Monetary Policy and Stock/Foreign Exchange Market Liquidity: The Japanese Case

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Abstract. This paper examines changes in liquidity of the stock market and foreign exchange market in response to monetary policy announcements of the Bank of Japan. In Japan, an unconventional monetary policy started from the year of 2001.This article reports on an empirical examination of the period from the beginning of the unconventional monetary policy to the present. Liquidity impairment in the foreign exchange market in Japan associated with announcements and conduct of monetary policy does not occur; however, such impairments normally do not occur. For the Japanese stock market, trade volume is associated with liquidity and the phenomenon occurs on the usual days. Market participants who obtain information about monetary policy are not subject to surprise and markets impairments do not happen as a result of the conduct of monetary policy in Japan. At least, these markets do not accept monetary policy conduct as a surprise.
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1. Introduction

This paper examines changes in the foreign exchange market and stock market liquidity in response to monetary policy announcements of the Bank of Japan (BOJ). When central banks, including BOJ, conduct policies, they usually prefer to communicate with markets to stabilize market fluctuations. I particular, turmoil that fluctuates prices largely (or stops trading) should be avoided. Central banks conduct surprising monetary policies in some cases, and to do so, they move markets; however, such policy conduct sometimes causes turmoil, as large price fluctuations and huge volumes of transactions occur. The side effects are sometimes very large such that the market cannot be returned easily to its usual status. Policymakers want to impact markets with their policies; however, they usually intend to move markets as smoothly as possible without turmoil or large impairments. Therefore, communication of central banks with financial markets is very important to develop and maintain sound financial markets. Recent experience indicates that turmoil sometimes spreads contagion to other countries or districts. Improvement in ICT (Information, communication, and technology) promotes such phenomena quite strongly.

When monetary policy decisions by central banks are made based on adequate communication between the central bank and the markets, liquidity is expected to be high because of a reductionin information asymmetry between informed and uninformed market participants. This paper employs this simple idea to perform empirical research on whether or not liquidity goes up as a result of monetary policy in Japan. The usual situation without special transactions would be ideal for this research.

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Market communication between central banks and market participants has been discussed a lot since the 2000s. Bernanke (2004) showed that higher communication and transparency by policymakers improves economic welfare by reducing information asymmetries among market participants. Ehrmann & Fratzscher (2005) indicated that central bank communication is an important factor for market participants to predict the future direction of interest rates and monetary policies. Nautz & Schmidt (2009) found that high transparency and communication of the federal funds target rate promotes stabilization of the federal funds rate in the United States. Hussian (2011) used high-frequency data and found that monetary policy surpriseshave an effect on European and US stock returns and other market volatilities. Blinder, *et al.,* (2008) and Knütter, Mohr, & Wagner (2011) noted that central bank communication is defined as the process of central banks giving information to market participants, monetary policy method, and outlook for future monetary policies. Hayo, Kutan, & Neuenkirch (2010) examined the effects of US federal funds target rate changes and other measures of FOMC communication and found that target rate changes impact the economy. Also, Hayo *et al.,* (2015) showed that Federal Reserve communications significantly affect US financial return rates. Liu (2015) stated that monetary policy conducted in emerging countries may increase the uncertainty of market fluctuations.

For the issue of market liquidity, Glosten & Milgraom (1985) showed that highly informed traders tend to use that information before news is announced, which reduces liquidity. Agarwal, *et al.,* (2015) showed that stocks with higher fund ownership, especially those owned by well informed traders or under large information asymmetry, increase liquidity greatly. Chung, *et al.,* (2012), Ali, Liu, & Su (2016), and Jain, Jiang, & Mekhaimer (2016) indicated that well-governed firms show high stock liquidity. Wang & Zhang (2015) found that stocks that are more largely traded by investors demonstrate high liquidity. One can expected that such transactionspromotestockliquidityby shrinking information asymmetry.

On the other hand, Chung, Elder, & Kim (2013) showed that liquidity decreases after monetary policy announcements and the effect continues for about one and a half hours. Glosten & Milgraom (1985) and Kim & Verrechia (1994) showed that announcements with included more information receive a larger response from investors and increase information asymmetry because of a gap among market participants; well-informed trading increases and liquidity declines after news announcements. Graham, Koski, & Lowenstein (2006) showed that liquidity declines before anticipated announcements. Chung *et al.,* (2013) showed that liquidity declines following the announcements and that information asymmetry increases. Riordan, *et al.,* (2013) found that adverse selection costs increase around the arrival of newswire messages. He & Lepone (2016) showed that liquidity may worsen as passive and uninformed investors migrate to the futures market.

The relationship between monetary policy and liquidity has room for further study. The consensus of the results has not been reached yet. This article focuses on the Japanese stock and foreign exchange market.

2. The Japanese Economic Situation, Monetary Policy, and Market Communication

2.1. The Japanese Economic Situation and Monetary Policy

Japan has been in severe economic condition and deflation since the so-called bubble economy burst in the 1990s. In 1980, Japan experienced rising stock and land prices; however, the bubble burst at the beginning of 1990s. At the end of 2001, the BOJ raised the outstanding balance of the current account at the BOJ. Usually, central banks make interest rates move (rise, reduce, or stay) using monetary policy; however, at that time, interest rates in Japan were already too low to boost the economy. There was no room to reduce interest rates (zero interest rate). This monetary policy objective can be perceived as a change from holding a level of reserves at the BOJ to one that transfers funds into lending to boost the

economy and remove deflationary pressures. Under this quantitative easing policy, the BOJ purchased huge amounts of Japanese government bonds to arrive at its target level of current account balances held by financial institutions. With interest rates already at the lower bound of zero, the BOJ set a new goal to purchase government bonds from financial institutions and to raise the level of cash reserves held by financial institutions. This was called *unconventional monetary policy,* which was unprecedented in the world at that time that is now common in other developed countries. At present. very few Japanese bonds are owned by foreign investors. This may be the reason that Japanese government prices are stable and low interest rates continue.

On April 4, 2013, the policy board of the BOJ decided to conduct quantitative and qualitative monetary easing policy, which is a more aggressive monetary policy. The BOJ decided to achieve the consumer price target of 2% for the year-on-year rate of change in consumer prices. Deflation had been thought of as seriouslyspoiling the Japanese economy. It was said that the BOJ imposed a new phase of monetary easing both in terms of quantity and quality. The BOJ doubled the monetary base and the amounts outstanding of Japanese government bonds as well as exchange-traded funds (ETFs) in two years and more than doubled the maturity of Japanese government bond purchases (quality).

2.2. Market communication between central banks and market participants

Central bank communication with financial markets seems to be increasingly important when central banks conduct their monetary policies. Schmidt & Nautz (2012) showed that efficient and effective communication among financial markets should ensure that financial markets understand the central banks' policies; that is, how interest rates are linked to future inflation rate and output. Christensen & Rudebusch (2012) indicated that decreases in US interest spreads (yields) reflect expectations of future low short-term interest rates, whereas decreases in UK bond yields reflect reduced premiums of interest rates.

Other types of studies have been conducted. Not only interest rates but also other financial variables have been examined with central banks' monetary policy and market responses to monetary policy. Romer & Romer (2000) analyzed the case of the United States. Kevin & Auerbach (2010) showed the effects of news announcements from the Federal Reserve System (FED) and from European Central Bank (ECB) on exchange rates. Syed (2010) examined the effects of monetary policy conduct in reaction to news announcements by the FED and ECB for stock prices. Komain (2012) confirmed evidence of risk spillovers in the stock and foreign exchange markets in emerging economies. Leon & Williams (2012) used a matched-sample test of before- and after-intervention events in foreign exchange markets and showed that interventions under sterilizationare effective. Not only economic variables but also other financial markets such as stock and foreign exchange markets have begun to be examined.

For the Japanese context, Kim & Le (2010) and Kurihara (2011) examined the effectiveness of intraday financial policies of the BOJ. Kurihara (2011) examined the impact of news announcements by the BOJ on interest rates using daily data. However, few studies have examined the Japanese case or focused on liquidity of financial markets.

3. Empirical Methods

3.1. Method

This paper examines the effects of monetary policy announcements on Japanese stock and foreign exchange market liquidity after the conduct of unconventional monetary policy in Japan. This section employs the empirical method. Not only price (bid-ask spread) but also trading volume are added for examination. The

estimated equation is (1),which is calculated from the stock and foreign exchange market in Japan. Daily data are used for estimation.

$$dLIQUIDITY_t = \alpha_0 + \alpha_1 I_t + \alpha_2 dlogPRICE_t + \alpha_3 dVOLATILITY + \alpha_4 dlogVOLUME_t + \varepsilon_t \qquad (1)$$

where d is the time difference. LIQUIDITY is liquidity of stock market and foreign exchange market during interval on announcement day in terms of spread. Also, stock prices (PRICE), volatility (VOLATILITY), and trading volume (VOLUME) are included in the equation.

Robust estimation is also used for estimation along with OLS. Robust estimation is unlike maximum likelihood estimation. OLS estimates for regression are sensitive to observations that do not follow the pattern of other observations. This is not a problem if the outlier is simply an extreme observation from the tail of a normal distribution; however, if the outlier is from non-normal measurement error or some other violation of standard OLS, it compromises the validity of the regression results if a nonrobust regression method is employed.

3.2. Data

This paper examines the cases of stock market and foreign exchange market in Japan. These liquidities are examined empirically.

For the stock market, Nikkei225 Average Stock Price daily data are used. There is no bid-ask price, so instead of this, the difference between asking volume and bidding volume is used. Price difference is between 12:45 and 14:00 for the case of stock as announcements of monetary policy usually occur between these times. Volatility is measured for five days at end of the day excluding closed days. For the case of the foreign exchange market, the spot exchange rate of Yen/USD in the Tokyo foreign exchange market is used for estimation. Price difference is between 9:00 to 17:00 and between 9:00 to 9:00 (next day) for data availability. All of the data are from Nikkei telecom (Japanese database). Volatility is the same as for stock price. The sample period is from 2001 to 2016. The data are daily. Only available data are used for estimation. Closed days of these two markets are excluded from the estimation.

4. Empirical Results

First, the prescription for each set of datais shown in Table 1 and Table 3. The probability is zero for both cases. *Event day* is the day that the BOY announced monetary policy's changes.

Table 1. *Event Day's Prescription (5 Days)*

	Stock Price Volatility	Exchange Rate Volatility
Mean	26.899	141.823
Median	24.285	124.478
Maximum	70.310	414.528
Minimum	15.430	21.333
Std. Dev.	11.280	94.804
Skewness	2.604	1.183
Kurtosis	9.866	3.928
Jarque-Bera	185.712	16.160
Probability	0.000	0.000
Sum Sq. Dev.	7507.696	530287.1

The empirical results of equation (1) are shown in Tables 2 and Table 4.

Table 2. *Deterministic Elements of Bid-Ask spread (Liquidity): Event Day*

	Stock Liquidity		Foreign Exchange Liquidity (9:00 to 17:00)		Foreign Exchange Liquidity (9:00 to 9:00)	
C	-416371.7***	-212963.1***	-0.003	-0.003	-0.006	-0.008
	(-4.270)	(-4.043)	(-0.415)	(-0.436)	(-0.997)	(-1.168)
Price Difference	115.658	60.900	0.0002***	0.000***	0.0002***	0.0003***
	(0.499)	(0.480)	(3.260)	(3.176)	(4.384)	(4.549)
Volatility	3344.376	2067.628*	9.13E-06	9.04E-06	-2.87E-07	-1.38E-06
	(1.615)	(1.848)	(0.700)	(0.653)	(-0.024)	(-0.113)
Volume	1.100***	1.040***	-2.23E-05	-2.64E-05	-1.48E-05	-1.94E-05
	(30.029)	(52.566)	(-1.378)	(-1.540)	(-0.102)	(-1.284)
Adj.R2	0.940		0.218		0.285	
Adj.Rw2		0.986		0.321		0.399
F-statistic	312.074		6.484		8.869	
Prob (F-statistic)	0.000		0.000		0.000	
Rn-squared		2895.239		18.979		28.969
Prob (Rn-squared)		0.000		0.000		0.000
Durbin-Watson	0.995		1.091		1.525	
Method	OLS	Robust Least Squares	OLS	Robust Least Squares	OLS	Robust Least Squares

Note: Price difference is between 12:45 and 14:00 for the case of stock. It is between 9:00 to 17:00 and between 9:00 to 9:00 (next day). Parentheses are t-statistic for the case of OLS and z-statistic for the case of robust least squares.

Table 3. *Non-Event Day's Prescription (5 Days)*

	Stock Price Volatility	Exchange Rate Volatility
Mean	24.407	141.279
Median	24.020	119.622
Maximum	92.030	958.308
Minimum	11.060	5.060
Std. Dev.	8.725	95.550
Skewness	2.568	2.192
Kurtosis	14.146	11.752
Jarque-Bera	27149.17	17273.09
Probability	0.000	0.000
Sum Sq. Dev.	329278.8	39486520.0

Table 4. *Deterministic Elements of Bid-Ask Spread (Liquidity): Non-Event Day*

	Stock Liquidity		Foreign Exchange Liquidity (9:00 to 17:00)		Foreign Exchange Liquidity (9:00 to 9:00)	
C	-399286.0***	-335981.7***	-0.010***	-0.011***	-0.008***	-0.009***
	(-26.033)	(-32.274)	(-11.903)	(-12.742)	(-9.491)	(-10.283)
Price Difference	31.533	24.793	0.0003***	0.0003***	0.0002***	0.0003***
	(0.619)	(0.717)	(38.690)	(39.104)	(36.212)	(36.161)
Volatility	802.632**	2110.232***	-1.77E-06	-1.81E-06	-3.14E-06***	-2.48E-06**
	(2.303)	(8.921)	(-1.486)	(-1.495)	(0.008)	(0.044)
Volume	1.115***	1.094***	-2.05E-06	-2.56E-06	1.80E-06	9.01E-07
	(211.601)	(306.190)	(-0.828)	(-1.016)	(0.722)	(0.350)
Adj.R2	0.920		0.261		0.234	
Adj.Rw2		0.968		0.312		0.279
F-statistic	16603.93		510.257		443.288	
Prob (F-statistic)	0.000		0.000		0.000	
Rn-squared		103004.8		1563.960		1331.370
Prob (Rn-squared)		0.000		0.000		0.000
Durbin-Watson	0.132		1.125		1.144	
Method	OLS	Robust Least Squares	OLS	Robust Least Squares	OLS	Robust Least Squares

Note: Price difference is between 12:45 and 14:00 for the case of stock. It is between 9:00 to 17:00 and between 9:00 to 9:00 (next day). Parentheses are t-statistic for the case of OLS and z-statistic for the case of robust least squares.

The tables above show that liquidity impairment in the foreign exchange market in Japan associated with announcements of monetary policy does not occur; however, such impairments also do not happen on usual days (i.e., days when non-monetary policy is not conducted). It is interesting to note that price volatility is linked with loss of liquidity for the usual days (non-monetary policy conduct days).

There may be some possibility that information asymmetry among market participants could expand.

For the stock market, trade volume is associated with liquidity and the phenomenon occurs on usual days. Liquidity of the stock market is not influenced by price difference in either case of monetary policy conduct (monetary policy conduct days and non-monetary policy conduct days). Also, increasesin trade volume are linked with liquidity on monetary policy conduct days; however, this situation does not occur on non-monetary policy conduct days. In general, market participants who can obtain information about monetary policy do not receive surprises, and impairment of the markets does not happen as a result of the conduct of monetary policies in Japan.

5. Conclusions

This paper examines changes in liquidity of the stock market and foreign exchange market in response to monetary policy announcements of the BOJ. In Japan, unconventional monetary policy started; the period following the beginning of unconventional monetary policy is examined empirically. The present research indicates that liquidity impairment in the foreign exchange market in Japan associated with announcements of monetary policy does not occur; however, such impairments do not occur as usual. For the stock market, trade volume is associated with liquidity and the phenomenon occurs on usual days. Market participants who obtain information about monetary policy do not receive surprises, and impairment of the markets does not happen as a result of the conduct of monetary policy in Japan.

Acknowledgments

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