The Effectiveness of Unconventional Monetary Policy in Japan

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Abstract

Since the global financial crisis of 2007-2008, central bankers around the world have been forced abandoned the conventional monetary policy tools in favor of unconventional policies such as quantitative easing, forward guidance, and even lowering the interest rate paid on bank reserves into negative territory. Japan, which faced a crisis in its banking sector and came up against the theoretical zero lower bound on interest rates nearly a decade earlier, was a pioneer in the use of many of these unconventional policy tools. This paper analyzes the effectiveness of Japan's bold experiment with unconventional monetary policy. Using a panel of bi-annual bank data covering the full universe of Japanese commercial banks over a fifteen year period, this study analyzes the effectiveness of quantitative easing policy on the bank lending channel of monetary policy transmission. Preliminary findings suggest that Japan's unconventional monetary policy worked: there is a bank lending channel of monetary policy transmission in Japan. These results are robust to the inclusion of time fixed effects and generalized method of moments analysis. However, contrary to the predictions of banking theory, the effects of quantitative easing seem to come mostly through *under*capitalized banks. These findings suggest that bank balance sheet problems and regulatory pressure continue to be important factors impairing the credit channel.

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1. Introduction

Since the global financial crisis of 2007-2008, central bankers around the world have been forced abandoned the conventional monetary policy tools[1] in favor of unconventional policies such as quantitative easing, forward guidance, and even lowering the interest rate paid on bank reserves into negative territory. In particular, facing the zero lower bound on interest rates, central bankers in the United States and Europe have shifted from their usual instrument of monetary policy – a targeted uncollateralized interest rate paid on overnight interbank loans – to targeting a certain level of bank reserves.

Japan was a pioneer of much of this unconventional monetary policy. The Bank of Japan first embarked on forward guidance (before the term was commonly used) in February of 1999 with its so-called "zero-interest rate policy" (ZIRP), by which BoJ Governor Hayami committed to keep the uncollateralized overnight interbank rate, the call rate, at zero "until deflationary conditions subside". The target call rate was raised to 25 basis points in August of 2000, but in retrospect, that rate raise seemed premature, and it was lowered again, this time to 15 basis points, in February 2001. With the economy still not performing at potential and mired in deflation, at its March 2001 meeting the BoJ shifted its monetary policy instrument from the call rate to the amount of bank reserves held on deposit at the BoJ.

Japan's bold experiment in targeting bank reserves was the world's first policy of

[1] The most commonly implemented conventional monetary policy is of course open market operations, but discount lending and reserve requirements are also usually categorized as conventional (if rarely used) monetary policy.

quantitative easing (QE). Despite much controversy and debate, even among the monetary policy board members of the BoJ itself, this first round of quantitative easing, now referred to as "QE1", remained in effect for nearly six years. Over that period, the targeted balance of the BoJ's current account was raised several times. When the policy was first announced in March 2001, reserves were targeted at 5 trillion yen. That was raised to 6 trillion yen in August 2001 and then to a range between 10-15 trillion in December of the same year. When Hayami was succeeded by Governor Fukui in 2003, QE1 was expanded further[2] to reach a target of 30-35 trillion by January 2004. Finally, on March 9, 2006, the BoJ lifted the quantitative easing policy by a 7-1 vote, citing that the three conditions for lifting QE, set out at the January 2004 monetary policy meeting, had been met[3]. The BoJ's monetary policy instrument was switched from the BoJ current account balance back to the conventional instrument of the uncollateralized overnight call rate, although to assuage critics in the Ministry of Finance and Cabinet Office, the BoJ pledged that the targeted call rate would remain effectively at zero for some time: ZIRP would remain in place. Three months later, in July 2006, the BoJ made the historic decision to lift ZIRP and target a 25 basis point call rate. Interest rates in Japan had finally been normalized after more than six years of experimental policy.

At the end of Governor Fukui's term in March, Masaaki Shirakawa took over at the helm of the BoJ. He was soon facing the global financial crisis, or the "Lehman Shock"

[2] The policy announcement also expanded the assets to be purchased to include asset backed securities (ABS) that passed certain screening, and forward guidance on how long QE would remain in place.

[3] Those conditions, articulated as forward guidance as to how long QE would remain in place at the January 2004 MPM, were as follows: "(1) Not only the most recently published CPI should register zero percent of above, but also that such tendency should be confirmed over a few months (2) The BoJ needed to be convinced that prospective CPI was not expected to register below zero percent (3) The above two conditions being the necessary condition for termination, there might be cases where the BoJ would judge it appropriate to continue with quantitative easing even if they were fulfilled.".

as it is sometimes referred to in Japan. By December 2008, policy rates were nearly at zero in the United States. The BoJ lowered the target call rate from 30 to 10 basis points and announced an increase in outright purchases of JGBs and some less conventional assets such as commercial paper. However, Governor Shirakawa insisted that this was *not* a return to quantitative easing. QE returned, however, in 2013, under Shirakawa's successor, Kuroda, and was promoted as the first of three "arrows" in Prime Minister Abe's economic plan, "Abenomics", which he placed at the center of his political agenda.

In April 2013, Governor Kuroda announced Qualitative *and* Quantitative Easing, of QQE. This was a pledge to end the "incremental" approach of the BoJ (presumably a dig at Shirakawa) by doubling the monetary base within one year and raising the average maturity of JGBs held by the BoJ. This was forecast to increase the size of the BoJs balance sheet by about 1% of GDP each month, double the rate that had been set by the Fed under its program of "Large Scale Asset Purchases" (Fed Chair Ben Bernanke was, like Shirakawa, insistent that his policy was *not* QE). At the time of this writing, QQE remains in place, more than four years after it was implemented[4].

What is the path of monetary policy transmission in the case of unconventional policies such as QE and QQE? Conventional monetary policy works

A seminal paper on the bank lending channel of monetary policy transmission is of course Kashyap and Stein (2000), which found support for the existence of the bank lending channel in an analysis of quarterly balance sheet data on U.S. commercial banks

[4] QQE was followed in September 2016 by a targeted yield on 10-year JGBs of less than zero and most recently with negative interest rate policy (NIRP), a -0.1% rate on new deposits banks hold on reserve at the BoJ, in January 2016.

from 1976 to 1993. Hosono (2006) builds on the model proposed by Kashyap and Stein (2000), extending their empirical analysis to include not only liquidity, but also bank capital, in an analysis of the transmission of Japanese monetary policy during the period 1975 to 1999. Echoing some of the findings of Kashyap and Stein (2000), Hosono (2006) finds evidence of a bank lending channel in Japan, and concludes that it works more effectively through smaller, less liquid, banks with higher capital ratios. In sub-sample analysis however, Hosono (2006) demonstrates that the effectiveness of the bank lending channel of monetary policy transmission is asymmetric: during period of monetary tightening, bank liquidity plays an important role in transmission, while during periods of monetary policy tightening, bank capital becomes paramount.

The study most closely related to our study, however, is Bowman, Cai, Davies, and Kamin (2015) which examines the impact of unconventional monetary policy in Japan. Bowman, Cai, Davies, and Kamin (2015) empirically evaluate the effect of Japan's first pioneering experiment with quantitative easing policy (now referred to as "QE1") from 2001 to 2006 on bank lending. They find a positive, statistically significant impact of bank liquidity on bank lending during the period of QE1, but conclude that it is so small as to be quantitatively, economically, rather insignificant.

The rest of this study is organized as follows. The next section presents the theoretical framework we use to inform our empirical analysis. Section three discusses the data used in the analysis and the empirical methodology. Section four presents and discusses the empirical results. Section five concludes.

2. Theoretical Framework

This study is theoretically based on Kopecky and VanHoose's (2004) model of bank behavior, which develops a hypothesis about the interaction between monetary policy and bank capital regulation. Their paper reveals why different banks may behave differently to monetary policy and under which conditions monetary policy may be effective.

Kopecky and VanHoose's (2004) model assumes a simplified bank balance sheet:

Assets	Liabilities
R	D
G	E
L	

Where:

R represents bank reserves

G represents government securities

L represents loans

D represents deposits

E represents capital

The constraints on bank behavior are summarized by the following equations:

$$R + G + L = D + E \tag{1}$$

$$R \geq \rho D \tag{2}$$

$$E \geq \theta L \tag{3}$$

$$C_G = (\frac{g}{2})G^2 \tag{4}$$

$$C_L = (\frac{f}{2})L^2 \tag{5}$$

$$C_E = (\frac{b}{2})E^2 \tag{6}$$

$$r_R = 0 \tag{7}$$

$$r_D = 0 \tag{8}$$

$$r_G > 0 \tag{9}$$

$$r_L > 0 \tag{10}$$

Where:

ρ represents the required reserve ratio

θ represents the minimum capital adequacy ratio required under current regulations

C_G represents the cost of government bond management

C_L represents the cost of loan management

C_E represents the cost of capital management

r_i represents bank resources costs for $i = R, D, G, L$.

C_i is assumed to be a quadratic function since bank managers face increasing marginal costs. Based on the above assumptions, the representative bank's profit function can be described as:

$$\Pi = r_L L + r_G G - r_E E - \left(\frac{b}{2}\right) E^2 - \left(\frac{g}{2}\right) G^2 - \left(\frac{f}{2}\right) L^2 \tag{11}$$

Suppose the central bank's instrument for monetary policy implementation is a targeted level of bank reserves is R. Further, assume that financial markets operate under perfect competition. Then, subject to the constraints laid out above in equations (1) to (10), profit maximization yields optimal supplies of loans, government bonds and capital for the representative bank. However, the result of profit maximization depends upon the banks' capital ratio, as explained below.

Case 1: The capital adequacy ratio is greater than required ($E/_L > \theta$)

If banks are meeting their required regulatory capital ratio, the optimal supplies of loan, government bond and capital are:

$$G = \frac{1}{\Omega}[-br_L + (f+b)r_G - fr_E + fb\hat{\rho}R] \tag{12}$$

$$E = \frac{1}{\Omega}[gr_L + fr_G - (f+g)r_E - fb\hat{\rho}R] \tag{13}$$

$$L = \frac{1}{\Omega}[(g+b)r_L - br_G - gr_E + gb\hat{\rho}R] \tag{14}$$

Where: $\Omega = \mathrm{fb} + \mathrm{gb} + \mathrm{fg}$ which is a constant

Ceteris Paribus, when a bank's actual capital adequacy ratio is greater than the minimum required capital adequacy ratio set by regulators, $(E/_L) > \theta$, and the central bank conducts expansionary monetary policy by increasing R, the optimal choice for commercial banks is to increase lending. Monetary policy is effective. Note that with the increase of R, E and L are moving inversely until the assumption $(E/_L) > \theta$ no longer holds.

Case 2: The capital adequacy ratio is lower than required ($E/L < \theta$) and capital is exogenous in the short-run.

If the representative bank's capital adequacy ratio is below the level required by regulators, $E/L < \theta$, and banks cannot adjust their capital, E, in the short-run, meaning that bank managers must take capital as exogenous in the short run, then the bank's loan supply is capped at:

$$L = \bar{E}/\theta \tag{15}$$

Under these conditions, when the central bank conducts expansionary monetary policy to stimulate the economy, commercial banks would rather transform liquidity into low-risk government bonds than increase the supply of loans. Commercial banks will shrink the supply of credit to satisfy their regulatory capital requirement. Monetary policy will be ineffective.

Case 3: The capital adequacy ratio is lower than required ($E/L < \theta$), but capital is endogenous.

In case 3, we consider that the representative bank is again not meeting the required capital adequacy ratio set by regulators, however capital is endogenous. In this case, the optimal supplies of government bonds, capital and bank loans are as follows:

$$G = \frac{1}{\Lambda}[-(1-\theta)r_L + (1-\theta)^2 r_G - (1-\theta)\theta r_E + (f + b\theta^2)\hat{\rho}R] \tag{16}$$

$$E = \frac{1}{\Lambda}[r_L - (1-\theta)r_G - \theta r_E + g(1-\theta)\hat{\rho}R] \tag{17}$$

$$L = E/\theta \tag{18}$$

Where: $\Lambda = \mathrm{b}\theta^2 + \mathrm{f} + \mathrm{g}(1-\theta)^2$, $\rho = (1-\rho)/\rho$,

3. Data and Methodology

3.1 Data

This study uses panel data of 109 Japanese banks' balance sheet and financial statements over the 15 year period between 2000 and 2015 from the *Japanese Bankers Association (JBA)*. The data frequency is semi-annual, as balance sheet and financial statement information is reported every September and March (note that Japan's fiscal year runs from April 1 to March 31). Thus, our panel of data includes a total of 4,003 bank-period observations.

Table 1 reports the summary statistics.

Table 1.
Summary Statistics, 1990-2000

Variable Name	Mean	Standard Deviation	Min	Max
Loan Growth (log change, %)	0.85%	5.24	-103.73%	84.43%
Liquidity Ratio (%)	6.64%	3.91	1.13%	54.85%
Total Assets (log, million yen)	14.67	1.23	10.38	19.12
Total Deposits (log, million yen)	14.45	1.38	4.01	18.70
Equity Ratio (%)	5.04%	4.93	-78.82	79.83
Bad Loan Ratio (%)	81.79	95.55	-612.47	1,916.83
No. of Banks (*i*)	109			
No. of Time Periods (*t*)	40			
No. of Observations	4,003			

Source: *Japanese Bankers Association*.

3.2 Empirical Methodology

Our baseline estimation regresses the panel of data described above using the following reduced-form equation:

$$\Delta\, log\left(L_{i,t+1}\right) = \beta_0 + \beta_1 LR_{i,t} + BX_{i,t} + \varepsilon_{i,t+1} \quad (19)$$

Where:

$\Delta\, log\left(L_{i,t+1}\right)$ represents log change of loans for bank i at time $t+1$

$LR_{i,t}$ represents the liquidity ratio of bank i at time $t+1$, defined as the ratio of liquid assets ("cash and due from banks" plus "call loans") divided by total assets

$X_{i,t}$ represents a vector of control variables, including the log of total assets, the log of total deposits, the equity ratio (the ratio of bank equity to total assets) and the bad loan ratio (the ratio of bad loans to total bank equity; bad loans are defined as the sum of "loan to borrowers in legal bankruptcy", "past due loans in arrears by six months or more", "loans in arrears by three months or more and less than six months" and "restructured loans") for bank i at time $t+1$

$\varepsilon_{i,t+1}$: represents the error term for bank i at time $(t+1)$

In equation 19, the main parameter of interest is β_1, the coefficient on the liquidity ratio. If monetary policy is effective, the estimate of β_1 will be positive and statistically significant, indicating that a higher bank liquidity ratio leads to higher bank loan growth.

To explore the implications of the model presented above, we also estimate the following equation:

$$\Delta\, log\left(L_{i,t+1}\right) = \beta_0 + \beta_1 LR_{i,t} + \beta_2 LR_{i,t} x HealthyBank + BX_{i,t} + \varepsilon_{i,t+1} \quad (20)$$

Where all variables are defined as above and :

$HealthyBank$ is a dummy variable that takes a value of one for banks that are meeting their capital adequacy requirement.

Thus, in equation 20, the coefficient estimate on the liquidity ratio, β_1, still gives us an overall estimate of the effectiveness of expansionary monetary policy as measured by an increase in the liquidity ratio, on bank lending. If the estimate of β_1 is positive and statistically significant, it indicates that expansionary monetary policy is effective: a higher bank liquidity ratio leads to higher bank loan growth. The new parameter of interest in equation 20 is β_2, the coefficient on the interaction term of bank i's liquidity ratio at time t, $LR_{i,t}$, and the new $HealthyBank$ dummy variable. If the estimate of β_2 is positive and statistically significant, the assumptions laid out in the model above are correct: monetary policy is effective (or, if the estimate of β_1 is also positive, then we can conclude that monetary policy is especially effective) in stimulating lending by healthy banks that are meeting their required capital adequacy ratio.

The empirical methodology used in estimating both equation (19) and (20) starts with a simple pooled ordinary least squares (OLS) regression, then turns to panel data analysis, exploring the effect of including both individual and time fixed effects. Finally, to address concerns about lagged dependent variable bias, we report the results of generalized method of moments analysis (GMM).

4. Empirical Results

The empirical results from estimation of equation (19) and (20) are reported in Table 2 and Table 3, respectively.

Table 2. The effect of higher bank liquidity ratios on loan growth

Dependent Variable: Loan Growth $\Delta log(L)_{i,t+1}$

	Pooled OLS	Panel Analysis with Individual Fixed Effects	Panel Analysis with Time Fixed Effects	Two Step System GMM	Two Step Difference GMM
Independent Variables	(1)	(2)	(3)	(4)	(5)
Constant Term	-0.00 (0.01)				
Liquidity Ratio, $LR_{i,t}$	**0.06**** **(0.03)**	**0.14***** **(0.03)**	**0.06***** **(0.03)**	**0.15**** **(0.08)**	**0.19** **(0.12)**
Log Total Assets	0.00 (0.00)	-0.05*** (0.01)	0.00 (0.00)	0.00 (0.00)	-0.06 (0.06)
Equity Ratio, $ER_{i,t}$	0.08 (0.06)	0.53*** (0.10)	0.06 (0.06)	0.04 (0.20)	1.23** (0.50)
Bad Loan Ratio	-0.01*** (0.00)	-0.01*** (0.00)	-0.00*** (0.00)	-0.00 (0.00)	-0.01 (0.01)
Log Total Deposits					
Lagged Loan Growth $\Delta log(L)_{i,t+1}$					
No. Obs.		2,460	2,460	4,003	2,172

Note: Standard errors are written in parenthesis below the finding, and asterisks represent significant findings at the 10%*, 5%**, and 1%*** level, respectively. I=133 (or 147), T=30 (or 33), N=2,460 (or 4,003)

The results reported in Table 2, which reports the results of empirical estimation of equation (19), indicate that monetary policy was effective during the period of our study. For nearly all empirical methodologies – pooled OLS, panel data with individual fixed effects or time fixed effects, and for GMM – the coefficient estimate of interest is positive and highly statistically significant at the 5% or even 1% level. This suggests that banks with relatively higher liquidity ratios in a given period tend to have statistically significantly higher loan growth in the following period.

The size of the parameter estimate nearly doubles when individual bank fixed effects are accounted for in column (2), and when we address the possibility of endogeneity due to a lagged dependent variable on the right hand side through two-step system GMM analysis.

Table 3. The effect of higher bank liquidity ratios on loan growth – Controlling for bank health

Dependent Variable: Loan Growth $\Delta log(L)_{i,t+1}$

	Pooled OLS	Pooled OLS with Bank Type Dummies	Panel Analysis with Time Fixed Effects	Two Step System GMM	Two Step Difference GMM
Independent Variables	(1)	(2)	(3)	(4)	(5)
Constant Term	-0.00 (0.01)	-0.01 (0.02)	-0.01 (0.01)		
Liquidity Ratio, $LR_{i,t}$	**0.08*** (0.03)**	**0.08*** (0.03)**	**0.08*** (0.03)**	**0.18** (0.09)**	**0.15 (0.12)**
Log Total Assets	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	-0.06 (0.09)
Equity Ratio, $ER_{i,t}$	0.15** (0.07)	0.19*** (0.07)	0.13* (0.06)	0.05 (0.21)	1.18*** (0.49)
Bad Loan Ratio	-0.01*** (0.00)	-0.01*** (0.00)	-0.01*** (0.00)	-0.01 (0.00)	-0.01 (0.01)
Log Total Deposits					
Lagged Loan Growth $\Delta log(L)_{i,t+1}$					
Liquidity Ratio x Health Bank Dummy, $LR_{i,t}xHealthyBank$	**-0.07** (0.03)**	**-0.07** (0.03)**	**-0.07** (0.03)**	**-0.12* (0.07)**	**-0.07 (0.08)**
No. Obs.		2,460	2,460	4,632	2,172

Note: Standard errors are written in parenthesis below the finding, and asterisks represent significant findings at the 10%*, 5%**, and 1%*** level, respectively. I=133 (or 147), T=30 (or 33), N=2,460 (or 4,003)

The results reported in Table 3, which reports the results of empirical estimation of equation (20), largely confirm the results reported above in Table 2. That is, the empirical results again indicate that monetary policy was effective during the period of our study. For nearly all empirical methodologies – pooled OLS, panel data with individual fixed effects or time fixed effects, and for GMM – the coefficient estimate of interest is positive and highly statistically significant at the 5% or even 1% level. This confirms that banks with relatively higher liquidity ratios in a given period tend to have statistically significantly higher loan growth in the following period. In estimating equation (20), we are not able to include individual bank fixed effects due to multicollinearity with the $HealthyBank$ dummy variable, but as in Table 2, the size of the parameter estimate on the liquidity ratio nearly doubles when we address the possibility of endogeneity due to a lagged dependent variable on the right hand side through two-step system GMM analysis.

What is new in equation (20) and the empirical results reported in Table 3, is the interaction term of each individual banks' liquidity ratio at time *t* and the $HealthyBank$ dummy variable. Contrary to the implications of our theoretical model, the coefficient estimate on the interaction term is highly statistically significantly *negative*. This indicates that monetary policy was effective overall, but was relatively less effective at stimulating lending by healthy banks that were meeting their regulatory capital ratio requirement. Or, alternatively, the results suggest that although monetary policy was effective overall, the lending stimulated by providing banks with higher liquidity was mostly lending by sick, undercapitalized banks.

5. Conclusions

The preliminary results presented above indicate that unconventional monetary policy is effective, although the impact on bank lending is quantitatively small.

Interestingly, the unconventional expansionary monetary policy seems to be particularly encouraging increased lending from sick, undercapitalized banks. This raises questions as to the appropriateness of the policy implementation and the long-term implications of the policy for the banking sector and macroeconomy as a whole.

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