the detailed calculation of ARIMA model fitting which is provided in Table# 1. After deciding the ARIMA model fit, we estimated the normal returns for all of 35 selected events from 1998 to 2011, which were deducted from actual return to calculate the abnormal returns. Abnormal returns were calculated for entire event window, i.e. pre-event days, event day, and the post-event days within event window.

2.2.2 Accumulation of Abnormal Returns

Abnormal Returns were aggregated on both sides, i.e. day-wise and event-wise. Day wise aggregation is within the event window (t-15, t-14, t-13, t-12, t-11, t-10, t-9, t-8, t-7, t-6, t-5, t-4, t-3, t-2, t-1, 0, t+1, t+2, t+3, t+4, t+5, t+6, t+7, t+8, t+9, t+10, t+11, t+12, t+13, t+14, t+15) and event wise aggregation is across the window (From event 1 to 35).

2.2.2.1 Day-wise Aggregation within Event Window

For aggregation of abnormal returns within event window as day-wise, we consider the 31 days (t-15, t-14, t-13, t-12, t-11, t-10, t-9, t-8, t-7, t-6, t-5, t-4, t-3, t-2, t-1, 0, t+1, t+2, t+3, t+4, t+5, t+6, t+7, t+8, t+9, t+10, t+11, t+12, t+13, t+14, t+15) within constructed event window. Cumulative Abnormal Returns (CAR) is here delineated on the kth event for the jth market in all of the following upcoming cases:

$$CAR_{JK} = \sum_{T-15}^{T+15} CAR_{JK}$$

³ In case of 1st event dt: July 01, 1998; the estimation window was of only 114 days due as I collected the data of stock prices from Jan 01, 1998 to Dec 31, 2011.

Table 1 ARIMA Model fitting (Meeting 1-18)

MP					MP				
Meetings/Announcements	ARIMA (p,d,q)	Adj R2	SER	BIC	Meetings/Announcements	ARIMA (p,d,q)	Adj R2	SER	BIC
1st Announcement dated:	(1, 0, 0)	0.1145	0.0469	-3.2169	2nd Announcement dated:	(1, 0, 0)	0.0681	0.0372	-3.7069
July 01, 98	(1, 0, 1)	0.1587	0.0457	-3.2351	March 04, 99.	(1, 0, 1)	0.0729	0.0371	-3.6940
	(2, 0, 0)	-0.0066	0.0502	-3.0793		(2, 0, 0)	-0.0039	0.0386	-3.6324
	(0, 0, 1)	0.1601	0.0454	-3.2791		(0, 0, 1)	0.0681	0.0372	-3.7069
	(0, 0, 2)	-0.0064	0.0497	-3.0983		(0, 0, 2)	-0.0039	0.0386	-3.6324
3rd Announcement dated:	(1, 0, 0)	-0.0014	0.0245	-4.5431	4th Announcement dated:	(1, 0, 0)	-0.0005	0.0252	-4.4853
April 02, 99.	(1, 0, 1)	-0.0042	0.0245	-4.5222	May 19, 99.	(1, 0, 1)	0.0136	0.0251	-4.4815
	(2, 0, 0)	-0.0012	0.0245	-4.5433		(2, 0, 0)	-0.0026	0.0253	-4.4833
	(0, 0, 1)	-0.0018	0.0245	-4.5427		(0, 0, 1)	-0.0005	0.0252	-4.4853
	(0, 0, 2)	0.0000	0.0245	-4.5445		(0, 0, 2)	-0.0026	0.0253	-4.4833
5th Announcement dated:	(1, 0, 0)	0.0036	0.0187	-5.0813	6th Announcement dated:	(1, 0, 0)	-0.0011	0.0191	-5.0387
Jan 05, 2000.	(1, 0, 1)	0.0211	0.0186	-5.0810	Oct 05, 2000.	(1, 0, 1)	-0.0025	0.0191	-5.0193
	(2, 0, 0)	-0.0035	0.0188	-5.0741		(2, 0, 0)	0.0122	0.0190	-5.0521
	(0, 0, 1)	0.0042	0.0187	-5.0819		(0, 0, 1)	-0.0016	0.0191	-5.0382
	(0, 0, 2)	-0.0034	0.0188	-5.0742		(0, 0, 2)	0.0178	0.0190	-5.0578
7th Announcement dated:	(1, 0, 0)	0.0133	0.0142	-5.6363	8th Announcement dated:	(1, 0, 0)	0.0185	0.0134	-5.7472
June 07, 01.	(1, 0, 1)	0.0107	0.0142	-5.6156	July 19, 01.	(1, 0, 1)	0.0141	0.0134	-5.7228
	(2, 0, 0)	0.0003	0.0143	-5.6233		(2, 0, 0)	-0.0043	0.0136	-5.7242
	(0, 0, 1)	0.0106	0.0142	-5.6336		(0, 0, 1)	0.0186	0.0134	-5.7472
	(0, 0, 2)	0.0023	0.0143	-5.6253		(0, 0, 2)	-0.0043	0.0136	-5.7242
9th Announcement dated:	(1, 0, 0)	0.0100	0.0132	-5.7841	10th Announcement dated:	(1, 0, 0)	0.0100	0.0132	-5.7841
Aug 17, 01.	(1, 0, 1)	0.0067	0.0132	-5.7627	Oct 22, 01.	(1, 0, 1)	0.0067	0.0132	-5.7627
	(2, 0, 0)	-0.0039	0.0133	-5.7702		(2, 0, 0)	-0.0039	0.0133	-5.7702
	(0, 0, 1)	0.0104	0.0132	-5.7845		(0, 0, 1)	0.0104	0.0132	-5.7845
	(0, 0, 2)	-0.0039	0.0133	-5.7701		(0, 0, 2)	-0.0039	0.0133	-5.7701
11th Announcement dated:	(1, 0, 0)	0.0175	0.0131	-5.7887	12th Announcement dated:	(1, 0, 0)	0.0154	0.0145	-5.5943
Jan 23, 02.	(1, 0, 1)	0.0153	0.0132	-5.7684	Nov 18, 02.	(1, 0, 1)	0.0147	0.0145	-5.5756
	(2, 0, 0)	0.0005	0.0133	-5.7716		(2, 0, 0)	-0.0011	0.0146	-5.5777
	(0, 0, 1)	0.0132	0.0132	-5.7843		(0, 0, 1)	0.0177	0.0145	-5.5967
	(0, 0, 2)	0.0043	0.0132	-5.7753		(0, 0, 2)	-0.0004	0.0146	-5.5784
13th Announcement dated:	(1, 0, 0)	0.0048	0.0148	-5.5510	14th Announcement dated:	(1, 0, 0)	0.0661	0.0179	-5.1763
April 11, 05.	(1, 0, 1)	0.0103	0.0148	-5.5386	July 21, 05.	(1, 0, 1)	0.0675	0.0178	-5.1597
	(2, 0, 0)	-0.0040	0.0149	-5.5422		(2, 0, 0)	-0.0037	0.0185	-5.1041
	(0, 0, 1)	0.0053	0.0148	-5.5515		(0, 0, 1)	0.0712	0.0178	-5.1817
	(0, 0, 2)	-0.0039	0.0149	-5.5423		(0, 0, 2)	-0.0039	0.0185	-5.1040
15th Announcement dated:	(1, 0, 0)	0.0733	0.0178	-5.1819	16th Announcement dated:	(1, 0, 0)	0.0324	0.0182	-5.1442
Jan 26, 06.	(1, 0, 1)	0.0726	0.0178	-5.1631	July 31, 06.	(1, 0, 1)	0.0302	0.0182	-5.1239
	(2, 0, 0)	-0.0017	0.0185	-5.1041		(2, 0, 0)	-0.0039	0.0185	-5.1073
	(0, 0, 1)	0.0763	0.0178	-5.1852		(0, 0, 1)	0.0341	0.0181	-5.1460
	(0, 0, 2)	-0.0019	0.0185	-5.1039		(0, 0, 2)	-0.0039	0.0185	-5.1074
17th Announcement dated:	(1, 0, 0)	0.0103	0.0187	-5.0865	18th Announcement dated:	(1, 0, 0)	-0.0006	0.0148	-5.5523
Jan 18, 07.	(1, 0, 1)	0.0069	0.0187	-5.0650	Aug 01, 07.	(1, 0, 1)	-0.0008	0.0148	-5.5341
	(2, 0, 0)	-0.0037	0.0188	-5.0725		(2, 0, 0)	0.0015	0.0148	-5.5544
	(0, 0, 1)	0.0109	0.0187	-5.0871		(0, 0, 1)	-0.0011	0.0148	-5.5518
	(0, 0, 2)	-0.0036	0.0188	-5.0726		(0, 0, 2)	0.0020	0.0148	-5.5549

Italic Values shows the order of fitted model (ARIMA)

Tabel # 1: Continued (Meetings 19-35)

MP					MP				
Meetings/Announcements	ARIMA (p,d,q)	Adj R2	SER	BIC	Meetings/Announcements	ARIMA (p,d,q)	Adj R2	SER	BIC
19th Announcement dated:	<i>(1, 0, 0)</i>	0.0054	0.0155	-5.4655	20th Announcement dated:	<i>(1, 0, 0)</i>	0.0094	0.0142	-5.6403
Feb 01, 08.	(1, 0, 1)	0.0060	0.0155	-5.4481	May 23, 08.	(1, 0, 1)	0.0054	0.0142	-5.6183
	(2, 0, 0)	0.0021	0.0155	-5.4622		(2, 0, 0)	-0.0036	0.0143	-5.6273
	(0, 0, 1)	0.0039	0.0155	-5.4640		(0, 0, 1)	0.0089	0.0142	-5.6399
	(0, 0, 2)	0.0014	0.0155	-5.4615		(0, 0, 2)	-0.0036	0.0143	-5.6273
21st Announcement dated:	<i>(1, 0, 0)</i>	0.0553	0.0156	-5.4410	22nd Announcement dated:	<i>(1, 0, 0)</i>	0.1298	0.0177	-5.1891
July 30, 08.	(1, 0, 1)	0.0531	0.0157	-5.4207	Nov 13, 08.	(1, 0, 1)	0.1331	0.0177	-5.1749
	(2, 0, 0)	0.0080	0.0160	-5.3921		(2, 0, 0)	-0.0020	0.0190	-5.0481
	(0, 0, 1)	0.0457	0.0157	-5.4309		<i>(0, 0, 1)</i>	0.1308	0.0177	-5.1903
	(0, 0, 2)	0.0070	0.0160	-5.3912		(0, 0, 2)	-0.0017	0.0190	-5.0484
23th Announcement dated:	<i>(1, 0, 0)</i>	0.2276	0.0187	-5.0864	24th Announcement dated:	<i>(1, 0, 0)</i>	0.1886	0.0230	-4.6539
Jan 31, 09.	(1, 0, 1)	0.2253	0.0187	-5.0653	April 21, 09.	<i>(1, 0, 1)</i>	0.2178	0.0226	-4.6639
	(2, 0, 0)	0.0382	0.0208	-4.8671		(2, 0, 0)	0.1368	0.0237	-4.5920
	(0, 0, 1)	0.1909	0.0191	-5.0399		(0, 0, 1)	0.1240	0.0239	-4.5772
	(0, 0, 2)	0.0330	0.0209	-4.8617		(0, 0, 2)	0.1258	0.0239	-4.5793
25th Announcement dated:	<i>(1, 0, 0)</i>	0.0928	0.0231	-4.6630	26th Announcement dated:	<i>(1, 0, 0)</i>	0.0876	0.0227	-4.6946
Aug 17, 09.	<i>(1, 0, 1)</i>	0.1104	0.0229	-4.6645	Sep 29, 09.	<i>(1, 0, 1)</i>	0.1112	0.0224	-4.7027
	(2, 0, 0)	0.0502	0.0236	-4.6172		(2, 0, 0)	0.0612	0.0231	-4.6661
	(0, 0, 1)	0.0656	0.0234	-4.6335		(0, 0, 1)	0.0620	0.0230	-4.6669
	(0, 0, 2)	0.0474	0.0237	-4.6141		(0, 0, 2)	0.0541	0.0231	-4.6585
27th Announcement dated:	<i>(1, 0, 0)</i>	0.0584	0.0244	-4.5517	28th Announcement dated:	<i>(1, 0, 0)</i>	-0.0040	0.0215	-4.8087
Nov 25, 09.	<i>(1, 0, 1)</i>	0.0863	0.0240	-4.5636	Jan 30, 10.	<i>(1, 0, 1)</i>	-0.0038	0.0215	-4.7909
	(2, 0, 0)	0.0568	0.0244	-4.5499		<i>(2, 0, 0)</i>	-0.0003	0.0214	-4.8124
	(0, 0, 1)	0.0406	0.0246	-4.5330		(0, 0, 1)	-0.0038	0.0215	-4.8089
	(0, 0, 2)	0.0505	0.0245	-4.5433		(0, 0, 2)	-0.0019	0.0214	-4.8108
29 Announcement dated:	<i>(1, 0, 0)</i>	0.0027	0.0174	-5.2302	30th Announcement dated:	<i>(1, 0, 0)</i>	-0.0033	0.0148	-5.5488
March 27, 10.	(1, 0, 1)	0.0165	0.0173	-5.2261	May 24, 10.	<i>(1, 0, 1)</i>	-0.0059	0.0148	-5.5254
	(2, 0, 0)	-0.0039	0.0174	-5.2236		<i>(2, 0, 0)</i>	0.0082	0.0147	-5.5603
	(0, 0, 1)	0.0004	0.0174	-5.2279		(0, 0, 1)	-0.0037	0.0148	-5.5484
	(0, 0, 2)	-0.0040	0.0174	-5.2235		(0, 0, 2)	0.0103	0.0147	-5.5624
31st Announcement dated:	<i>(1, 0, 0)</i>	-0.0040	0.0151	-5.5072	32nd Announcement dated:	<i>(1, 0, 0)</i>	0.0009	0.0150	-5.5309
Aug 02, 10.	(1, 0, 1)	-0.0002	0.0151	-5.4928	Sep 29, 10.	<i>(1, 0, 1)</i>	0.0095	0.0149	-5.5215
	(2, 0, 0)	0.0101	0.0150	-5.5213		<i>(2, 0, 0)</i>	0.0052	0.0149	-5.5352
	(0, 0, 1)	-0.0039	0.0151	-5.5072		(0, 0, 1)	0.0005	0.0150	-5.5305
	<i>(0, 0, 2)</i>	0.0105	0.0150	-5.5217		(0, 0, 2)	0.0038	0.0149	-5.5338
33th Announcement dated:	<i>(1, 0, 0)</i>	-0.0039	0.0132	-5.7739	34th Announcement dated:	<i>(1, 0, 0)</i>	-0.0011	0.0138	-5.6955
Nov 29, 10.	(1, 0, 1)	0.0135	0.0131	-5.7733	March 25, 11.	<i>(1, 0, 1)</i>	-0.0016	0.0138	-5.6950
	<i>(2, 0, 0)</i>	0.0124	0.0131	-5.7902		<i>(2, 0, 0)</i>	-0.0001	0.0138	-5.6965
	(0, 0, 1)	-0.0039	0.0132	-5.7739		(0, 0, 1)	-0.0016	0.0138	-5.6950
	(0, 0, 2)	0.0116	0.0131	-5.7893		(0, 0, 2)	-0.0008	0.0138	-5.6958
35th Announcement dated:	<i>(1, 0, 0)</i>	0.0016	0.0137	-5.7008					
May 20, 11.	(1, 0, 1)	0.0131	0.0137	-5.6944					
	(2, 0, 0)	-0.0015	0.0138	-5.6978					
	(0, 0, 1)	0.0011	0.0137	-5.7003					
	(0, 0, 2)	-0.0007	0.0138	-5.6986					

Italic Values shows the order of fitted model (ARIMA)

We performed our analysis of abnormal returns on the basis of average (Arithmetic Mean) to find out one figure for deciding our event impact. Average of CAR is evaluated as;

$$\overline{CAR}_{JK} = \frac{1}{15} \sum_{T-15}^{T+15} CAR_{JK}$$

2.2.2.2 Event-wise Accumulation across the Event Window

Our focus was on the impact of policy rate changes on bank stock returns, so we were interested in finding out an overall impact of all of the 35 announcements. CAR for all 35 MP meetings is calculated as follows;

$$CAR_{jk} = \sum_{n=1}^{35} AR_{jk}$$

At the end we calculated its average (Arithmetic Mean) to conclude the overall impact of announcements on the stock returns of banking sector in Pakistan, as follows;

$$\overline{CAR}_{jk} = \frac{1}{35} \sum_{n=1}^{35} CAR_{jk}$$

2.2.3 Hypothesis Testing

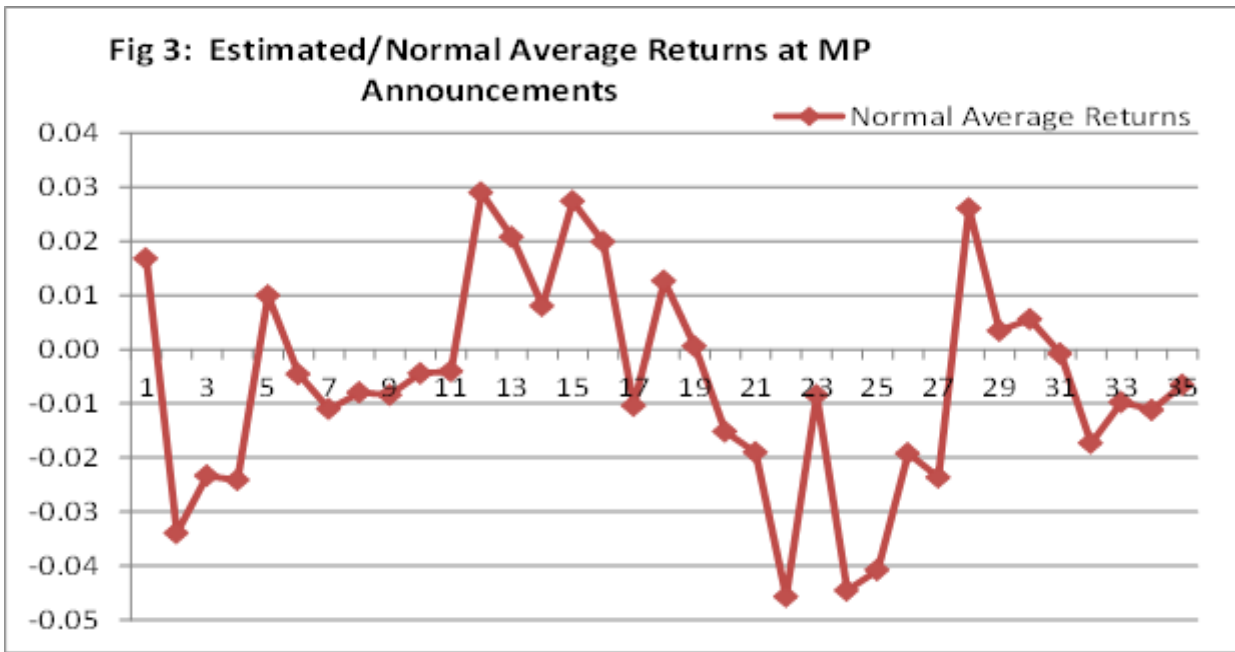
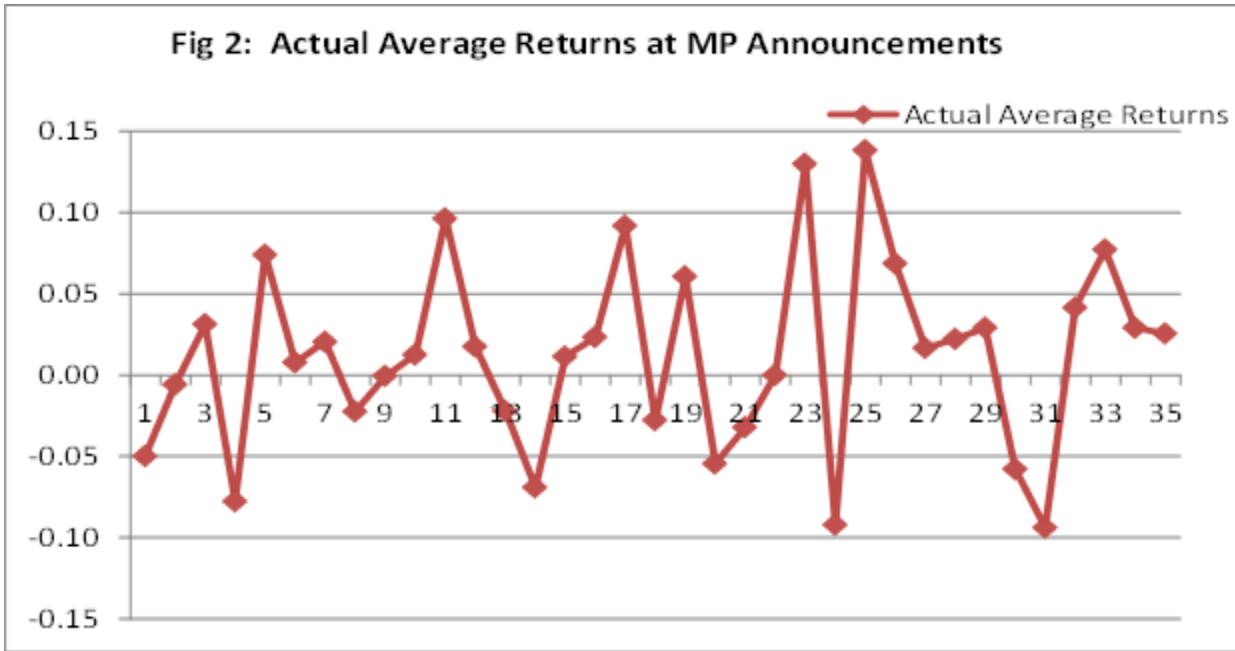
We applied t-test to test the null hypothesis of zero abnormal returns in banking sector of Pakistan. As SBP changes the policy rates in monetary policy meetings, so the followings will be our hypothesis for event study approach;

H₀: There is no significant impact of monetary policy announcement on banks stock returns,

H₁: There is significant impact of monetary policy announcement on banks stock returns.

3. Estimation and Discussion of Results

Daily stock prices of 13 commercial banks were collected from the Karachi Stock Exchange (official website) and business recorder. Stock returns were calculated from stock prices through continuous compounding. We used average (Arithmetic Mean) stock returns of 13 selected commercial banks for our further analysis. We captured the impact of policy rate changes by SBP through event study and monetary policy announcements were taken as event. Abnormal returns were calculated by taking the difference of actual daily banks stock returns and forecasted daily banks stock returns. Daily stock were forecasted through using ARIMA (p,d,q) model. Abnormal returns were accumulated from two dimensions, i.e. 1st through event-wise analysis, which captured the overall impact of policy rate changes on banks stock returns in Pakistan, 2nd through day-wise analysis within event window. To analyze the overall impact of events, we calculated CAR through event-wise analysis. CAR at 0.6340 shows that actual daily stock returns (Fig # 2) were more than normal daily stock returns (Fig # 3) by 63.4% within t+15 (Table # 2).



It indicates the transmission mechanism of monetary policy and good transparency in banking sector of Pakistan. This value of 63.4% shows a good regulatory control by SBP on the Pakistani Banking Sector. As CAR at 0.634 (Table # 2) is an aggregated value, so we evaluated the impact of all 35 MP meetings/announcements/events one by one by suing t-statistics. 31 out of all 35 events have significant impact on banks stock returns (Table # 3).

Table # 2 Event-wise CAR with (ARIMA Model Fitting Order)

MP Meetings	ARIMA Oder for Model Fitting	Actual Daily Returns	Normal Daily Returns	Abnormal Daily Returns	CAR (Event-wise)
July 1, 1998	(0, 0, 1)	-0.0498	0.0168	-0.0665	-0.0665
March 4, 1999	(1, 0, 1)	-0.0059	-0.0339	0.0281	-0.0385
April 3, 1999	(0, 0, 2)	0.0312	-0.0233	0.0546	0.0161
May 19, 1999	(0, 0, 1)	-0.0777	-0.0241	-0.0535	-0.0374
January 5, 2000	(0, 0, 1)	0.0740	0.0099	0.0640	0.0266
October 5, 2000	(0, 0, 2)	0.0078	-0.0046	0.0124	0.0390
June 7, 2001	(1, 0, 0)	0.0205	-0.0110	0.0315	0.0705
July 19, 2001	(0, 0, 1)	-0.0225	-0.0080	-0.0145	0.0560
August 17, 2001	(0, 0, 1)	-0.0005	-0.0084	0.0079	0.0639
October 22, 2001	(0, 0, 1)	0.0125	-0.0044	0.0170	0.0808
January 23, 2002	(1, 0, 0)	0.0963	-0.0041	0.1004	0.1812
November 18, 2002	(0, 0, 1)	0.0175	0.0290	-0.0115	0.1698
April 11, 2005	(0, 0, 1)	-0.0221	0.0207	-0.0428	0.1269
July 21, 2005	(0, 0, 1)	-0.0692	0.0081	-0.0772	0.0497
January 26, 2006	(0, 0, 1)	0.0114	0.0274	-0.0160	0.0338
July 31, 2006	(0, 0, 1)	0.0233	0.0199	0.0034	0.0372
January 18, 2007	(0, 0, 1)	0.0920	-0.0104	0.1024	0.1395
August 1, 2007	(0, 0, 2)	-0.0278	0.0127	-0.0404	0.0991
February 1, 2008	(1, 0, 0)	0.0607	0.0006	0.0601	0.1592
May 23, 2008	(1, 0, 0)	-0.0544	-0.0152	-0.0392	0.1199
July 30, 2008	(1, 0, 0)	-0.0322	-0.0190	-0.0132	0.1068
November 13, 2008	(0, 0, 1)	0.0000	-0.0457	0.0457	0.1524
January 31, 2009	(1, 0, 0)	0.1299	-0.0085	0.1383	0.2907
April 21, 2009	(1, 0, 1)	-0.0921	-0.0446	-0.0476	0.2432
August 17, 2009	(1, 0, 1)	0.1383	-0.0408	0.1791	0.4222
September 29, 2009	(1, 0, 1)	0.0688	-0.0192	0.0880	0.5102
November 25, 2009	(1, 0, 1)	0.0166	-0.0236	0.0403	0.5505
January 30, 2010	(2, 0, 0)	0.0222	0.0261	-0.0038	0.5467
March 27, 2010	(1, 0, 0)	0.0290	0.0035	0.0255	0.5722
May 24, 2010	(2, 0, 0)	-0.0578	0.0056	-0.0634	0.5088
August 2, 2010	(0, 0, 2)	-0.0938	-0.0008	-0.0930	0.4158
September 29, 2010	(2, 0, 0)	0.0415	-0.0173	0.0588	0.4746
November 30, 2010	(2, 0, 0)	0.0772	-0.0097	0.0870	0.5616
March 25, 2011	(2, 0, 0)	0.0291	-0.0112	0.0403	0.6019
May 20, 2011	(1, 0, 0)	0.0255	-0.0066	0.0321	0.6340
Event-wise CAR					0.6340

Table # 3 Event-Wise Analysis for Impact of Policy Rate Changes

MP Meetings	ARIMA Oder for Model Fitting	Abnormal Daily Returns	t statistics	Sig/In-Sig
July 1, 1998	(0, 0, 1)	-0.0665	-0.3373	Sig
March 4, 1999	(1, 0, 1)	0.0281	0.2321	Sig
April 3, 1999	(0, 0, 2)	0.0546	0.8260	Sig
May 19, 1999	(0, 0, 1)	-0.0535	-0.4158	Sig
January 5, 2000	(0, 0, 1)	0.0640	0.5752	Sig
October 5, 2000	(0, 0, 2)	0.0124	0.2663	Sig
June 7, 2001	(1, 0, 0)	0.0315	0.6372	Sig
July 19, 2001	(0, 0, 1)	-0.0145	-0.3389	Sig
August 17, 2001	(0, 0, 1)	0.0079	0.3730	Sig
October 22, 2001	(0, 0, 1)	0.0170	0.3031	Sig
January 23, 2002	(1, 0, 0)	0.1004	1.7635	Sig
November 18, 2002	(0, 0, 1)	-0.0115	-0.2449	Sig
April 11, 2005	(0, 0, 1)	-0.0428	-0.4619	Sig
July 21, 2005	(0, 0, 1)	-0.0772	-1.7506	Sig
January 26, 2006	(0, 0, 1)	-0.0160	-0.3109	Sig
July 31, 2006	(0, 0, 1)	0.0034	0.0790	Sig
January 18, 2007	(0, 0, 1)	0.1024	5.6936	In-Sig
August 1, 2007	(0, 0, 2)	-0.0404	-0.9172	Sig
February 1, 2008	(1, 0, 0)	0.0601	1.7955	Sig
May 23, 2008	(1, 0, 0)	-0.0392	-0.3659	Sig
July 30, 2008	(1, 0, 0)	-0.0132	-0.1026	Sig
November 13, 2008	(0, 0, 1)	0.0457	88.1660	In-Sig
January 31, 2009	(1, 0, 0)	0.1383	1.3831	Sig
April 21, 2009	(1, 0, 1)	-0.0476	-0.4443	Sig
August 17, 2009	(1, 0, 1)	0.1791	3.3273	In-Sig
September 29, 2009	(1, 0, 1)	0.0880	1.0423	Sig
November 25, 2009	(1, 0, 1)	0.0403	0.8541	Sig
January 30, 2010	(2, 0, 0)	-0.0038	-0.1302	Sig
March 27, 2010	(1, 0, 0)	0.0255	0.6931	Sig
May 24, 2010	(2, 0, 0)	-0.0634	-0.6052	Sig
August 2, 2010	(0, 0, 2)	-0.0930	-1.2817	Sig
September 29, 2010	(2, 0, 0)	0.0588	1.5542	Sig
November 30, 2010	(2, 0, 0)	0.0870	1.9792	In-Sig
March 25, 2011	(2, 0, 0)	0.0403	1.4214	Sig
May 20, 2011	(1, 0, 0)	0.0321	1.0942	Sig

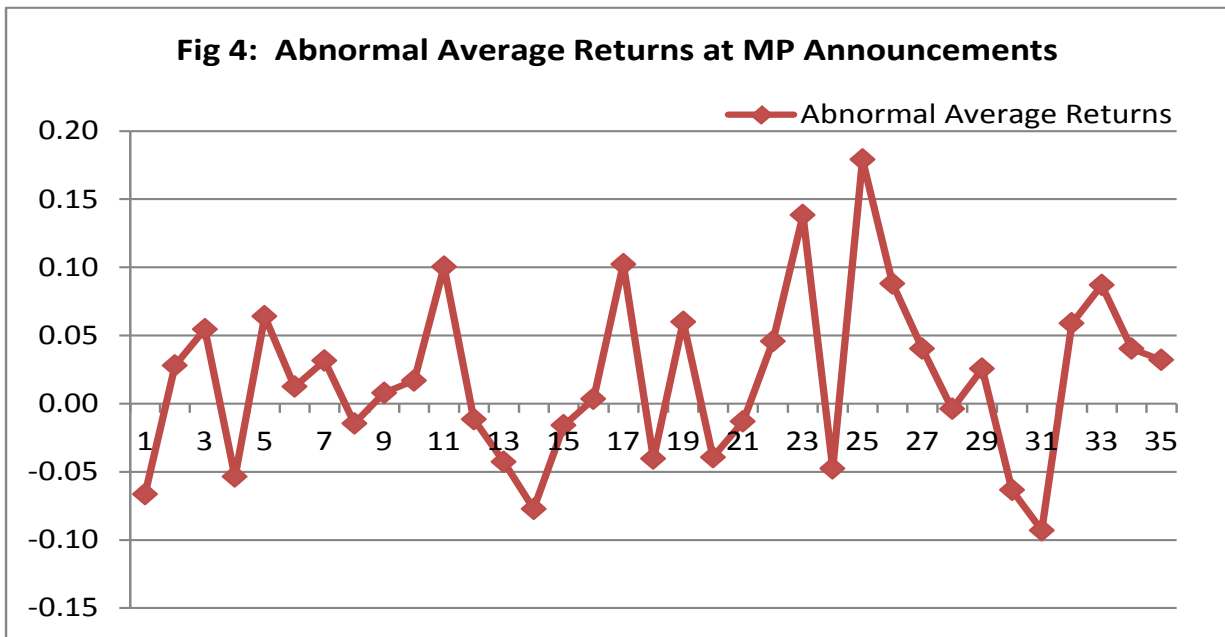
Abnormal returns (0.1024, 0.0457, 0.1791 & 0.0870) were in-significant at 01-18-2007, 11-13-2008, 08-17-2009 & 11-30-2010. All of the events having significant impact on the banks stock returns are presented in Table # 4, in descending order on the basis of abnormal returns.

Table # 4 Event-Wise Analysis (PR Announcements having Significant Impact on Banking Stock Returns)

MP Meetings	ARIMA Oder for Model Fitting	Abnormal Daily Returns	t statistics	Sig/ln-Sig
January 31, 2009	(1, 0, 0)	0.1383	1.3831	Sig
January 23, 2002	(1, 0, 0)	0.1004	1.7635	Sig
September 29, 2009	(1, 0, 1)	0.0880	1.0423	Sig
January 5, 2000	(0, 0, 1)	0.0640	0.5752	Sig
February 1, 2008	(1, 0, 0)	0.0601	1.7955	Sig
September 29, 2010	(2, 0, 0)	0.0588	1.5542	Sig
April 3, 1999	(0, 0, 2)	0.0546	0.8260	Sig
March 25, 2011	(2, 0, 0)	0.0403	1.4214	Sig
November 25, 2009	(1, 0, 1)	0.0403	0.8541	Sig
May 20, 2011	(1, 0, 0)	0.0321	1.0942	Sig
June 7, 2001	(1, 0, 0)	0.0315	0.6372	Sig
March 4, 1999	(1, 0, 1)	0.0281	0.2321	Sig
March 27, 2010	(1, 0, 0)	0.0255	0.6931	Sig
October 22, 2001	(0, 0, 1)	0.0170	0.3031	Sig
October 5, 2000	(0, 0, 2)	0.0124	0.2663	Sig
August 17, 2001	(0, 0, 1)	0.0079	0.3730	Sig
July 31, 2006	(0, 0, 1)	0.0034	0.0790	Sig
January 30, 2010	(2, 0, 0)	-0.0038	-0.1302	Sig
November 18, 2002	(0, 0, 1)	-0.0115	-0.2449	Sig
July 30, 2008	(1, 0, 0)	-0.0132	-0.1026	Sig
July 19, 2001	(0, 0, 1)	-0.0145	-0.3389	Sig
January 26, 2006	(0, 0, 1)	-0.0160	-0.3109	Sig
May 23, 2008	(1, 0, 0)	-0.0392	-0.3659	Sig
August 1, 2007	(0, 0, 2)	-0.0404	-0.9172	Sig
April 11, 2005	(0, 0, 1)	-0.0428	-0.4619	Sig
April 21, 2009	(1, 0, 1)	-0.0476	-0.4443	Sig
May 19, 1999	(0, 0, 1)	-0.0535	-0.4158	Sig
May 24, 2010	(2, 0, 0)	-0.0634	-0.6052	Sig
July 1, 1998	(0, 0, 1)	-0.0665	-0.3373	Sig
July 21, 2005	(0, 0, 1)	-0.0772	-1.7506	Sig
August 2, 2010	(0, 0, 2)	-0.0930	-1.2817	Sig

We can analyze the impact with respect to expansionary or contractionary monetary policy (Table # 4). In the event having highest abnormal return of 0.1383 (dt: Jan 31, 2009), policy rate was remained un-changed at 15% and same was the case in 3rd highest announcement dt: Sep 29, 2009 with respect to abnormal returns. But, in case of 2nd announcement dt: Jan 23, 2003, SBP announced expansionary monetary policy when policy rate was reduced with 100 basis points, i.e., from 10% to 09%. And in case of 4th announcement dt: Jan 05, 2000, having highest impact on banks stock returns, SBP again announced expansionary monetary policy when policy rate was reduced with 200 basis points, i.e., from 13% to 11% (These results are aligned with Smirlock and Yawitz (1985) and, Born and Moser (1990). So, this event study suggests that expansionary

monetary policy is good sign from the bank's profit making concerns. So, abnormal returns were higher in event-wise analysis (Fig # 4).



Then we analyzed day-wise impact within event window (t-15, 0, t+15). If we analyze the day-wise impact within short period of time, i.e. t-4, t+4 then we observe that abnormal returns were -ve at t-1, t-2, and at t+1 only (Table # 5). So, the abnormal returns were -0.2355 at t+1 and these results are aligned with Rahman and Mohsin (2011a). The results were normal at 4th day of MP announcements.

4. Conclusion

Objective of this study is to analyze the impact of policy rate changes on stock returns of banking sector in Pakistan. We used event study approach by constructing the estimation window of 250 days and an event window of 31 days (15 pre-event days, event day and 15 post event days. We used daily stock returns from 1998 to 2011 to analyze the impact of policy rate changes by State Bank of Pakistan (SBP) on banking stock returns. ARIMA model was used to estimate the normal returns by using estimation window of 250 days. As SBP changes the policy rate in the Monetary Policy (MP) meetings held by monetary policy committee, so we used monetary policy meeting/announcements as event to capture the impact of policy rate. 35 meetings were conducted during study period from Jan 1998 to Dec 2011. Abnormal returns were calculated by taking the difference of actual daily stock returns and estimated daily stock returns. Abnormal daily stock returns were aggregated as cumulative abnormal returns (CAR). CAR at 0.6340 showed a significant impact of policy rate changes on banks stock returns. Null hypothesis of zero abnormal returns were rejected since results were falling within critical region of normal distribution. At the end, impact was analyzed from two dimensions; i.e. event-wise and day-wise. 31 out of all 35 events have significant impact on banks stock returns and returns were normal at 4th day of MP announcement. Further, we analyzed the impact with respect to expansionary and contractionary

monetary policy and observed that the highest impact on banks stock returns was due to expansionary monetary policy.

Table # 5 Day-Wise Analysis within Event Window (t-15, 0, t+15)

Days within Event Window	Average Actual Daily Stock Returns	Average Estimated Daily Stock Returns	Average Abnormal Daily Stock Return
-15	-0.2270	-0.0126	-0.2144
-14	-0.0727	-0.0298	-0.0430
-13	-0.0731	-0.0529	-0.0202
-12	-0.0475	-0.0388	-0.0087
-11	-0.1180	-0.0044	-0.1135
-10	-0.0921	-0.0143	-0.0778
-9	0.0167	-0.0375	0.0541
-8	0.0199	-0.0166	0.0365
-7	0.1399	-0.0229	0.1628
-6	-0.0613	-0.0392	-0.0221
-5	-0.1273	-0.0112	-0.1161
-4	-0.0034	-0.0286	0.0252
-3	0.0850	-0.0216	0.1066
-2	-0.1248	-0.0091	-0.1157
-1	-0.0709	-0.0369	-0.0340
0	0.0699	-0.0369	0.1068
1	-0.2103	0.0252	-0.2355
2	0.1867	0.0120	0.1747
3	0.1743	-0.0252	0.1995
4	0.0268	-0.0238	0.0507
5	-0.1385	-0.0296	-0.1088
6	-0.0769	-0.0181	-0.0588
7	0.0040	0.0186	-0.0146
8	0.1064	-0.0298	0.1361
9	-0.0164	-0.0291	0.0126
10	0.0900	-0.0202	0.1102
11	0.1583	-0.0224	0.1807
12	0.1969	-0.0112	0.2081
13	-0.0078	-0.0100	0.0022
14	0.0052	-0.0225	0.0277
15	-0.0789	-0.0279	-0.0510

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