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Financial Market Responses to Bank Indonesia's Policy Announcements

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Abstract

This paper examines the effect of the BI rate announcements on financial markets in Indonesia. The estimation results show that interbank interest rates with overnight, 1-week, and 1-month maturity are significantly lower a day before the announcement of lower BI-rate. On the other hand, the levels of exchange rate return, stock return, or government bond's yield are not significantly affected by BI-rate announcements. The announcements of lower or constant BI-rate significantly bring down volatility of interbank interest rate with overnight, 1-week, and 1-month maturity, as well as the volatility of government bonds' yield, exchange rate return and stock returns. The largest effect of BI rate announcement is experienced by overnight interbank interest rate, both in terms of level as well as in terms of volatility.

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1. Introduction

In line with the growing implementation of inflation targeting framework since the 1990s, many central banks have moved toward more transparent policies. The need for a more transparent central bank has been accepted not only in academic but also in central banks. There is a broad consensus that transparency may help the effectiveness of policy (Woodford, 2003). Two key arguments stand out for the emphasis of the need for more transparent central bank. On normative side, as a public institution, independent central banks should meet high standard accountability through transparency. And from the conduct of monetary policy, it is viewed that the efficiency of monetary policy depends heavily on the credibility of central banks to implement inflation targeting framework and public perceptions of the consistency of central bank actions to achieve its announced targets (Heenan et al., 2006)   The increase in the transparency itself is reflected in the increase in public communication by central banks.

Within inflation targeting frameworks, monetary policy communication is a key component, and inflation targeting central banks typically put much more effort into explaining the policy issues and decision, as well as more open about central bank activities. As pointed out by Heenan et al (2006), the main objectives of monetary policy communication is to convince economic agents—notably including financial market participants, price and wage setters, and fiscal authorities—that policy formulation and implementation is consistently oriented toward achieving inflation objective. Particularly for financial markets, the objectives of monetary policy announcement include ensuring that market participants are fully and simultaneously informed of any adjustments in policy instruments, ensuring that reporting and debate on monetary policy issues is well-informed, and promoting good understanding of monetary policy's approach to policy formulation and risk assessment to maximize policy predictability.

While there is a convergence towards an agreement on the importance of central bank communication for the effectiveness of monetary policy, the effectiveness of communication strategy undertaken by a typical central bank remains an issue. In general, the effectiveness of central bank communication can be defined into two elements (Ehrmann and Fratzscher, 2007), that is, the ability of financial markets to predict future monetary policy decisions (market predictability), and the ability of policy

makers to influence financial markets by moving asset prices in desired direction (market responsiveness). The hypothesis here is that if central bank is transparent then market should be able to anticipate policy decision rules well, that is, changes in asset prices on the announcement days should be small.

Recognizing the importance of transparency of an independent central bank, Bank Indonesia has moved toward a more transparent central bank since it obtained its independence from the government in 1999. The need for a more transparent central bank become even more crucial for Bank Indonesia since its implementation of inflation targeting framework started on July 2005. Since 1999 Bank Indonesia has taken various measures to be more open to the public regarding policies issues and decision as well as operations and research. In this respects, Bank Indonesia communicates with the public through various publications, Board's speeches and testimonies, seminars, and discussions.

The purpose of this paper is to investigate the effect of Bank Indonesia's policy announcements on financial markets in Indonesia. Specifically, we investigate how Bank Indonesia's monetary policy announcements affect inter-bank interest rates, exchange rate of the rupiah, stock return, and government bond's yield in Indonesia. A better understanding on the effects of monetary policy announcement on financial markets will give a better understanding on the effectiveness of monetary policy undertaken.

The paper is organized as follows. Section 2 reviews monetary policy communication in Indonesia. Section 3 presents literature review. Section 4 discusses theoretical background of the announcement effects of monetary policy. Section 5 presents empirical models. Section 6 presents data and their descriptive statistics. Section 7 shows estimation results. Finally, this paper concludes with section 8.

2. Monetary Policy Communication in Indonesia

The milestone of the implementation of inflation targeting framework in Indonesia is the change in the operational target from base money into interest rate in July 2005 in which the reference rate used in monetary policy is called BI rate. To increase the effectiveness of the monetary policy in influencing public expectation on inflation, Bank Indonesia enhances its transparency and accountability in the

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implementation of monetary policy. And in line with the increase in transparency and accountability, since July 2005 Bank Indonesia announces BI Rate following Board of Governor policy meeting every month.

As stipulated in Act No. 23, 1999 amended by Act No.3, 2004, Bank Indonesia's board of governor is required to hold monetary policy meeting at least once in a month. The policy meeting evaluates monetary policy undertaken and sets the direction of the monetary policy. The policy meeting is scheduled on first Tuesday or Thursday for every month following the day in which inflation rate is released by BPS (Statistics Indonesia). The BPS releases inflation rate on the first working day of every month. If for some reason the meeting cannot be held either on Tuesday or Thursday, the policy meeting is held on different pre-announced day. All policy meeting days are pre-announced publicly.

Table 1 shows the policy meeting days and BI decisions on BI rates. Since Bank Indonesia started using BI rate as a policy instrument until September 2007, there were 26 announcement days of BI rate, in which BI rate was raised five times, BI rate was cut 13 times and BI rate was kept unchanged eight times. Out of those 26 BI rate announcements, there is only incidence in which market expectation on BI rate was different from the announced BI rate, that is, on April 2007. Prior to the announcement on April 5, 2007, the median of market expectation on BI rate was 8.75 while the BI rate announced on April 5 was 9.00%[2].

To avoid favoring some players in financial markets, the announcement of the policy meeting is released simultaneously, and since prompt information on BI rate is of great interest not only to domestic agents but also to foreigners, the press release on policy rate is published in both Bahasa Indonesia and English. As pointed out by Heenan et al (2002), international audiences of the policy announcement are also very important. International investors, portfolio managers, and foreign exchange strategists may not be well informed on the inflation targeting regime being into place that financial market may be more volatile than if such audiences were better informed. As background to its

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[2] The market expectation on BI rate is the expectation of a sample of large financial institutions provided by Bloomberg.

monthly policy statement, Bank Indonesia publishes a *Monetary Policy Review* in the months when a full inflation report has not been released by BPS.

Table 1: Bank Indonesia's Press Release on BI Rate

Date	Day	Board of Governor Meeting's (RDG) decision
July 5, 2005	Tuesday	Sets BI rate for the first time, that is, at 8.5%
August 9, 2005	Tuesday	Raises BI rate by 25 bps to 8.75%
September 6, 2005	Tuesday	Raises BI rate by 125 bps to 10.00%
October 4, 2005	Tuesday	Raises BI rate by 100 bps to 11.00%
November 1, 2005	Tuesday	Raises BI rate by 125 bps to 12.25%
December 6, 2005	Tuesday	Raises BI rate by 50 bps to 12.75%
January 9, 2006	Monday	Keeps BI rate at 12.75%
February 7, 2006	Tuesday	Keeps BI rate at 12.75%
March 7, 2006	Tuesday	Keeps BI rate at 12.75%
April 5, 2006	Wednesday	Keeps BI rate at 12.75%
May 9, 2006	Tuesday	Cuts BI rate by 25 bps to 12.50%
June 6, 2006	Tuesday	Keeps BI rate at 12.50%
July 6, 2006	Thursday	Cuts BI rate by 25 bps to 12.25%
August 8, 2006	Tuesday	Cuts BI rate by 50 bps to 11.75%
September 5, 2006	Tuesday	Cuts BI rate by 50 bps to 11.25%
October 5, 2006	Thursday	Cuts BI rate by 50 bps to 10.75%
November 7, 2006	Tuesday	Cuts BI rate by 50 bps to 10.25%
December 7, 2006	Thursday	Cuts BI rate by 50 bps to 9.75%
January 4, 2007	Thursday	Curs BI rate by 25 bps to 9.50%
February 6, 2007	Tuesday	Cuts BI rate by 25 bps to 9.25%
March 6, 2007	Tuesday	Cuts BI rate by 25 bps to 9.00%
April 5, 2007	Thursday	Keeps BI rate at 9.00%
May 8, 2007	Tuesday	Cuts BI rate by 25 bps to 8.75%
June 7, 2007	Thursday	Cuts BI rate by 25 bps to 8.50%
July 5, 2007	Thursday	Cuts BI rate by 25 bps to 8.25%
August 7, 2007	Tuesday	Keeps BI rate at 8.25%
September 6, 2007	Thursday	Keeps BI rate at 8.25%

Source: Bank Indonesia

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3. Literature Review

A large number of studies on the effects of macroeconomic announcements on financial markets can be found in the literature. And so far, most of the empirical studies on the announcement effects of monetary policy focus on the US and ECB monetary policy. Jones et al. (1998) examines the effects of announcements on the volatility of asset prices. They find that the volatility of asset prices on the announcement day does not persist, which is consistent with the immediate incorporation of information into prices. Unlike non-announcement shocks, shocks to volatility that occur on announcement days have no subsequent impact on daily volatility. When markets know that a large shock is forthcoming, return volatility in the market decreases.

Gurkayank et al. (2005) argue that viewing the effects of FOMC announcements on financial markets as driven by changes in federal fund rate target itself is inadequate. Instead, a second policy factor, which is the statements that the FOMC releases, accounted for more than three-fourth of the explaninable variation in the movements of five- and ten-year Treasury yield. When the decisions regarding the target for federal funds rate is not a surprise, changes in the wording of FOMC statements typically have been the major driver of financial market response.

Demirlap and Jorda (2004) investigate to what extent the policy of "the announcement" affected a key ingredient in the monetary transmission mechanism, that is, the term structure of nominally risk-free, Treasury securities. They show that the movements of short-term interest rates tend be driven by public announcements by the Fed rather than liquidity changes as a result of open market operation

Bomfim (2000) examines how stock market in the US is affected by the Federal Reserve's scheduled policy announcements. He finds that stock market tends to be relatively quite on days preceding regularly scheduled policy announcements, that is, the conditional volatility of stock return is abnormally low on those days. The element of surprise in actual interest rate decisions tends to boost stock market volatility significantly in the short run, and positive surprises tend to have a larger effect on volatility than negative surprises.

Ehrmann and Fratzscher (2007) use daily data of interest rates in the US and euro area market to examine the effectiveness of monetary policy announcement in those two

markets. They find that interest rates in US and euro area markets respond strongly to domestic monetary policy announcements. And interest rates in Germany and the euro area market react to Federal Reserve announcements in addition to European monetary policy announcements, while interest rates in US markets in general do not respond to European monetary policy announcements.

Rosa and Verga (2006) use tick-by-tick data to examine how ECB policy rate decision and the explanation of its monetary policy stance systematically hit financial markets the euro area. They find that unexpected component of ECB explanations significantly affect future prices and the impact is sizable. Their results suggest that financial markets seem to believe that the ECB does what it says it will do.

Among a few studies on the announcement effects of monetary policy other than that of the US or the ECB has been done, for example, by Guthrie and Right (2000). In their paper they develop theoretical as well as empirical models to analyze the effect of Reserve Bank of New Zealand (RBNZ) on interest rates in New Zealand. Their study show that the RBNZ has used communication systematically and effectively in controlling short-term interest rates.

Whereas a large literature exists on the response of monetary policy announcements on financial markets in industrialized countries, relatively little is known about the response of monetary policy announcement on financial markets in developing countries. This paper fills the gap in the literature by providing evidence on the effect of monetary policy announcements on financial markets in Indonesia.

4. Theoretical Background

Theoretically, the goal of the policy announcement is to increase transparency that leads to improving economic efficiency. The influential work by Cukierman and Meltzer (1986) has provided a theoretical explanation on the importance of monetary policy communication and transparency. Cukierman and Meltzer define credibility as how fast is public recognizes the changes in the objectives of policymaker. Looser monetary control and higher time preference of policymakers leads to variable monetary growth that in turn lower credibility. Policymakers may choose a more ambiguous procedure

monetary control if their objectives are less certain and have higher time preference, and therefore it takes longer for monetary policy to gain credible deflationary policy.

In another theoretical model, Guthrie and Wright (2000) analyze how central bank statements (*open mouth operation*) rather than open market operation leads to large changes in interest rates. Their model shows how the central bank can achieve inflation (and output) outcome without having to use open market operations to influence interest rates. Instead, as they show in their model, the central bank can achieve its objective by having a credible threat which ties down the level of interest rates. Without knowing the central bank's preferred rate, the private sector may deliver the wrong rate. This deviation is costly from the central bank perspective.

By making an announcement (*open mouth operation*), the central bank can ensure the private sector delivers the correct rate. In choosing when to make such statements, the central bank trades off the flow costs of deviations away from its preferred level with the costs of making announcements. As central bank announcements release new information, each announcement should lead to a discrete jump in the level of interest rates in the desired direction. Moreover, using only publicly available information, announcements should be predictable—if the private sector could anticipate the released information, that information would already be incorporated in market rates.

The empirical implications of Guthrie and Wright's (2000) theoretical model are as follows. First, an open mouth operation that released regularly represents a surprise to the private sector. If the market already knows that the central bank wants a change in monetary conditions, the market will already have delivered it. And second, interest rates of all maturities increase significantly following a tightening announcement, together with some appreciation of exchange rate. In another study specifically on financial markets, Ehrmann and Fratszcher (2007) argue that a credible monetary authority may be able to influence asset prices by communicating its views about its intended level and by signaling its intention to move policy if asset prices deviate from the target

Regarding the effects of monetary policy announcement on stock market, Bomfim (2003) argues that there are two possibilities in which the announcements affect stock market. First, there is a potential for pre-announcement effects which is commonly dubbed as "calm-before-the-storm" effect. With this kind of effect, conditional volatility

of asset returns tend to be lower in days leading up to releases of major economic data ("calming" effect) and then higher on the day of the announcement itself ("storm" effect). And second, monetary policy decisions potentially affect market volatility through the nature of the decision itself. The announcement of the policy decision may reveal new information which is not previously incorporated into asset prices and volatility while participants process the newly received information.

5. Empirical Model

To measure the reactions of financial markets to Bank Indonesia's policy announcement, we use Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. Similar model has also been used in many other studies on the effect of announcements on asset markets (see for example, Jones et al, 1998; Bomfim, 2003; and Ehrmann and Fratzscher's, 2007). The advantage of using exponential GARCH is that it corrects for the kurtosis, and skewness of the data. Considering that communication may influence both level and volatility of asset prices, we model both the influence of communication on asset price levels as well as the influence of communication on the volatility of asset prices.

Specifically, the base model is formulated as follows. Let R_t be the asset price returns then the relationship between asset price returns and announcement is given by:

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + \delta_1 D_{t-1} + \delta_2 D_t + \delta_3 D_{t+1} + \delta_5 TUE + \delta_6 THU + \varepsilon_t \tag{1}$$

$$\varepsilon_t = \eta_t \sqrt{h_t} \tag{2}$$

$$h_t = \beta_0 + \beta_1 \varepsilon_{t-1}^2 + \beta_2 h_{t-1} + \theta_1 D_{t-1} + \theta_2 D_t + \theta_3 D_{t+1} + \theta_5 TUE + \theta_6 THU \tag{3}$$

where η_t is an independently identical distributed random variable with zero mean and unit variance, D is a dummy for day in which BI policy rate is announced, TUE is dummy for Tuesday, and THU is dummy for Thursday.

Other than base model above, we also estimate the following model in which the announcement days are broken down based on the changes in the BI rate, that is:

$$R_t = \alpha_0 + \alpha_1 R_{t-1} + \delta_1 D_{t-1}^- + \delta_2 D_t^- + \delta_3 D_{t+1}^- + \delta_4 D_{t-1}^0 + \delta_5 D_t^0 + \delta_6 D_{t+1}^0$$

$$+ \delta_7 D_{t-1}^+ + \delta_8 D_t^+ + \delta_9 D_{t+1}^+ + \delta_{10} TUE + \delta_{11} THU + \varepsilon_t \qquad (4)$$

$$\varepsilon_t = \eta_t \sqrt{h_t} \qquad (5)$$

$$h_t = \beta_0 + \beta_1 \varepsilon_{t-1}^2 + \beta_2 h_{t-1} + \theta_1 D_{t-1}^- + \theta_2 D_{t-1}^- + \theta_3 D_{t-1}^- + \theta_4 D_{t-1}^0 + \theta_5 D_{t-1}^0$$

$$+ \theta_6 D_{t-1}^0 + \theta_7 D_{t-1}^+ + \theta_8 D_t^+ + \theta_9 D_{t+1}^+ + \theta_{10} TUE + \theta_{11} THU + \varepsilon_t \qquad (6)$$

where D^- is a dummy in which BI announces lower BI rate, D^0 is a dummy in which BI announces keeps BI rate, and D^+ is a dummy in which BI announces higher BI rate. The estimation uses Bollersev-Wooldridge robust quasi-maximum likelihood (QML) covariance/standard errors.

6. Data and Preliminary Analysis

Data on Bank Indonesia's announcement on policy rates are obtained from Bank Indonesia's website which is released every month following the policy meetings. Data on daily interest rates, exchange rates, and Jakarta Stock Market (JSX) Composite Index , and government-bond yield are obtained from CEIC database. Sample runs from July 1, 2005 to September 28, 2007. The starting date is chosen based on the fact that the use of BI rate as policy instrument started in July 2005. The advantage of using daily data is that it accounts for potential overshooting effects in the very short run (Ehrmann and Fratzscher, 2007). Moreover, since market participants are not necessarily clear about the exact time of the day in which monetary authority change the policy rate, using daily data instead of tick-by-tick data for the purpose of this study is reasonable.

Financial data are 5-days-week data, and missing data for holidays are replaced by data of the last active day before the holiday. The interest rates we examine in this study are inter-bank interest rates with overnight, 1-week, and 1-month maturity while government-bond yield is 1-year maturity. For exchange rate, we calculate daily exchange rate return of the rupiah per US dollar. Therefore, exchange rate depreciation results in positive return while exchange rate appreciation results in negative return, and the higher the depreciation, the higher is the exchange rate return. Finally, Stock return is calculated as a daily percentage of change in JSX composite index.

Table 2: Descriptive Statistics of the Data

	R_1N	R_1W	R_1M	R_ER	R_JSX	SUN_1Y
Mean	7.76	8.92	10.82	-0.01	0.12	10.58
Median	7.48	8.93	10.89	0.00	0.13	10.64
Maximum	21.11	15.35	17.01	3.73	6.73	17.00
Minimum	3.50	3.59	3.69	-5.32	-6.65	2.31
Std. Dev.	3.02	2.53	2.11	0.56	1.33	2.06
Skewness	1.08	-0.01	-0.04	-0.72	-0.72	0.07
Kurtosis	4.43	1.69	1.83	22.58	8.32	2.28
Jarque-Bera	164.2	42.0	33.8	9391.0	739.6	12.99
Probability	0.00	0.00	0.00	0.00	0.00	0.00
Sum	4545.0	5226.4	6341.3	-6.6	72.8	6199.5
Sum Sq. Dev.	5322.3	3749.2	2608.3	179.9	1040.6	2482.5
Observations	586	586	586	585	585	586

Summary statistics of the data are presented in Table 2. The statistics of the interest rates show that while overnight rate has the lowest mean relative to 1-week and 1-month rates, the overnight rate has the highest standard deviation. This indicates that the overnight rate is more volatile relative to 1-week and 1-month rates. The information on the skewness and kurtosis of the data motivate the use of ARCH class of model in this paper. And the Jarque-Bera statistics show that for all series, the null hypothesis of a normal distribution is rejected at one percent significance level.

Compared with the average of non-announcement days, except for overnight interbank interest rate, the average of interbank interest rates are higher than those of the average of non-announcement days (Table 3). A closer look at the announcement days shows that the averages of interbank interest rates in the announcement day, regardless the direction of the announced BI rate, are higher than the average of interbank interest rates in non-announcement days. However, when the announced BI rate does not change or increase, the averages of interbank interest rate are higher. If we look at the standard deviation of the data, overnight rate and 1-week rate have lower standard deviation on announcement days, while 1-month rate has the higher standard deviation on the announcement days (Table 4).

Table 3: Mean of the Data by Announcements

|	R_1N	R_1W	R_1M	R_ER	R_JSX	SUN_1Y
All Days	7.76	8.92	10.82	-0.011	0.124	10.58
Non-Announcement (t)	7.75	8.91	10.81	-0.014	0.121	10.58
Announcement (t-1)	7.25	8.90	10.97	-0.027	0.239	10.53
Announcement (t)	7.88	9.16	11.04	0.050	0.190	10.59
Announcement (t+1)	7.51	9.32	10.97	-0.090	0.050	10.56
Announcement cut (t-1)	6.39	7.67	10.22	0.019	0.182	9.52
Announcement cut (t)	7.46	8.27	10.37	0.139	0.254	9.69
Announcement cut (t+1)	7.11	8.50	10.37	-0.057	0.235	9.70
Announcement keep (t-1)	7.96	9.42	10.98	0.122	-0.063	10.57
Announcement keep (t)	7.75	9.36	10.98	-0.098	-0.210	10.55
Announcement keep (t+1)	7.97	9.58	11.00	-0.106	-0.130	10.56
Announcement raise (t-1)	8.21	11.14	12.89	0.098	0.736	13.05
Announcement raise (t)	9.23	11.13	12.89	-0.415	0.931	12.99
Announcement raise (t+1)	7.71	11.00	12.45	-0.148	-0.093	12.77

Table 4: Standard Deviation of the Data by Announcements

	R_1N	R_1W	R_1M	R_ER	R_JSX	SUN_1Y
All Days	3.02	2.53	2.11	0.555	1.335	2.06
Non Announcement (t)	3.05	2.54	2.10	0.558	1.346	2.06
Announcement (t-1)	2.31	2.62	2.30	0.052	1.268	2.19
Announcement (t)	2.33	2.46	2.37	0.490	1.100	2.11
Announcement (t+1)	2.50	2.65	2.13	0.570	1.270	2.08
Announcement cut (t-1)	1.35	1.96	1.65	0.486	0.765	1.58
Announcement cut (t)	2.00	1.87	1.65	0.358	0.881	1.45
Announcement cut (t+1)	2.34	2.49	1.67	0.586	1.374	1.48
Announcement keep (t-1)	2.60	2.62	2.50	0.455	1.864	2.23
Announcement keep (t)	2.11	2.59	2.49	0.647	1.437	2.29
Announcement keep (t+1)	3.01	2.75	2.49	0.387	1.413	2.34
Announcement raise (t-1)	3.33	2.77	2.70	0.634	0.968	1.60
Announcement raise (t)	3.39	2.79	3.20	0.499	0.782	1.53
Announcement raise (t+1)	2.26	2.48	2.23	0.889	0.819	1.45

For exchange rate, the average of exchange rate return is higher when the announced BI rate is lower, and the average exchange rate return is lower when the announced BI rate is higher or doesn't change. The average stock return is also higher when announced BI rate is lower or higher, but the average is lower when the announced BI rate doesn't change. And the average of government-bond yield is lower when announced BI rate is lower or doesn't change, and higher when the announced BI rate is higher. Standard deviations of exchange rate return and stock return are lower when announced BI rate is lower or higher, but the standard deviation is higher then the announced BI rate doesn't change. Meanwhile, standard deviation of government-bond yield is lower when BI rate is either higher or lower.

Given that monetary policy meetings are normally held either on Tuesday or Thursday, and so do the announcements on the decisions on of policy meetings, the models include dummy for Tuesday and Thursday to capture days-of-the week effects. Except overnight inter-bank interest rates, other interbank interest rates on either Tuesday or Thursday do not seem to substantially differ from interbank interest rates on other days (Figure 1). The average of overnight interest rates on Tuesday is substantially higher than the average of overnight interest rates on the other days. However, if we look at the standard deviations of the data for each day, Tuesday does not have the largest standard deviation even for overnight interest rate. And although interest rate with 1 month maturity tends to have higher standard deviation on Friday, but the magnitude of the differences are very small. If we look at Figure 2, the highest average exchange rate return is on Tuesday which preceded and followed by negative return. On the other hand, stock return reached the highest average on Friday, instead of Tuesday or Thursday. And the largest standard deviation of exchange rate return occurs on Wednesday, while the largest standard deviation of stock return occurs on Monday.

Figure 1: Mean and Standard Deviation of Interest Rates by Day of the Week

(a) Overnight
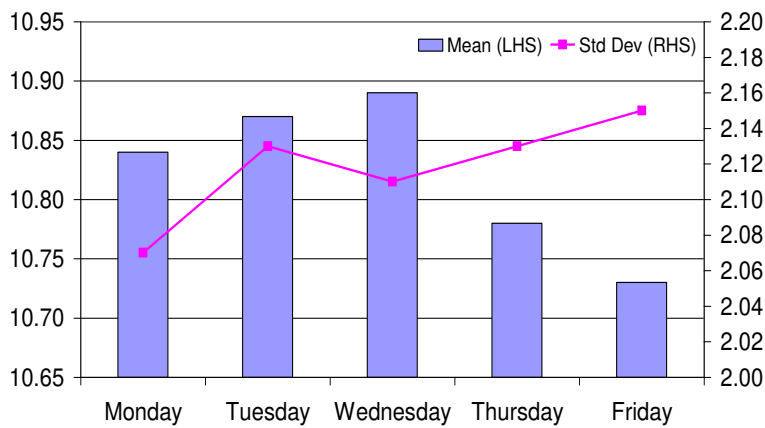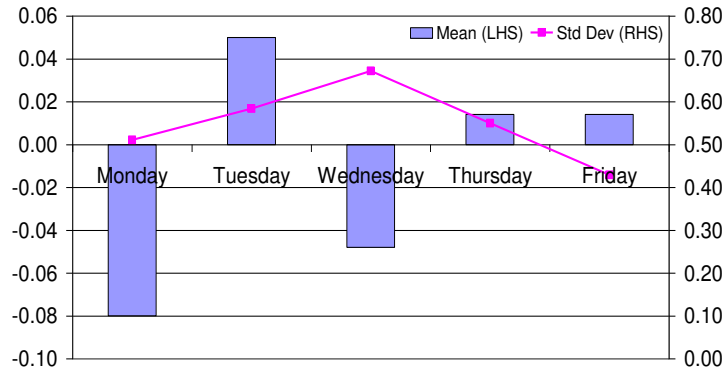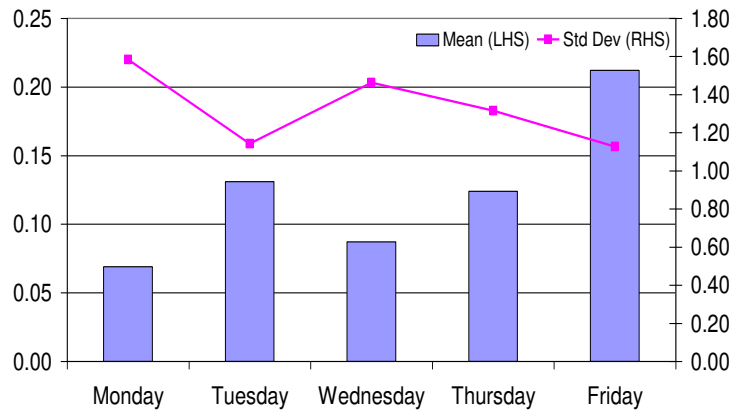

(b) 1-Week

(c) 1-Month

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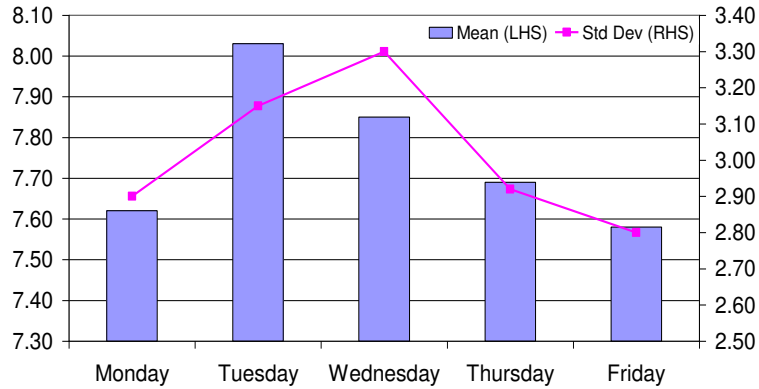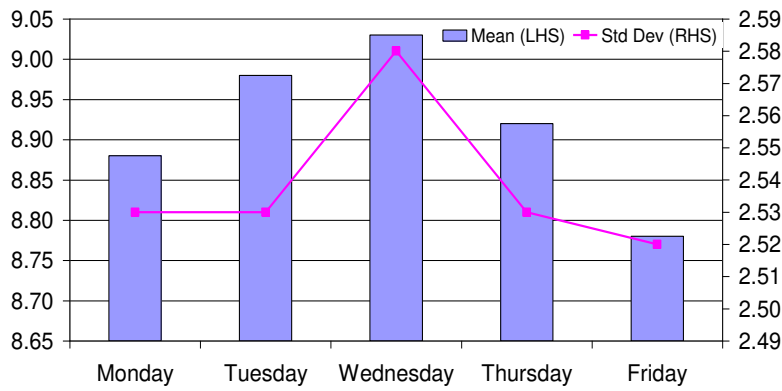
Figure 2: Mean and Standard Deviation of Exchange Rate Return, Stock Returns,
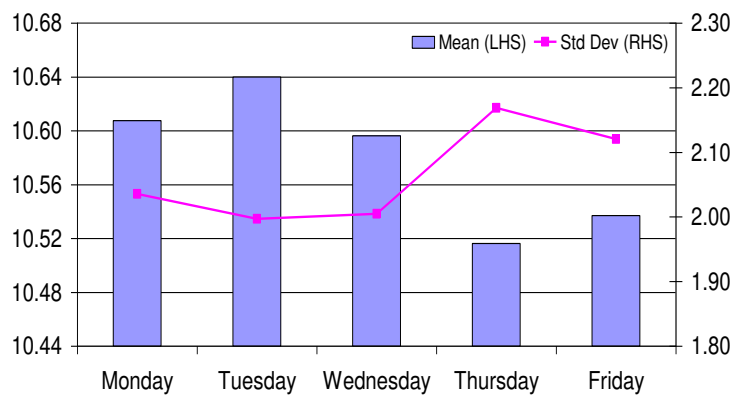Government Bond's Yield by Day of the Week

(a) Exchange Rate Return

(b) Stock Return

(c) G-Bond's Yield

7. Estimation Results

The most commonly used model of financial asset return volatility is the GARCH (1,1). The advantage of GARCH specification over ARCH specification is parsimony in identifying the conditional variance in GARCH (Wang, 2003). Moreover, GARCH models provide approximate descriptions of conditional volatility for a wide variety of volatility process (Jones, 1998). As discussed in section 5, two model specifications are estimated: (i) the model without taking into account direction of the change in BI rate; and (ii) the models separating the effects of the announcement based on the direction of the change in BI rate. The estimation results for those two model specifications are as follows.

7.1. Interest Rates

As shown in Table 5, interbank interest rate with 1-week maturity is significantly lower on the announcement day. A day before the announcement, interbank interest rates are significantly lower for overnight, and 1-week maturity, at least at 10 percent significance level. On the other hand, none of the interest rates is significantly lower for a day after the announcement. The effects of Tuesday or Thursday on interest rates are mixed, that is, on Tuesday interest rate is significantly higher for overnight and 1-week maturity, and it is significantly lower for 1-month maturity. On Thursday, only interest rate for 1-month that is significantly lower.

In terms of volatility, none of the interest rate is significantly lower on the announcement day or the day before the announcement, while on the day following the announcement the volatility of overnight rate and 1-month rate is significantly lower. If we look at the days-of-the-week effect, while the volatility of 1-week rate and 1-month rate are significantly lower on Tuesday, none of the interest rate has significant lower volatility on Thursday.

Table 5: Estimation Results for Interest Rate (without Direction of BI-Rate Change)

	R_1N	R_1W	R_1M		R_1N	R_1W	R_1M
Mean Equation				**Variance Equation**			
				C	2.993***	0.751***	0.340***
C	1.561***	0.728***	0.501**		(4.19)	(4.64)	(3.53)
	(5.37)	(3.00)	(2.31)	ARCH(1)	0.089	0.200	0.157
R_1N(-1)	0.791***	0.924***	0.952***		(1.55)	(1.01)	(0.14)
	(20.39)	(33.75)	(49.40)	GARCH(1)	0.543***	0.493***	0.580**
DUM(-1)	-0.564*	-0.677***	0.147*		(6.63)	(7.92)	(2.00)
	-(1.79)	-(3.49)	(1.83)	DUM(-1)	-1.337	-0.187	-0.015
DUM	0.093	-0.327***	0.001		-(1.00)	-(0.82)	-(0.11)
	(0.49)	-(4.36)	(0.03)	DUM	-2.043*	-0.196	-0.069
DUM(1)	-0.074	0.374	-0.093		-(1.75)	-(0.46)	-(0.30)
	-(0.28)	(1.59)	-(1.06)	DUM(1)	-3.115***	-0.098	-0.214***
TUE	0.424**	0.152**	-0.074***		-(4.40)	-(0.14)	-(2.70)
	(2.28)	(2.35)	-(3.25)	TUE	-1.087	-0.984***	-0.349***
THU	-0.029	-0.044	-0.121**		-(0.78)	-(4.18)	-(2.57)
	-(0.11)	-(0.34)	-(2.40)	THU	-0.354	0.046	-0.075
					-(0.17)	(0.06)	-(0.36)
R-squared	0.630	0.853	0.906				
Adjusted R-squared	0.621	0.849	0.904				
S.E. of regression	1.860	0.985	0.653				
Sum squared resid	1968.3	551.9	242.7				
Log likelihood	-1202.0	-763.2	-453.7				
Durbin-Watson stat	1.906	1.943	1.776				

Notes: Numbers in the parentheses are z-statistics with Bollerslev-Wooldridge robust standard error. ***) significant at 1%; **) significant at 5%; *) significant at 10%.

In Table 6 we show the results of the estimation of the interest rate models in which the announcements are broken down based on the direction of the policy, that is, BI rate is cut, BI rate doesn't change, and BI rate is raised. A day before the announcement of a lower BI rate the interbank interest rates for overnight, 1-week, and 1-month maturity are significantly lower. On the announcement day, however, the announcement of unchanged BI-rate is only significantly for 1-week interbank rate, and the effect is negative.

Looking at the volatility of interest rates, on the announcement day the volatility of interest rate is significantly lower for 1-month maturity if BI rate is cut and for 1-week and 1-month maturity if BI rate doesn't change. On the day before the announcement, the volatility of interest rates with 1-week and 1-month maturity is significantly lower when BI rate is cut or doesn't change. On the day after the announcement, volatility of interest

rate is significantly lower for overnight and 1-month maturity if BI rate is cut; for overnight, 1-week, and 1-month maturity if BI rate doesn't change; and for overnight maturity if BI rate is raised. Finally, day-of-the-week effect doesn't have a significant effect on interest volatility.

Table 6: Estimation Results for Interest Rate (with Direction of BI-Rate Change)

	R_1N	R_1W	R_1M		R_1N	R_1W	R_1M
Mean Equation				**Variance Equation**			
C	1.599***	0.684***	0.548***	C	2.898	0.861***	0.375***
	(5.08)	(3.46)	(4.00)		(1.51)	(4.50)	(10.04)
R_1N(-1)	0.786***	0.921***	0.950***	ARCH(1)	0.078	0.141	0.156
	(21.06)	(42.04)	(102.52)		(1.15)	(1.27)	(0.25)
DUM_NEG(-1)	-1.148***	-0.640***	-0.181***	GARCH(1)	0.487	0.573***	0.579***
	-(2.84)	-(2.99)	-(4.00)		(1.41)	(8.88)	(5.64)
DUM_NEG	-0.049	-0.152	0.020	DUM_NEG(-1)	-2.251	-1.016***	-0.385***
	-(0.15)	-(0.67)	(0.80)		-(1.13)	-(3.07)	-(10.35)
DUM_NEG(1)	-0.002	0.408	-0.041	DUM_NEG	-2.185	-0.756	-0.403***
	-(0.01)	(0.95)	-(0.43)		-(1.55)	-(0.79)	-(3.56)
DUM_NOL(-1)	0.312	0.100	0.012	DUM_NEG(1)	-3.778***	-0.196	-0.514***
	(0.64)	(1.36)	(0.17)		-(5.58)	-(0.14)	-(4.12)
DUM_NOL	-0.130	-0.185***	-0.012	DUM_NOL(-1)	-1.485	-0.825***	-0.377***
	-(0.59)	-(2.55)	-(0.14)		-(0.90)	-(4.44)	-(10.06)
DUM_NOL(1)	-0.192	0.064	0.004	DUM_NOL	-2.049	-0.638**	-0.288*
	-(0.52)	(0.80)	(0.06)		-(1.05)	-(2.35)	-(1.80)
DUM_POS(-1)	-0.830	-0.226	0.271	DUM_NOL(1)	-2.789*	-0.661***	-0.276***
	-(1.09)	-(0.47)	(0.21)		-(1.72)	-(2.69)	-(3.10)
DUM_POS	0.904	0.019	0.412	DUM_POS(-1)	0.365	0.088	0.040
	(1.16)	(0.01)	(0.20)		(0.09)	(0.01)	(0.01)
DUM_POS(1)	0.518	0.638	0.292	DUM_POS	0.329	0.126	0.061
	(0.79)	(0.95)	(0.38)		(0.16)	(0.11)	(0.11)
TUE	0.458**	0.096	-0.055**	DUM_POS(1)	-5.539***	0.105	0.036
	(2.07)	(1.46)	-(2.11)		-(7.09)	(0.15)	(0.08)
THU	0.105	-0.046	-0.085**	TUE	-1.001	-0.346	-0.149
	(0.36)	-(0.35)	-(2.53)		-(0.85)	-(1.10)	-(1.01)
				THU	-0.106	-0.062	-0.081
					-(0.07)	-(0.12)	-(0.66)
R-squared		0.632	0.856	0.909			
Adjusted R-squared		0.615	0.849	0.905			
S.E. of regression		1.874	0.984	0.651			
Sum squared resid		1956.8	539.7	236.4			
Log likelihood		-1187.2	-825.3	-457.0			
Durbin-Watson stat		1.902	1.939	1.778			

Notes: Numbers in the parentheses are z-statistics with Bollerslev-Wooldridge robust standard error. ***) significant at 1%; **) significant at 5%; *) significant at 10%.

7.2. Exchange Rate Return, Stock Return and Government Bond's Yield

The model without breaking down the announcement does not show significant effect on the announcement on either exchange rate return or stock return both in level and in volatility (Table 7). However, when we breakdown the announcement based on the direction of the BI rate, in some cases the effect of the announcement is significant (Table 8). A day before the announcement in which the BI rate does not change, exchange rate return is significantly higher, and on the day of the announcement and a day before the announcement of higher BI rate, stock return is significantly higher. But the stock return is significantly lower a day after the announcement of higher BI rate. For government bond's yield, a day before the announcement of lower BI rate, the yield on government bond is significantly lower, but on the day that BI rate is announced higher, the yield on government bond is significantly higher.

Table 7: Estimation Results for Exchange Rate Return, Stock Return
and Government Bond's Yield (without Direction of BI Rate Change)

	R_ER	R_JSX	SUN_1Y		R_ER	R_JSX	SUN_1Y
Mean Equation				**Variance Equation**			
C	-0.013	0.202***	0.195	C	0.033*	0.108	0.157***
	-(0.56)	(3.63)	(0.91)		(1.74)	(1.06)	(7.42)
R_1N(-1)	-0.013	0.126**	0.980***	ARCH(1)	0.293***	0.297***	1.610
	-(0.19)	(2.39)	(59.18)		(3.86)	(3.60)	(1.09)
DUM(-1)	0.011	-0.197	0.042	GARCH(1)	0.666***	0.608***	0.034
	(0.16)	-(1.03)	(1.25)		(10.58)	(7.58)	(0.50)
DUM	0.007	-0.022	0.097	DUM(-1)	-0.024	0.270	-0.127***
	(0.11)	-(0.11)	(1.47)		-(0.85)	(1.06)	-(5.82)
DUM(1)	0.035	-0.113	0.056	DUM	-0.063	-0.433	-0.087***
	(0.43)	-(0.48)	(1.12)		-(1.29)	-(1.17)	-(3.91)
TUE	-0.039	-0.067	0.006	DUM(1)	0.047	0.484	-0.118***
	-(0.94)	-(0.54)	(0.19)		(0.70)	(0.90)	-(7.12)
THU	-0.010	0.027	-0.019	TUE	-0.017	0.369	-0.046***
	-(0.22)	(0.24)	-(0.23)		-(0.40)	(1.55)	-(3.55)
				THU	-0.044	0.060	0.025
					-(1.12)	(0.24)	(0.47)
R-squared		-0.002	0.000	0.944			
Adjusted R-squared		-0.027	-0.025	0.943			
S.E. of regression		0.563	1.353	0.493			
Sum squared resid		180.1	1040.1	138.2			
Log likelihood		-344.8	-920.5	-227.5			
Durbin-Watson stat		2.252	2.062	2.583			

Notes: Numbers in the parentheses are z-statistics with Bollerslev-Wooldridge robust standard error. ***) significant at 1%; **) significant at 5%; *) significant at 10%.

Table 8: Estimation Results for Exchange Rate, Stock Returns
and Government Bond's Yield (with Direction of BI-Rate Change)

	R_ER	R_JSX	SUN_1Y		R_ER	R_JSX	SUN_1Y
Mean Equation				**Variance Equation**			
C	-0.031	0.121*	0.334	C	0.246***	1.428***	0.223***
	-(1.14)	(1.77)	(2.68)		(3.71)	(4.95)	(6.33)
R_1N(-1)	-0.046	0.104**	0.968***	ARCH(1)	0.160	0.142***	0.123
	-(0.87)	(1.99)	(90.32)		(1.55)	(2.52)	(1.61)
DUM_NEG(-1)	-0.001	-0.053	-0.240*	GARCH(1)	0.531***	0.505***	0.567***
	-(0.01)	-(0.23)	-(1.88)		(3.23)	(4.14)	(8.26)
DUM_NEG	0.007	0.057	0.016	DUM_NEG(-1)	-0.198***	-1.040**	-0.083
	(0.15)	(0.27)	(0.35)		-(2.79)	-(2.45)	-(0.52)
DUM_NEG(1)	-0.046	-0.020	-0.089	DUM_NEG	-0.223***	-0.985*	-0.216***
	-(1.19)	-(0.06)	-(1.51)		-(2.64)	-(1.94)	-(2.07)
DUM_NOL(-1)	0.105**	-0.180	0.011	DUM_NEG(1)	-0.194	-0.589	-0.385***
	(2.36)	-(0.43)	(0.29)		-(1.38)	-(0.63)	-(7.51)
DUM_NOL	-0.055	-0.344	-0.011	DUM_NOL(-1)	-0.193***	-0.618	-0.228***
	-(0.38)	-(0.91)	-(0.28)		-(4.87)	-(1.03)	-(6.45)
DUM_NOL(1)	-0.114	-0.162	-0.238	DUM_NOL	-0.119	-0.105	-0.222*
	-(0.93)	-(0.49)	-(1.68)		-(1.54)	-(0.28)	-(1.81)
DUM_POS(-1)	-0.331	0.796**	0.096	DUM_NOL(1)	-0.201**	-1.088**	-0.128
	-(1.24)	(2.02)	(1.58)		-(2.39)	-(2.22)	-(1.24)
DUM_POS	0.036	0.498***	0.235***	DUM_POS(-1)	-0.080	-0.844*	-0.211***
	(0.17)	(3.73)	(3.03)		-(0.61)	-(1.69)	-(5.96)
DUM_POS(1)	0.202	-0.760*	0.184	DUM_POS	-0.096	-1.083***	-0.247**
	(0.85)	-(1.68)	(1.33)		-(0.85)	-(2.71)	-(2.18)
TUE	0.040	-0.048	0.025	DUM_POS(1)	-0.249*	-1.367**	-0.350***
	(0.75)	-(0.40)	(0.77)		-(1.92)	-(2.20)	-(4.50)
THU	-0.008	0.047	-0.098***	TUE	-0.134*	-1.081***	-0.057
	-(0.16)	(0.37)	-(2.13)		-(1.73)	-(3.00)	-(0.48)
				THU	-0.181***	-1.188***	-0.011
					-(2.80)	-(3.70)	-(0.08)

	R_ER	R_JSX	SUN_1Y
R-squared	0.016	0.011	0.945
Adjusted R-squared	-0.030	-0.035	0.943
S.E. of regression	0.564	1.360	0.493
Sum squared resid	176.9	1028.4	135.5
Log likelihood	-431.8	-954.6	-387.2
Durbin-Watson stat	2.183	2.031	2.590

Notes: Numbers in the parentheses are z-statistics with Bollerslev-Wooldridge robust standard error. ***) significant at 1%; **) significant at 5%; *) significant at 10%.

If we look at volatility, the volatility of exchange rate return is significantly lower on the day of the announcement and a day before the announcement of lower BI rate, on the day before the announcement of unchanged BI rate, and on the day following the

announcement of higher BI rate. The volatility of stock return is also lower on the day of announcement and a day before the announcement of lower BI rate, on the day following the announcement of unchanged BI rate, on the day of announcement, and before and following the announcement of higher BI rate. Lower volatility of stock return is consistent with Bomfim's (2003) finding for US stock market. The volatility of government bond's yield is also significantly lower on the day of the announcement regardless the direction of the BI rate change, on the day before the announcement that BI rate does not change or higher BI rate, and on the day after the announcement of lower or higher BI rate. On Tuesday and Thursday, the volatility of exchange rate return and stock return is significantly lower.

8. Conclusions

Starting in July 2005, Bank Indonesia has used BI rate as a reference interest rate and since then the decision on BI rate has been announced publicly every month. In this paper we examine the effect of the BI rate announcements following the monetary policy meeting every month. The estimation results reveal a number of regularities. First, interbank interest rates with overnight, 1-week, and 1-month maturity are significantly lower a day before the announcement of lower BI-rate. On the other hand, exchange rate, stock return, or government bond's yield are not significantly affected by BI-rate announcements.

Second, the announcements of lower or stay BI-rate significantly bring down volatility of interbank interest rate with overnight, 1-week, and 1-month maturity, government-bond yield with 1-year maturity, as well as exchange rate and stock returns.

Third, in terms of level, the largest effect of BI-rate announcement takes place in overnight interbank interest rates while the lowest effect takes place in 1-month interbank interest rate. Similarly, in terms of volatility, the largest effect of BI-rate announcement takes place in overnight interbank while the lowest effect takes place in 1-month overnight interest rate.

If we compare the effect of BI rate announcement on interbank interest rates and government bonds, it turns out that the effect of BI rate announcement on government bond is lower than that of overnight interest rates with overnight, 1-week, and 1-month

maturities. If we compare the magnitude of the effects of BI rate announcements on exchange rate return and stock return, the effect on stock return is much larger than the effect on exchange rate return.

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