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Who Killed the Japanese Money Multiplier?

A Micro-data Analysis of Banks

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Abstract

This paper investigates causes of the recent sharp decline in the money multiplier in Japan from the bank side. Two candidates for the cause are examined: the first is the worsening of the banks' financial soundness, and the second is the zero interest rate policy. Using panel data of banks' balance sheets, it is shown that both can contribute to a decline in the responsiveness of loans to a base money expansion. Quantitatively, the low interest rate is the more important among the two.

1 Introduction

This paper investigates causes of the recent decline in the money multiplier in Japan. Using a panel data set of Japanese banks, I estimate how the elasticities of reserves and loans to monetary base are affected (or not affected) by candidates for the cause of this decline. Two such candidates are considered. The first one is the increased financial fragility of the banks. The second is the very low level of the interest rate.

Currently, there is a strong political pressure on the Bank of Japan to ease its policy stance. It is argued that, even though the short term interest rate has practically hit the lower bound of zero, the Bank can still stimulate the economy through printing more money. A potential problem with such a policy proposal is that the money multiplier has declined sharply in Japan. Figure 1 shows the time series behavior of the Japanese money multiplier, which is defined as money supply (M2+CD) divided by monetary base. The recent decline in the multiplier is evident. If the "average" multiplier is falling down in recent years, the "marginal" multiplier, defined as an increase in money supply generated by a unit increase in monetary base, seems to have reached its bottom. Figure 2 compares the annual growth rates of monetary base and money supply. While the growth rate of monetary base has experienced volatile movements recently, that of money supply stayed almost constant, without showing even a sign of responding to the ups and downs of base money growth. This tendency is even more evident in Figure 3 in which the month-to-month growth rates (annualized) of the two are compared for the most recent two years. Thus, it is not clear if an expansion of monetary base by the central bank, even an aggressive one, would lead to an increase in money supply in the private economy. And if the policy cannot influence money supply, it would be very difficult to stimulate the private economic activities with such means.

One factor which is often cited to as the principal cause of the decline in the money multiplier is the unhealthy banking sector crippled by non-performing loans problem. It is said that, because private banks, facing possibilities of defaults on existing loans, are unwilling to take further risks, additional base money supplied to them is used mostly to build up reserves and it does not induce them to lend more. Another possibility is the extremely low interest rate. Figure 4, which shows the recent movements in the short term interest rate (call rate, which plays a role similar to that of the federal funds rate in the US monetary policy): it has not exceeded 0.25% since

September 1998, and, at the moment when this paper is written, it is as low as 0.001%. Under such a situation, banks that receive additional base money become almost indifferent between lending it out and keeping it as non-interest-bearing reserves. With even a slight chance of default, they may actually prefer to keep it as a part of reserves.

It is important to know which cause is the dominant one. If the banking sector problem is the main cause, we can expect that a quantitative easing by the Bank of Japan, coupled with a decisive action to clean up the banking sector, might be enough to lift the Japanese economy. On the other hand, if the low interest rate is the main cause, we may first have to find a way to leave the zero interest rate bound without causing too much negative impact on the private economy, which is admittedly a difficult task.

In this paper, I estimate how banks' financial soundness and the market interest rate change banks' reactions to additional base money. I use a panel data of Japanese banks' financial statements between 1975 and 2002 to study how the elasticities of bank reserves and loans depend on their financial soundness and the interest rate. It is shown that raising the interest rate is more crucial for "reviving" the money multiplier than improving the banks' financial situation.

The rest of the paper is organized as follows. In section 2, I explain the basic empirical approach. Section 3 reviews papers that are directly related to this one. Section 4 explains the data. Sections 5-7 present estimation results. Section 8 concludes.

2 Empirical Specification

The objective of this study is to estimate the effects of the zero interest rate policy and the deterioration of the Japanese banks' financial soundness on the responses of the banks to aggregate monetary base growth. To that end, I will use bank-level panel data on reserves and loans and estimate how their elasticities with respect to aggregate monetary base are affected by the interest rate and financial soundness of the banks. First, consider the following basic equation:

$$\begin{aligned} YG_{i,t} = \; & (\text{constant}) + a_0\, YG_{i,t-1} + a_1\, MBG_t \\ & + a_2\, HEALTH_{i,t} + a_3\, RATE_t + u_{i,t} \qquad (1) \end{aligned}$$

In the above equation, subscript i stands for a bank and t stands for a year. *YG* stands for growth rate of either reserves or loans. Lagged dependent variable, $YG_{i,t-1}$, is included on the right hand side to take into account possible persistence or mean reversion in this variable. *MBG* and *RATE* stand for the aggregate monetary base growth rate and the short term interest rate, which are macroeconomic variables and thus are common to all the banks in each period. *HEALTH* is an indicator for bank's financial soundness. In this paper, I will consider three alternative indicators: the first one is the capital-loans ratio (a higher value means that the bank is better prepared for risks of defaults and bank runs); the second one is the share of non-performing loans in total loans; the third one is the share of loans designated to firms in three major financially troubled industries in Japan, namely construction, real estates, and distribution. Finally, $u_{i,t}$ is the error term.

In the above basic specification, the elasticity of *YG* with respect to *MBG* is assumed to be time invariant. An important hypothesis in this paper is that this elasticity actually changes over time, depending on either the bank's financial healthiness (*HEALTH*) or the short term interest rate (*RATE*), or both. This hypothesis is tested through estimating the following augmented equation:

$$\begin{aligned} YG_{i,t} \quad &= (\text{constant}) + a_0\, YG_{i,t-1} + a_1\, MBG_t \\ &+ a_2\, HEALTH_{i,t} + a_3\, RATE_t \\ &+ a_{12}\, HEALTH_{i,t} * MBG_t + a_{13}\, RATE_{i,t} * MBG_t + u_{i,t} \qquad (2) \end{aligned}$$

In equation (2), two interaction terms are added to the basic equation (1). By testing whether the coefficients on those terms are significantly different from zero, we can test whether the elasticities of reserves and loans with respect to *MBG* are functions of *HEALTH* and *RATE*. And, if they are indeed significant, by examining the magnitudes of those coefficients, we can evaluate the quantitative importance of this dependence.

3 Related Work

Various studies have investigated the relationship between the financial situation of banks and their lending behavior in Japan, mainly from the viewpoint of the credit crunch hypothesis. Yoshikawa, Eto and Ike (1994) examine the cross-section data of banks from March 1993. They regress loans growth on the share of nonperforming loans in total loans, both for the entire sample and for various sub-groups defined by bank types and borrower types. They find negative effects only for a limited number of groups (and not for the entire sample). Especially, in the category of lending to small and medium firms, which they are primarily interested in, they do not find any negative effects at all. Honda, Kawahara and Kohara (1995) use a panel data of Japanese banks to show that both the capital loans ratio and the share of nonperforming loans have negative impacts on loans growth of "city" banks in Japan, though the effects are weak. They do not find similar effects for smaller "regional" banks. Ito and Sasaki (1998) use a panel data of major Japanese banks (for the period between 1990 and 1993) to study the impact of the Basle capital standard on their lending. They find that, when the stock prices decline, the banks with lower risk-based capital ratios tend to reduce their lending to meet the BIS standard. Woo (1999) studies effects of capital loans ratio on banks' asset growth and loan growth using a panel data of Japanese banks (for the period between 1990 and 1997). He finds that, although the capital ratio has the expected positive effect on asset growth, its effect on loans growth is insignificant. Then he turns to a series of cross section regressions for each year, and finds that the capital ratio had a significantly positive impact on loans growth only in 1997, the year of a huge financial distress.

Hosono (2002) is most closely related to this study. His paper uses the same data set as this one (though mine is updated by three years) and investigates how the banks' financial situation affects the response of loans to changes in the *interest rate*. He finds that loans become more responsive when capital-loans ratio is higher and the share of liquid assets in total assets is lower. In contrast, in this paper, I investigate the effects of banks' financial situation on the responsiveness of reserves and loans to *monetary base growth*. Hence, this paper is looking at a different policy instrument than that of Hosono's. Also, the main purpose of this paper is to compare those effects with the influence of the interest rate.

4 Data Source

The main data source used in this paper is Nikkei Quick Information Technology Corporation's NEEDS financial statements data CD-ROM (version 2002). This contains information from financial statements of all the commercial banks[1] that existed in Japan between September 1974 and March 2002. The number of banks in the data set varies over time, mostly due to mergers. For example, in 1975, there were 158 banks in the data. In 2002, the number was down to 128. I exclude banks that have experienced mergers during a particular fiscal year from the data set, and they are treated as new banks from the following fiscal year[2]. From this data set, I retrieve the values of loans outstanding[3] and bank reserves outstanding, as well as the values of capital, non-performing loans and industrial composition of bank loans. The Japanese fiscal year starts in April and ends in March. The data set contains information from midterm financial statements in September for a few early years and those in March for all the years. In this paper I will focus exclusively on March reports so that the lengths of the intervals between data points are always the same.

Macroeconomic data, specifically monetary base (monthly average, seasonally adjusted and adjusted for reserve requirement changes) and the short term interest rate (call rate, with collateral, monthly average) are from the Bank of Japan web page. The growth rate of monetary base is defined as its March-to-March rate of change. The interest rate is measured by the average during the month of March.

Throughout the paper, growth rates are defined as logarithmic changes from the previous year.

5 Main Results

In this section, I will use Capital-Loans Ratio, denoted as *CAPITAL*, as the indicator of financial soundness of the banks (i.e., "*HEALTH*" in equations (1) and (2)). In section 7, I will check robustness of the results by using alternative indicators of financial soundness. Note that an increase in the value of this variable means greater capital adequacy and thus greater financial soundness.

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[1] This does not include credit unions ("Shinyo-kumiai" or "Shinyo-kinko) or cooperatives. On the other hand, trust banks and long term credit banks are included.

[2] The CD-ROM contains information on mergers (as well as acquisitions of branches from other banks), including those between commercial banks and credit unions.

[3] I added loans in the regular account (bank account) and loans in the trust account to compute total loans.

First, the basic equation without the interaction terms, equation (1), is estimated. When *HEALTH=CAPITAL* is assumed, this equation takes the form:

$$YG_{i,t} = (\text{constant}) + a_0\, YG_{i,t-1} + a_1\, MBG_t + a_2\, CAPITAL_{i,t} + a_3\, RATE_t + u_{i,t}. \qquad (1')$$

This equation is estimated by OLS, pooling all the data. Table 1 reports the result.

Table 1: Aggregate Monetary Base Growth and Growth in Bank Asset Components
Bank Health Variable = Capital/Loans Ratio
(method = OLS, standard errors in parentheses)

Dependent Variable (YG)		Bank Reserves Growth	Bank Loans Growth
YG(t-1)	(Lagged Dependent Variable)	-0.372 (0.016)	0.595 (0.016)
MBG	(Monetary Base Growth)	4.533 (0.345)	0.128 (0.014)
CAPITAL	(Capital/Loans Ratio)	3.528 (0.612)	0.186 (0.025)
RATE	(Short-term Interest Rate)	-0.641 (0.556)	0.465 (0.032)
R**2		0.183	0.545
Sample Size		3790	3831

(Note: Constant terms are omitted from the table but are included in the estimation.)

The first column reports the result for bank reserves and the second column is for bank loans. Starting with reserves, the first three coefficients are strongly significant. The coefficient on the lagged reserves growth is negative, which indicates a tendency for mean reversion. The same tendency will show up in all the results that will follow. The coefficient on monetary base growth is positive and very large, suggesting that (at least on average) bank reserves respond very strongly to monetary base expansions. The coefficient on capital-loans ratio is positive, indicating that a more financially sound bank would tend to build up more reserves. As such a bank seems to have *less* need to keep more reserves, this finding is not necessarily easy to reconcile with our prior expectation. The coefficient on the short term interest rate is negative as expected, but it is not significant.

Turning to the second column, the estimated coefficients for the loans equation are all significant and of expected signs. The coefficient on the lagged dependent variable is positive, indicating persistence in this variable. The coefficient on monetary base growth is positive though it is much smaller than the one in the reserves equation. The coefficient on *CAPITAL* is positive, indicating that a more financially sound bank can expand its lending more aggressively. The coefficient on *RATE* is also positive, indicating that, when the interest rate is high, banks are more willing to lend.

Next, the equation with interaction terms, equation (2), is estimated. Under the assumption that *HEALTH*=*CAPITAL*, this equation becomes:

$$\begin{aligned} YG_{i,t} &= \text{(constant)} + a_0\, YG_{i,t-1} + a_1\, MBG_t \\ &\quad + a_2\, CAPITAL_{i,t} + a_3\, RATE_t \\ &\quad + a_{12}\, CAPITAL_{i,t} * MBG_t + a_{13}\, RATE_{i,t} * MBG_t + u_{i,t}. \qquad (2') \end{aligned}$$

The estimation results are summarized in the first panel of Table 2. To facilitate understanding, after the estimated coefficients, I report coefficients on *MBG*, *CAPITAL*, and *RATE*, evaluated at the overall sample means. They are called "average coefficients" for short. For example, the average coefficient on *MBG* is defined as

$$a_1 + a_{12} \cdot \overline{CAPITAL} + a_{13} \cdot \overline{RATE}$$

where the upper-bars indicate the overall sample averages. Likewise, the average coefficients on *CAPITAL* and *RATE* are evaluated at the sample mean of *MBG*.

Table 2: Aggregate Monetary Base Growth and Growth in Bank Asset Components

Bank Health Variable = Capital/Loans Ratio

(method = OLS, standard errors in parentheses)

Dependent Variable (YG)		Bank Reserves Growth	Bank Loans Growth
YG(t-1)	(Lagged Dependent Variable)	-0.355 (0.016)	0.559 (0.015)
MBG	(Monetary Base Growth)	3.157 (0.702)	-0.155 (0.028)
CAPITAL	(Capital/Loans Ratio)	-0.408 (0.930)	0.064 (0.037)
RATE	(Short-term Interest Rate)	5.066 (1.076)	-0.213 (0.046)
CAPITAL*MBG		49.307 (5.301)	1.886 (0.369)
RATE*MBG		-79.179 (12.724)	9.998 (0.513)
Avg. coef. on	*MBG*	*2.292*	*0.348*
	CAPITAL	*3.405*	*0.210*
	RATE	*-1.058*	*0.560*
R**2		0.200	0.587
Sample Size		3790	3831

coef. on MBG when		
CAPITAL=0.06, RATE=0.00	*6.115*	*-0.042*
CAPITAL=0.07, RATE=0.00	*6.608*	*-0.023*
CAPITAL=0.06, RATE=0.01	*5.323*	*0.058*

(Note: Constant terms are omitted from the table but are included in the estimation.)

Comparison between the estimated coefficients in Table 1 and the *average* coefficients in Table 2, it is apparent that the average tendencies are similar, at least qualitatively, between the two tables. What is most notable in Table 2 is that all the interaction terms are significant. Starting with the first column, the elasticity of bank reserves growth with respect to monetary base growth is positively related to *CAPITAL* and is negatively related to *RATE*. The former result is again a little bit difficult to explain because it means that banks with more adequate capital are likely to increase their reserves more strongly in response to a monetary base expansion than those with lower capital adequacy. The latter result indicates that, when additional monetary base is supplied to the banks, they are more likely to keep it as their own reserves under a low interest rate. Turning to the second column, the elasticity of bank loans growth with respect to monetary base growth is positively related to both *CAPITAL* and *RATE*. The result on *CAPITAL* implies that, when additional base money is supplied, more banks with more adequate capital are more willing to use it to expand their loans than less sound ones. The result on *RATE* indicates that, when additional base money is supplied, banks are less willing to use it to expand their loans under a low interest rate. Hence, one can infer that, under the current Japanese situation with a poor financial situation for the commercial banks and a near-zero interest rate, it would be very difficult for the central bank to stimulate lending through base money expansion. And the fact that the coefficient on the interaction term with *RATE* is much greater than that with *CAPITAL* indicates that a low interest rate is more likely to contribute to a decline in the sensitivity of loans to monetary base.

To evaluate those effects quantitatively, consider the following exercise. At the end of the sample (March 2002), the average value of *CAPITAL* across the existing banks was around 0.06 (to be exact, 0.0628). On the other hand, the value of *RATE* was about 0.00% (0.001% to be exact). We can plug in those numbers to derive the coefficients on *MBG* evaluated at that point. This is done in the first row of the second panel of Table 2. In the reserves regression, this "local" coefficient on *MBG* was 6.115, far above the "average" coefficient. In the loans regression, the "local" coefficient was very small: in fact, it was even slightly negative (-0.042)! This indicates that additional base money under this situation would be used mainly to build up more reserves, and loans will not increase at all (or even decrease). The money multiplier would be very small and could even be zero or negative! The second row of the second panel asks what would happen if, starting from the above situation, all the banks increased their capital-loans ratio by 1%. In this case, the elasticity of bank reserves would increase even further, and there would be a small increase in the elasticity of bank loans (though it is still negative). The third row shows what would happen if, instead, the interest rate increased by 1%. In this case, the elasticity of bank reserves would decrease and that of loans would turn positive, though it would still be small. Thus, by moving away from the zero interest rate ceiling even slightly, the money multiplier would be "revived".

6 Non-linearity

It is conceivable that the effects of both bank balance sheet situation and the interest rate on the responses of the banks to monetary base expansion are non-linear. To take into account this possibility, I introduce quadratic terms of *CAPITAL* and *RATE* into the above analysis. That is, to the previous list of explanatory variables, I add four new variables, namely the squares of *CAPITAL* and *RATE*, and their interaction terms with *MBG*:

$$\begin{aligned} YG_{i,t} = &\text{(constant)} + a_0\, YG_{i,t-1} + a_1\, MBG_t \\ &+ a_2\, CAPITAL_{i,t} + a_3\, RATE_t + a_4\, CAPITAL^2_{i,t} + a_5\, RATE^2_t \\ &+ a_{12}\, CAPITAL_{i,t} * MBG_t + a_{13}\, RATE_{i,t} * MBG_t \\ &+ a_{14}\, CAPITAL^2_{i,t} * MBG_t + a_{15}\, RATE^2_{i,t} * MBG_t \\ &+ u_{i,t}. \end{aligned} \tag{3}$$

An advantage of this approach is that we can allow for richer forms of interaction of *CAPITAL* and *RATE* with *MBG*. A drawback is that their levels tend to be highly correlated with their squares. Hence the standard errors around the estimates tend to be relatively high. Table 3 presents the estimation results. The first panel shows the estimated coefficients as well as the “average” coefficients (to derive them in this nonlinear case, I linearize equation (3) and evaluate the coefficients around the sample means). In the second panel, I study their quantitative implications in the same way as in Table 2.

The average coefficient on *CAPITAL* in the reserves equation and that on *RATE* in the loans equation change their signs, but this might be due to the loss of accuracy of the estimates. In the reserves equation, the interaction term between the square of *CAPITAL* and *MBG* is significant. Around the sample mean, the coefficient on *MBG* is increasing in *CAPITAL* (as in Table 3) and takes a concave form. In the loans equation, the interaction term between the square of *RATE* and *MBG* is significantly negative. Around the sample mean, the coefficient on *MBG* is increasing in *RATE* and takes a concave form: that is, as the interest rate gets closer and closer to zero, the responsiveness of bank loans to monetary base is diminished faster and faster.

Table 3: Aggregate Monetary Base Growth and Growth in Bank Asset Components

Bank Health Variable = Capital/Loans Ratio

(method = OLS, standard errors in parentheses)

Dependent Variable (YG)		Bank Reserves Growth	Bank Loans Growth
YG(t-1)	(Lagged Dependent Variable)	-0.377 (0.015)	0.449 (0.015)
MBG	(Monetary Base Growth)	4.728 (1.075)	-0.229 (0.040)
CAPITAL	(Capital/Loans Ratio)	-1.273 (1.315)	-0.077 (0.049)
$CAPITAL^2$		-2.271 (3.702)	-0.633 (0.140)
RATE	(Short-term Interest Rate)	-16.770 (4.110)	0.144 (0.157)
$RATE^2$		269.417 (53.473)	-0.391 (2.038)
CAPITAL*MBG		27.467 (12.668)	2.973 (0.463)
$CAPITAL^2$*MBG		-174.356 (46.913)	2.586 (1.723)
RATE*MBG		-55.978 (43.120)	21.488 (1.664)
$RATE^2$*MBG		-531.995 (593.016)	-161.043 (22.807)
Avg. coef. on	*MBG*	*2.444*	*0.534*
	CAPITAL	*-0.680*	*0.111*
	RATE	*-12.196*	*-0.714*
R**2		0.237	0.637
Sample Size		3790	3831

coef. on MBG when		
CAPITAL=0.06, RATE=0.00	*5.749*	*-0.041*
CAPITAL=0.07, RATE=0.00	*5.797*	*-0.008*
CAPITAL=0.06, RATE=0.01	*5.136*	*0.158*

(Note: Constant terms are omitted from the table but are included in the estimation.)

The second panel of Table 3 demonstrates the following. Around the values in March 2002, the elasticity of bank reserves changes in ways that are very similar to the ones found in Table 2. On the other hand, the elasticity of bank loans becomes even more sensitive to small changes in the interest rate. Just by raising the interest rate from zero to one percent, the elasticity goes up from (practically) zero to respectable 0.15. Hence, by introducing nonlinearity into the estimation, we learn that the zero interest rate policy has actually had even more destructive effects on the money multiplier than was suggested by the results in Table 2.

7 Alternative Measures of Financial Soundness

In this section, I use two alternative measures of banks' financial soundness, to check robustness of the previous results.

7-1 Bad Loans

The first alternative is the share of non-performing loans in total loans. This variable will be denoted as *BAD*, and is measured as the sum of "credit to borrowers in bankruptcy" and "delinquent credit". Banks started reporting these numbers only in 1993, hence the sample size is going to be severely limited. Also, this is only a fraction of the entire non-performing loans. On the other hand, one could argue that this is a more direct measure of the banks' financial soundness than the capital-loans ratio. In Table 4, I report results for the case without quadratic terms.

The first panel of Table 4 summarizes the estimation results in the same way as in Table 2. Presumably because the short sample makes uncertainty around the estimates large, some results do not make much intuitive sense, especially for the reserves equation: for example, the average coefficient on *MBG* is hugely negative (note that the standard error around the coefficient for *RATE***MBG* is huge). However, from the loans equation, we learn again that both a lower interest rate and a decline in the bank financial soundness work negatively on the elasticity of loans to monetary base. In the second panel, where the coefficients on *MBG* are evaluated around the values of *BAD* and *RATE* in 2002 (the average of *BAD* was about 5.8%), we learn again that raising the interest rate is more effective in restoring the money multiplier than reducing the magnitude of the bad loans problem.

Table 4: Aggregate Monetary Base Growth and Growth in Bank Asset Components
Bank Health Variable = Share of Bad Loans
(method = OLS, standard errors in parentheses)

Dependent Variable (YG)		(1) Bank Reserves Growth	(2) Bank Loans Growth
YG(t-1)	(Lagged Dependent Variable)	-0.391	0.369
		(0.034)	(0.036)
MBG	(Monetary Base Growth)	8.746	0.042
		(0.939)	(0.036)
BAD	(Share of Bad Loans)	1.767	-0.382
		(1.600)	(0.061)
RATE	(Short-term Interest Rate)	41.845	-1.446
		(15.342)	(0.604)
BAD*MBG		-55.183	-0.798
		(12.934)	(0.499)
RATE*MBG		-1452.268	33.970
		(376.987)	(14.970)
Avg. coef. on	*MBG*	*-53.289*	*1.409*
	BAD	*-2.501*	*-0.444*
	RATE	*-70.467*	*1.182*
R**2		0.286	0.318
Sample Size		966	976

coef. on MBG when		
BAD=0.06, RATE=0.00	*5.435*	*-0.006*
BAD=0.05, RATE=0.00	*5.987*	*0.002*
BAD=0.06, RATE=0.01	*-9.088*	*0.334*

(Note: Constant terms are omitted from the table but are included in the estimation.)

7-2 Industrial Composition of Lending

The second alternative measure of the financial soundness of the banks is the share of three troubled industries, namely construction, real estate and distribution, in total lending. It is widely believed that those three are the major sources of the bad loans problems in Japan. Hence, a higher value in this variable would suggest greater financial fragility. This variable will be denoted as *TROUBLE*.

I estimate equation (2) with the assumption that *HEALTH=TROUBLE*. At first, I was using data from the entire sample period to run this regression. However, I did not get any significant result for this new variable *TROUBLE*. I therefore decided to limit the sample to year 1990 onwards. After all, the three industries in questions *became* troubled industries in early 1990s, after the so-called bubble collapses. Prior to that, a higher share of lending to these industries could not be considered as a sign of weakness. The results are summarized in Table 5 below.

Table 5: Aggregate Monetary Base Growth and Growth in Bank Asset Components

Bank Health Variable = Share of Three Troubled Industries in Total Loans

Sample: 1990-2002

(method = OLS, standard errors in parentheses)

Dependent Variable (YG)		(1) Bank Reserves Growth	(2) Bank Loans Growth
YG(t-1)	(Lagged Dependent Variable)	-0.377 (0.023)	0.445 (0.025)
MBG	(Monetary Base Growth)	1.229 (2.897)	0.218 (0.115)
TROUBLE	(Share of the Three Troubled Industries)	-0.894 (0.773)	0.071 (0.031)
RATE	(Short-term Interest Rate)	0.224 (1.648)	-0.342 (0.076)
TROUBLE*MBG		15.823 (8.489)	-0.813 (0.336)
RATE*MBG		-0.352 (24.076)	16.214 (0.994)
Avg. coef. on	*MBG*	*7.359*	*0.570*
	TROUBLE	*0.329*	*0.008*
	RATE	*0.197*	*0.912*
R**2		0.259	0.490
Sample Size		1803	1813

coef. on MBG when		
TROUBLE=0.35, RATE=0.00	*6.767*	*-0.066*
TROUBLE=0.25, RATE=0.00	*5.185*	*0.015*
TROUBLE=0.35, RATE=0.01	*6.764*	*0.096*

(Note: Constant terms are omitted from the table but are included in the estimation.)

For the reserves equation, the results do not look very good in the sense that not many coefficients are significant. This is presumably due to the shortened sample. But for the loans equation, all the coefficients are significant and the results make intuitive sense. In particular, as the coefficient on *TROUBLE* times *MBG* suggests, an increased share of the three troubled industries lowers the responsiveness of bank loans to monetary base. The elasticity also declines under a lower interest rate. The second panel of Table 5 shows that, among those two factors, a lower interest rate has a greater quantitative impact: when evaluated around the values at the end of the sample (the average of *TROUBLE* in 2002 was 0.382), raising the interest rate by 1% has a much larger impact on the elasticity of loans than reducing the share of the three industries by as much as 10%.

8 Summary

In this paper, I have studied the effects of banks' balance sheet situation and the market interest rate on responses of the banks to base money expansion. I have found that, especially for bank loans, both factors have significant impacts. A bank with a more deteriorated balance sheet expands its lending less aggressively when additional base money is supplied from the central bank. Likewise, under a low interest rate, banks are less likely to lend more aggressively when monetary base expands: rather, they tend to keep the extra base money in the form of reserves. Through evaluating the estimated forms of those elasticities, I have found that, under the current situation in Japan, the elasticity of bank loans with respect to monetary base would be almost zero or could even be negative. I have also found that, to get out of this situation and to "revive" the responsiveness of loans, raising the market rate is more effective (in the quantitative sense) than cleaning up the bank balance sheets.

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Figure 1: Money Multiplier = M2+CD/MB

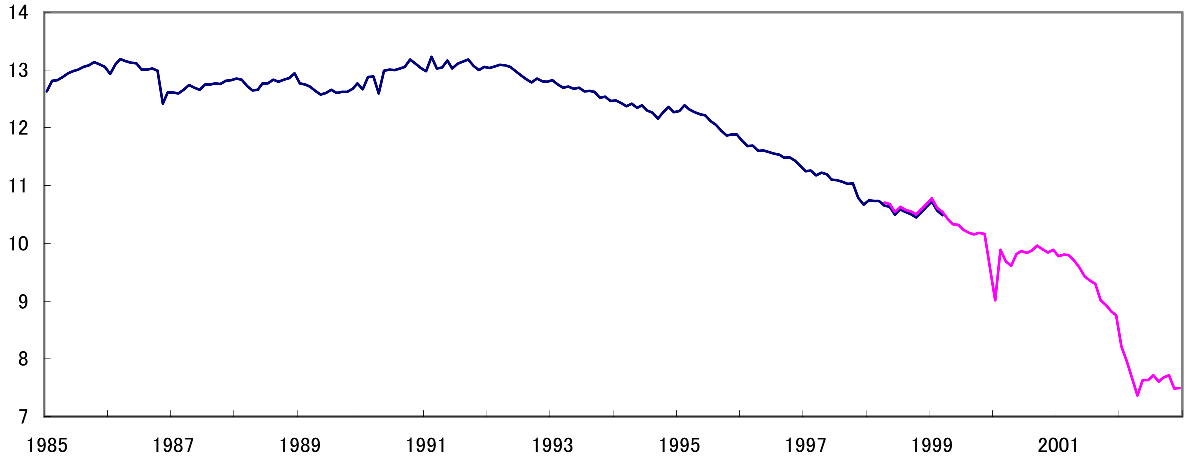

Figure 2: Growth of Money Supply and Monetary Base
(Rate of Change from the Same Month of the Previous Year)

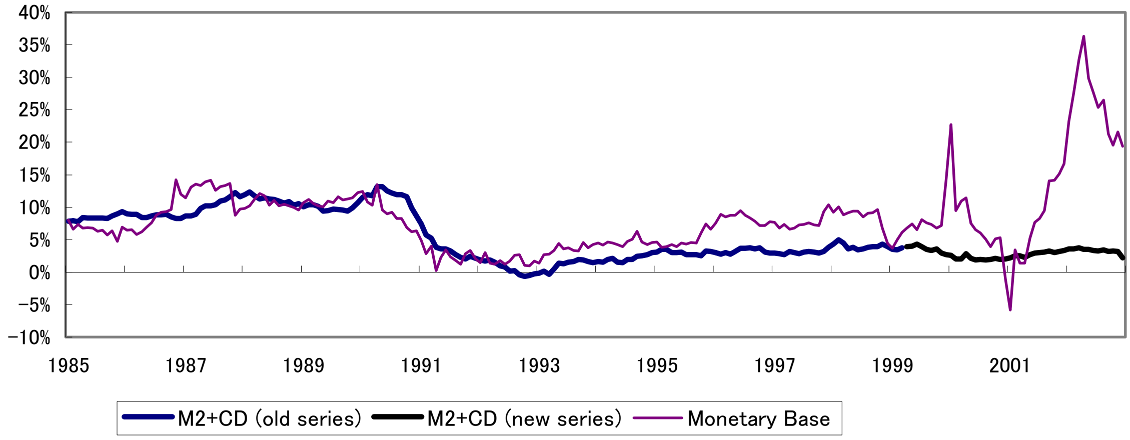

Figure 3: Recent Movements in Money Supply and Monetary Base
Rate of Change from the Previous MONTH (annualized)

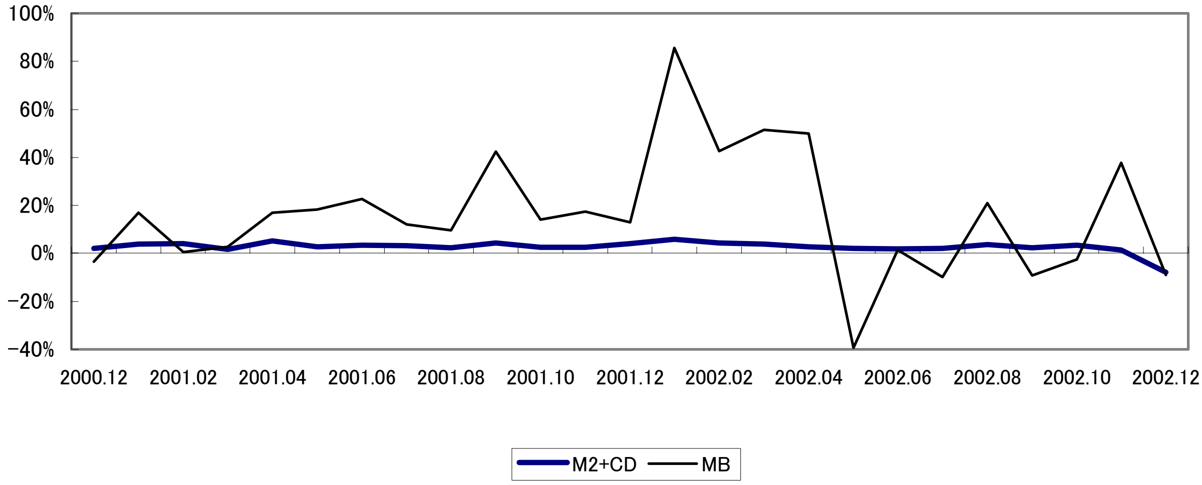

Figure 4: Call Rate