Article
Japan's Prolonged Recession and Monetary Policy*

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Abstract

This paper examines how over a period of more than ten years, Japan's economy
experienced prolonged recession of a kind which had never been observed before. It
focuses on the events in Japan's economy since 1985, tracing how asset prices inflated
and collapsed, and how the Bank of Japan responded to the deteriorating economy. We
will learn from Japan's experience that it is very difficult to reactivate an economy with
monetary policy, once it has fallen into deflation. We will conclude that the BOJ should
not ignore the role of money stock, citing statistical evidence of the relationship between
money stock and the economic activity.

Keywords: bubble, deflation, money stock, financial anxiety

Introduction

Japan's economy experienced prolonged recession over a period of more than ten years, of
a kind which had never been observed before. The recession is characterized by rapid
decline in assets prices that substantially accumulated the nonperforming loans. The
mounting nonperforming loans, especially in the financial sectors, hampered the normal
functions of financial intermediaries and Japan's economy came to the verge of financial
panic.

The financial distress and deflation is rooted in the so-called bubble economy of the
latter half of the 1980s when the economy has experienced the expansion of bubbles in
assets prices. This article will focus on how the strong economy deteriorated and how the
authority, especially the Bank of Japan responded to its deterioration. We will divide the
periods we focus on into 2 periods, before and after the burst of the bubble and the latter
will be divided into several periods.

We will conclude that the BOJ should not ignore the role of money stock by showing the statistical evidence of the relationship between money stock and the economic activity. We will perform Johansen's cointegration test by taking the financial anxieties into consideration. The lessons from Japan's prolonged recession and policy response would be much instructive not to repeat the financial disaster.

## 1. The emergence of the bubble (1985-89)

It was September 1985 when the Minister of Finance and Governor of the Central Bank of G5 countries (United States, United Kingdom, France, West Germany, and Japan) gathered to Plaza Hotel in New York to discuss how to correct the trade imbalance between US and Japan and West Germany, especially how to reduce the huge trade deficit in US. The US had suffered from huge trade deficit, which might be caused by then president Regan's economic policy, so-called Reganomics characterized by strong dollar and high interest rates. US congress had took very hard stance to the Japanese increasing trade surplus and threatened with retaliating trade measures.

G5 countries had agreed to concert to depreciate the high dollar in the meeting. The cooperative interest rate reduction had begun. As a result, the long-term difference between US and Japan had begun to contract in 1985 as shown in Figure 1. The exchange rate of 250s yen per dollar had rapidly appreciated in line with the start of cooperative interest rate reduction. The diference of long-term interest rate between US and Japan was reduced to 2.26 percent in 1986Q4, which caused yen's rapid appreciation against dollar at 150s (see Figure 1). However Japanese current account balance did not decrease in spite of the yen's appreciation. US government was afraid that the further appreciation of the
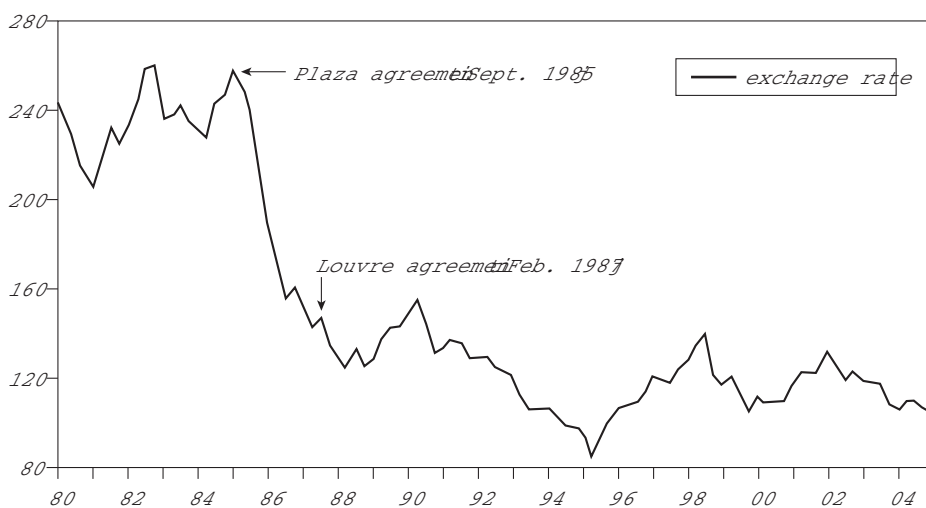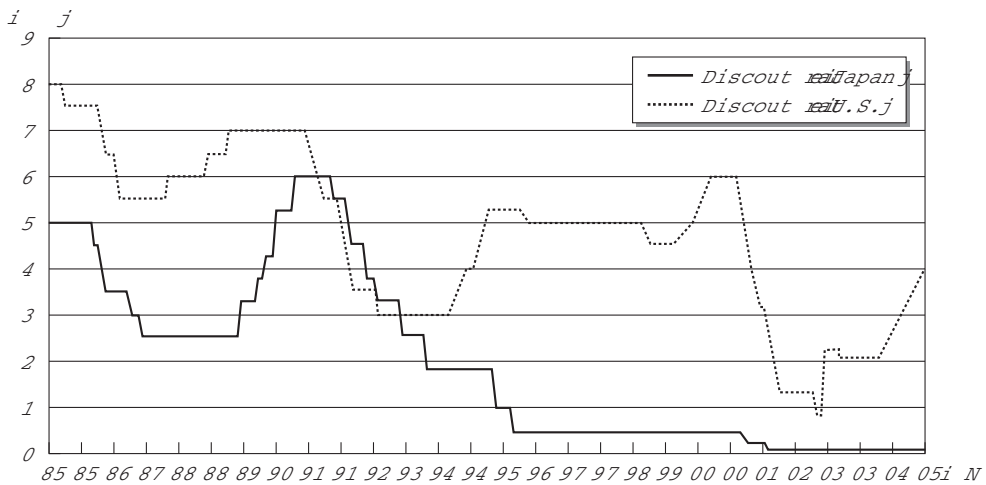

(source) Bank of Japan
Figure 1. Exchange Rate, yen/dollar
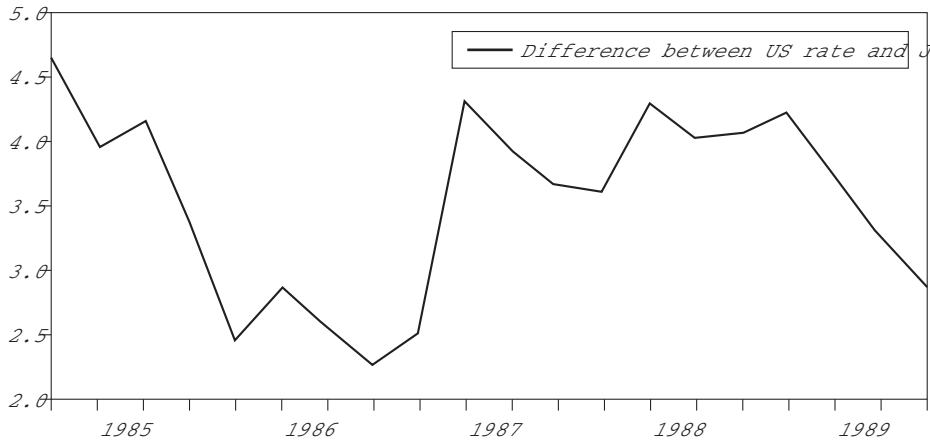
(source) Bank of Japan

**Figure 2. Long-term Interest Rate Difference,
US and Japan (1985-89)**

(source) Bank of Japan

**Figure 3. Official Discount Rate US and Japan (1985-2004)**

yen would make the Japanese economy so stagnant and would be counter productive to the US economy. Japanese economy was in the slight recession due to the high yen after Plaza agreement. So US had changed their policy stance to give the pressure to stimulate the Japan's domestic demand and to raise the imports.

In the February 1987 Louvre agreement, Japan was demanded to take further easy monetary policy. The Bank of Japan reduced the official discount rate to 2.5 percent, the lowest level in response to the Louvere agreement in February 1987, while US increased the discount rate to 6.0 percent as shown in Figure 3. As a results, the difference between the long-term interest rate in US and that in Japan expanded from 2.2 percent to 4.5 percent which depreciated yen to the normal level, 140s yen.
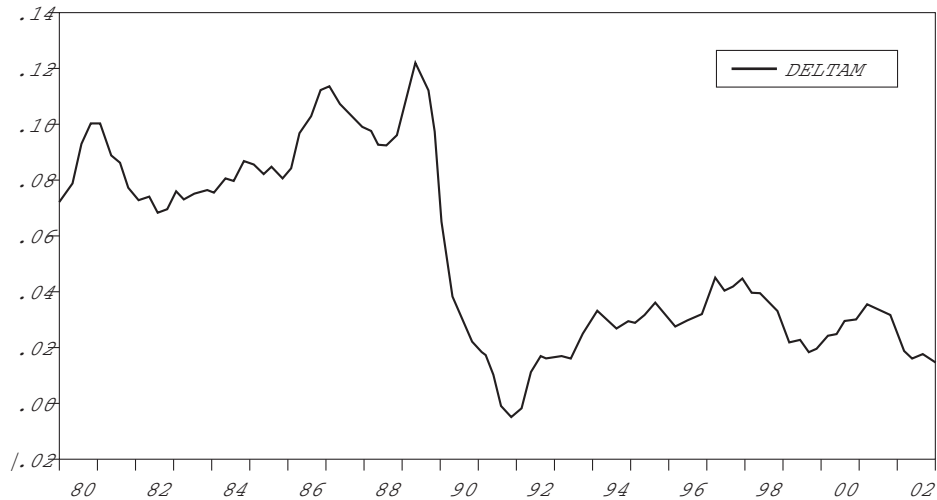
(source) Bank of Japan

Figure 4. Money Growth Rate (year on year)
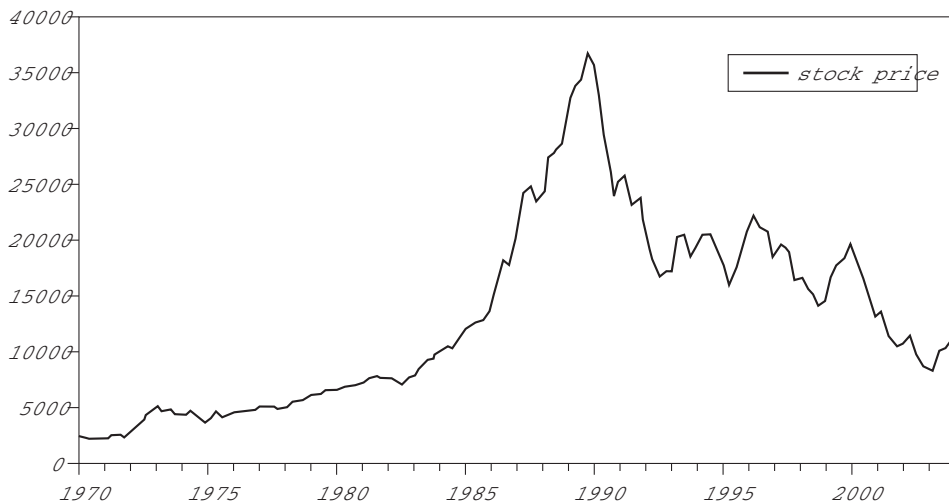
(source) Tokyo Stock Exchange

Figure 5. Stock Price (Nikkei 225)

Money growth had started to rise in 1987 Q1. It grows more than 10 percent from 1987 Q1 through 1990 Q2. It was the beginning of Japanese bubble. Some feel that the low discount rate might cause the inflation. However market crash had happened in NY in October 1987. G7 countries decided to cooperate to take easy monetary policy to avoid the world depression. As a result, Japan had to keep the low interest rate policy. However the Bundesbank (central bank of West Germany) raised the discount rate and returned monetary policy to the neutral level (4.5 percent).

The reason why only Japan had to keep the easy monetary policy is as follows. The dollar was still weak to the Japanese yen. It was thought that the dollar would be rapidly
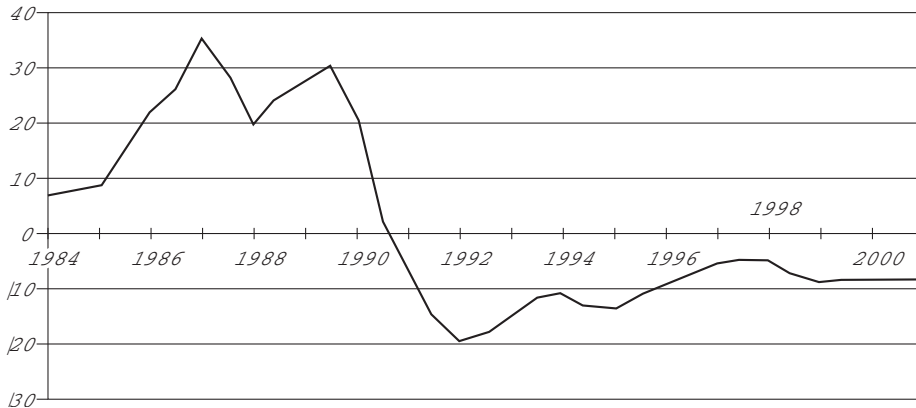
(source) Japan Real Estate Institute, 6 Large Urban Areas, average (residential, commercial, and industrial)

Figure 6. Land Price (year on year)

depreciated and bond and stock price would substantially decrease and cause the depression in US, if the BOJ raise the discount rate. Then people had thought the BOJ would never take the tight policy and the easy policy would continue for a long time.[1]

Under the assumption of affluent funds available, the banks were very aggressive and competitive to make a loan. Anybody could get loans very easily from the banks as far as they have lands as collateral because lands were believed to keep increasing forever. Large firms could get funds easily by using "equity finances". So banks had tried to expand the loans to household and small firms that had not enough collateral with the expectation of their rise. Even housewives were advised to manage the apartment by borrowing money from the banks.

The stock prices and land prices had rapidly increased from 1988 through 1989 as shown in Figures 5 and 6, which could not be explained by the fundamentals. The increasing of assets prices did not respond to the first rise of the discount rate in May 1988 from 2.5 to 3.25 percent and the second rise in January 1989 from 3.25 to 3.75 percent at all. The bullish expectation had dispelled the negative effects on the asset prices. The asset prices kept increasing.

2. Prolonged recessions after the burst of the bubble

2-1   The burst of the bubble (1990-93)

The BOJ implemented the third rise of discount rate from 3.75 to 4.25 percent in December 1989. The market was still bullish. However the market had begun to change, when the new governor, Mieno had showed very strong stance to the bullish economy by

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1. See Suzuki (1993) for more details.

fourth rise of discount rate from 4.25 to 5.25 percent.[2] The governor Mieno had implemented the fifth rise of discount rate to 6.0 percent to avoid the homemade inflation caused by the Gulf War in August 1990. The government also placed a ceiling on the total amount of financing availed for real estate purchase.

The burst of the bubble had begun at last. Money stock (M2+CD) rapidly declined. It recorded negative year on year growth in mid -1992 as shown in Figure 4. After hitting a record high of 38,915 yen at the end of 1989, the stock price rapidly began to decline. In August 1992, stock price dipped below 15,000 yen, a 63 percent plunge from peak level (see Figure 5). Land prices began to fail after hitting a peak in September 1990 and still keep falling now as shown in Figure 6.

In response to the asset price decline, the BOJ reduced the discount rate six times from July 1991 to February 1993. The discount rate was ultimately reduced from 6.0 percent to 2.5 percent (see Figure 3). The government also implemented the fiscal stimulus by spending a total of 29.9 trillion yen in two years from 1992 to 1993. Those policy measures seemed to succeed in recovering the economy.


2-2   Modest Economic Recovery (1994-96)

In 1994, the economy showed signs of a recovery because of the stimulus policies.[3] However there remained some adverse factors as follows.

1. Firms was obliged to continue the adjustment of their balance sheet damaged by the decline of assets price.
2. Land prices still kept decreasing
3. Hyogo Bank failed in 1995. It was the first bank failure listed on the Tokyo stock exchanges.
4. The highly appreciated yen hampered the export industries. Yen reached at record high level of 79.75 yen per dollar on April 19, 1995.
5. The great earthquake attacked Kansai districts and seriously damaged its economy in 1995.
6. Prices especially wholesale prices continued to decline and increased the deflationary pressure.

Under these conditions, the BOJ continued to decline the discount rate from 1.75 to 0.5 percent successively as shown in Figure 3. The government also increased the fiscal expenditures.[4] The Ministry of Finance had issued a report entitled "Reorganizing the Japanese Financial System (Kinyu Shisutemu no Kinoukaifuku nituite)" in June 1995, in

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2. New governor Mieno was called a "Heisei no Onihei", who had strongly fighted against the gangs as a leader of police offcers in the Edo period more than 200 years ago.
3. Mori, Shirakawa, and Taguchi (2001) indicate the increase of residual investment and the business investment in 1994 as signs of economic recovery. See N.Mori et al. (2001) figures 4 and 5 in detail.
4. The new policy package was entitled "Emergency Measures for Yen Appreciation and the Economy." See in detail N. Mori et al. (2001) p.62.
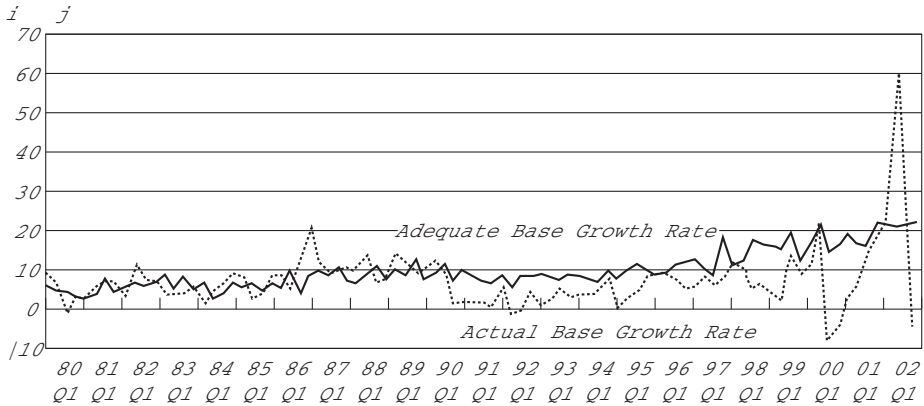
(source) Okada and Iida (2004)

Figure 7. Adequate and Actual Growth Rate
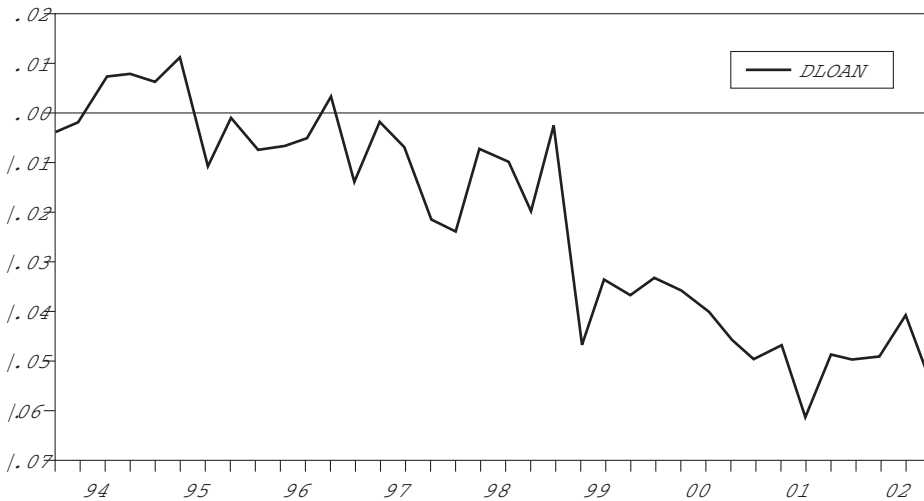
(source) Bank of Japan

Figure 8. Bank Loan Growth Rate (year on year)

which they showed diehard attitude to tackle with the nonperforming problems by officially disclosing the magnitude of NPL totaled 40 Trillion yen (about 4 percent of the loans held by deposit institutions).

Furthermore MOF had strongly pledged the complete deposit guarantee by March 2001, the reform of the Deposit Insurance Corporation and the adoption of Prompt Corrective Action. As a result, several symptoms appeared to indicate the economic recovery.

1. Bank lending began to increase which rapidly decreased after the burst of the bubble (see Figure 8).
2. Stock prices gradually increased in the latter half of 1995 and reached at 20,000 yen in September 1995 (see Figure 5).
3. The long -term interest rate began to increase with the expectation of the recovery.

Every body thought the recession had come to end at last.

2-3　Serious recession (1997-98)

The Prime Minister Hashimoto, who convinced the recovery of the Japanese economy, implemented the measures to reconstruct the Japanese finance. He was afraid that fiscal condition would get worse and worse with the coming of aging society in Japan. He decided to increase the consumption tax from 3 to 5 percent and abolish a special income tax cut in April 1997, which amount to a tax increase of 9 trillion yen. Unfortunately to the Japanese economy, the East Asian economic crises had occurred in July 1997. The fiscal contraction compounded by Asian crisis decreased the aggregate demand.

Under the deflationary conditions, the financial panic had occurred. Hokkaido Takushoku Bank, one of Japan's city banks (largest twenty banks), and Yamaichi Securities Company, one of Japan's four largest security company, failed in November 1997. The Failure of both big financial institutes sent the signs that the government gave up the "too big to fail" policy. People thought no financial institutes were immune from failures. Rumors about the other banks' failure had spread out through Japan. The stock prices of many financial institutes sharply declined and "Japan premium" in the international money market jumped by around 100 basis points.[5] Japanese banks was obliged to pay the additional basis points for raising funds in oversea financial markets. The premium is calculated as the difference between the quoted rates of TIBOR in the Tokyo offshore market and LIBOR in the London offshore market. Bonds issued not only by Japanese financial institutions but also by Japanese government were down graded at the investment grade rating by international credit-rating agency (such as Moody's).

In response to the serious situation, the government decided to provide a 30 trillion yen funds by issuing bonds. The government was not willing to inject the public funds into the problem banks by considering the negative sentiments of the congress and public at first. However the financial panic was so severe that neither the congress nor the public strongly opposed to inject the public funds to assist the problem banks. The 30 trillion yen was divided into the following two categories. 13 trillion yen was prepared for the enforcement of the Deposit Insurance System, while the remaining 17 trillion yen was intended for the capital injection of the problem financial institutes.[6]

The government actually injected 1.8 trillion yen to 21 large banks to raise their capital ratio in March 1998. However it had no significant effect on the banks because it was lax. Long-Term Credit Bank and Nippon Credit Bank had failed in 1998 after the injection of public fund. The 7.5 trillion yen was again injected in March in 1999. The implementation was quite diferent from the former injection. Banks were strongly required to submit detailed and meaningful restructuring plan.[7]

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5. See Cargill, Hutchison, and Ito (2000) Figure 2.9, p.27, and N. Mori et al. (2001) Figure 16, p.67 for more detailes.
6. See Cargill, et al. (2000) p.27.
7. See Cargill, et al. (2000) pp.61-66.
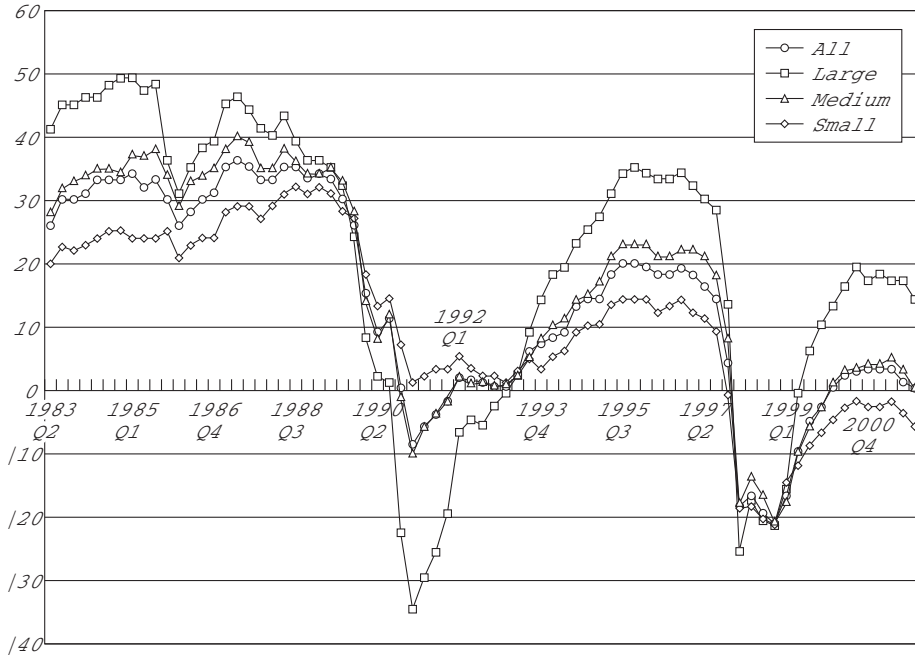
(source) Bank of Japan, TANKAN

Figure 9. Lending Attitude of Financial Institutions, DI
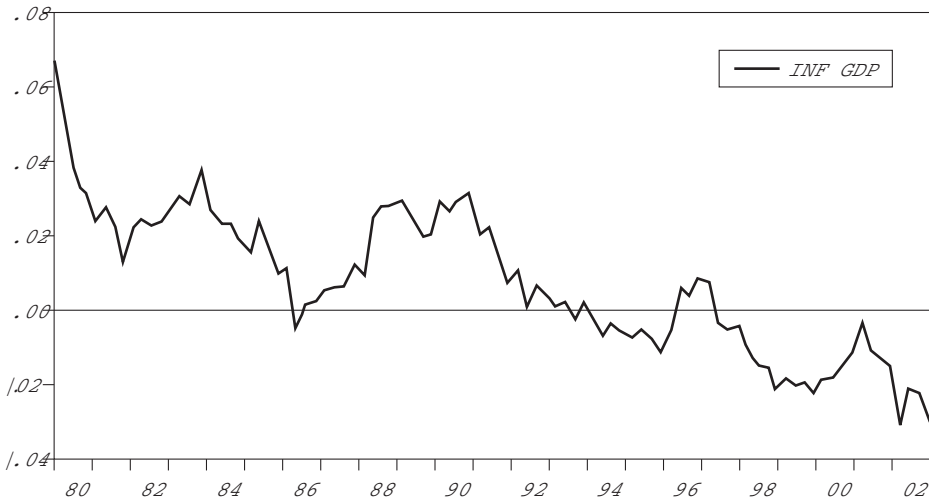
Figure 10. Inflation Rate (GDP deflator)

The government hesitated to quickly resolve the nonperforming loans and bank problems which weekend financial institute and caused long recession. The government officially announced in late 1995 that nonperforming loan totaled 38 trillion yen, 4 percent of outstanding all loans. In 1998, nonperforming loan increased at 73.1 trillion yen, 12 percent of all loans or 10 percent of GDP. All efforts by the government and private banks to decrease nonperforming loans did not succeed in reducing them at all because of the

severe deflationary pressure.[8]

The Japanese economy was thus caught in a vicious circle, so called deflationary spiral indicated in Irving Fisher (1933). Decline in demand → Decline in production and price → Decline in employment (Decline in consumption) and Increase in loan in real term (Decline in investment) → Decline in demand. GDP recorded negative growth for 5 consecutive quarters from 1997 Q4 onward (for the first time since the start of GDP statistics in 1955).

2-4 Expansionary Policy (1999-)

In response to the serious situation, the government decided to take the following expansionary fiscal policy.[9]

1. Special tax reduction (2 trillion yen)
2. Economic stimulus package (totally 16 trillion yen)
3. Revision of the Financial Structure Reform (temporally freezing)
4. Public funds was increased from 30 to 60 trillion yen in October 1998, based on the Financial Reconstruction Law and the Financial Function Early Strengthening Law
5. Injection of public funds to major financial institutes (7.5 trillion yen)

The BOJ adopted further easy monetary policy by reducing the call rate to 0.25 percent in 1998. The BOJ also took the so-called zero interest policy by reducing it to virtually zero percent in February 1999. Further the BOJ adopted the untraditional
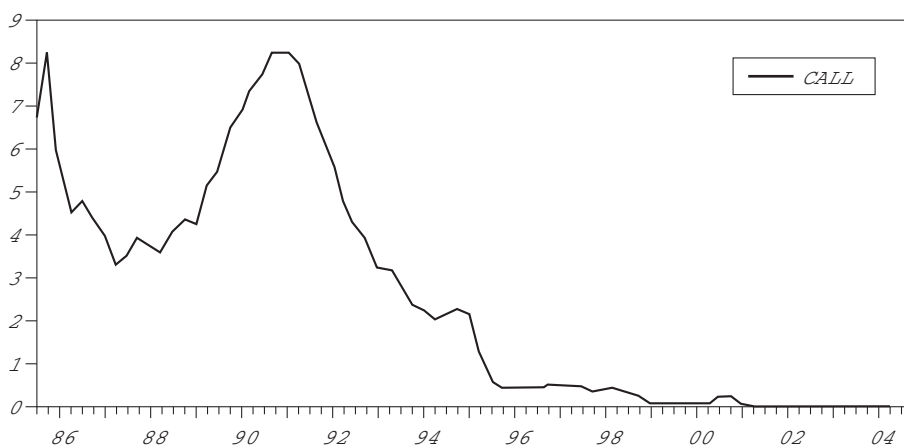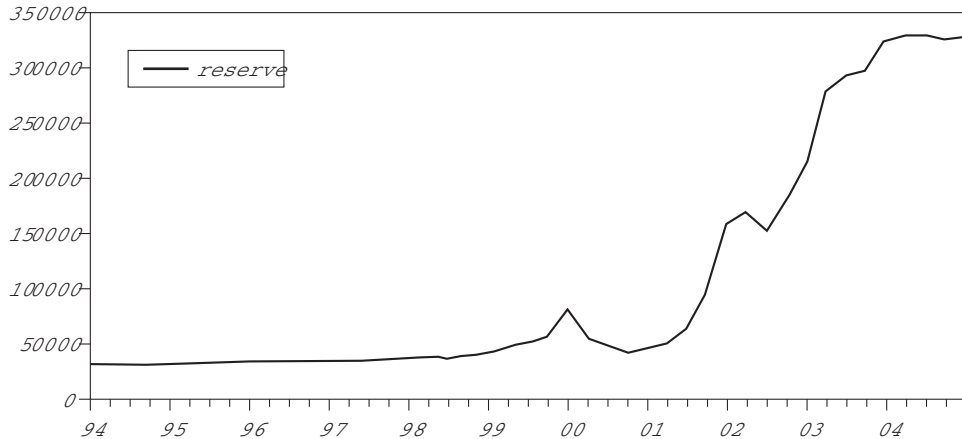

(source) Bank of Japan

Figure 11. Figure Call Rate

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8. Mori et al. (2001) admit the BOJ's buy time policy delayed in vitalizing the financial institutions. However they also emphasize that the quick resolution would cause financial turmoil especially in the case of poor safety net.
9. See Mori et al. (2001) p.71 for more details.

(source) Bank of Japan

Figure 12. Bank Reserve

monetary policy, so-called quantity easy policy by putting the bank reserve on its target (see Figure 12). They committed to keep the new policy until the CPI registers stably either zero percent year on year or an increase and to increase in the outright purchase of long-term government bonds, in case they consider the increase necessary for providing liquidity smoothly. Now they conduct money market operations, aiming at the outstanding balance of account held at the Bank at around 30 to 35 trillion yen (5.20, 2005). Owing to these expansionary policies, the financial panic seems to settle down. However Japanese economy remains still stagnant.

3. Evaluation of BOJ's policy

We now focus on the evaluation of the BOJ's monetary policy response in the prolonged recession. We try to examine whether the BOJ took the appropriate easy policy to prevent the long -lasting recession. First we check the behavior of the Marshallian k, *i.e*., the ratio of money stock to nominal GDP. We need to compare its movement with the trend line in order to evaluate the size of magnitude of easy policy (see Figure 14) . The trend line is computed over the period from 1980 to 2005. Marshallian k started to exceed the trend line from 1987, when the BOJ began to take much easier policy following the Louvre agreement. It gradually declined after reached at peak in 1990. It began to decline less than the trend line and bottomed out in 1997. It started again to increase and exceed the trend line in 2001, when the BOJ implemented the radical quantity easy policy.

Next we try to examine the BOJ's policy by using the McCallum rule (McCallum, 1988). McCallum rule is an adaptive policy formula with a target of monetary base. With this rule, monetary base growth rate changes in response to deviation of the nominal GDP growth rate from a desired target value that grows at a specified rate. Okada and Iida (2004) compared the movement of actual monetary base growth with that of adequate
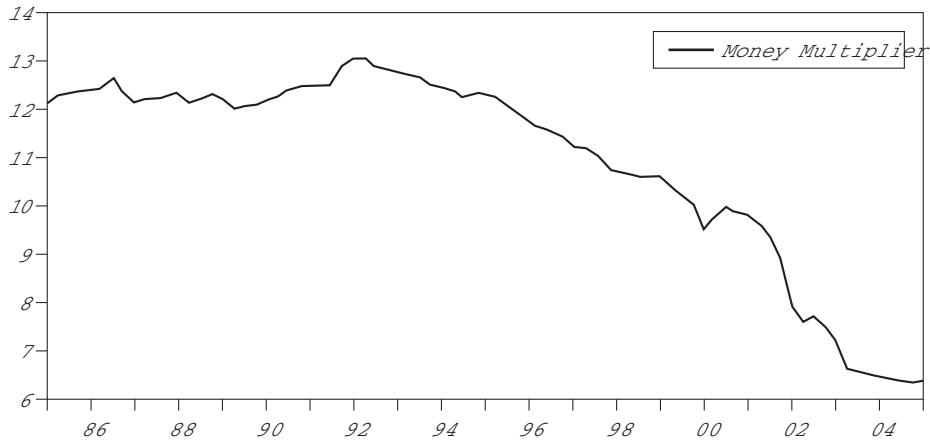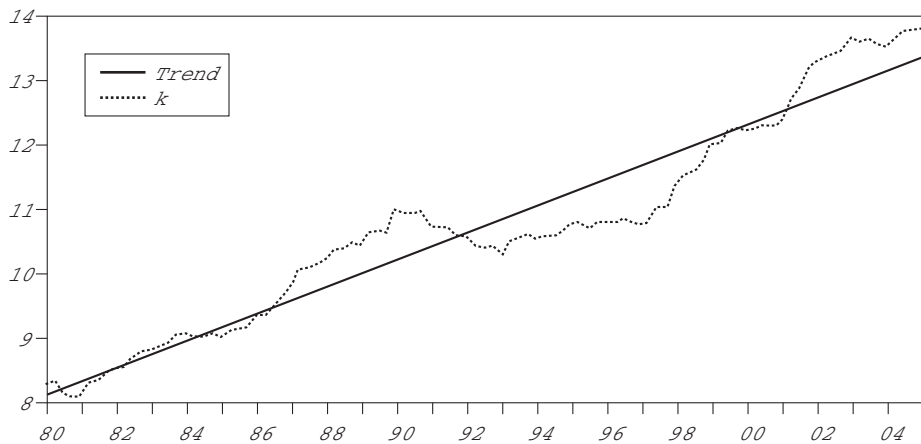
Figure 13. Money Multiplier

Figure 14. Marshallian k

monetary base growth based on the McCallum policy reaction rule as shown in Figure 7.[10] According to their results, adequate monetary growth rate derived from the McCallum policy rule remained less than actual monetary growth in the bubble period from the half of 1980s. On the contrary, the adequate base growth has been consistently exceeding the actual base growth indicating that the volume of monetary base has remained insufficient since 1991.The results suggest that monetary policy was too easy in the latter half of 1980s and too tight since 1991 and do not respond properly to the external shock which affected the Japanese economy.[11]

We now turn on the behavior of the money stock that remains stagnant despite of the

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10.   The base growth rule was computed under the assumption that target rate of nominal GDP is 5 percent (3 percent real GDP growth and 2 percent inflation). See Okada and Iida (2004) for more details.

11.   A. Ahearne et al. (2002) and Bernanke and Gerter (1999) had got the same results by using the Taylor-style monetary rule. They concluded that Taylor's equation indicated that interest rates should have declined more rapidly than was in fact the case.

BOJ's efforts to increase it. The reason of the stagnant of money stock seems to be related with drastic change in firms' borrowing behavior and financial institutions' lending behavior since the bursting of the bubble. Firms substantially increased their liability in the bubble period with the bullish expectation. However they turned to intensify to reduce the liability under the deflationary pressure.

On the side of financial institutions, there are at least three reasons they have to reduce their lending. First they have to reduce the lending to keep their own capital/ asset ratio at adequate level *i.e.*, the international standard level imposed by Bank for international Settlement, so-called capital adequacy standard. They had already decreased their capital to deal with nonperforming loans. Second, the worsening of financial position made financial institutions to raise funds in the financial market difficult. Third, the financial institutions reduced their desire of new lending because the new loan might be used to reduce the borrowers' debt.[12] Thus, they contracted their lending as shown in Figure13.

As Tankan Survey shows in Figure 9, financial institutions adopted a stringent attitude toward lending to firms especially to small and medium-sized firms. This survey asks firms their view of the lending attitude of financial institutes. The lending attitude was the most stringent in 1998. DI can be calculated by the difference (percentage) between the firms perceive "accommodative" and the firms perceive "severe". Accommodative means firms perceive that financial institutions are willing to satisfy their credit request, while severe means firms perceive that financial institution are reluctant to lend.

Thus, we conclude that both reduction in firms' excess liability and financial institutions' nonperforming loans' problem contributed to the credit decline as shown in Figure 8. The decline of loan (banks' negative attitude toward loans) substantially decreases the money multiplier as shown in Figure 13, which contribute to offset the BOJ's efforts to increase money stock. Figure 12 indicates how earger the BOJ try to increase money stock. Thus, the decline of loans causes that of deposit and, by extension, money stock.

4. The relationship between money and economic activity

We examine whether or not there exists a long-run equilibrium relationship between the money stock and economic activity in Japan. We focus on the relationship between three variables; the real money stock, real GDP, and the opportunity cost measured as the difference between the interest rates on the money stock and that on other financial assets. If a long-run equilibrium relationship exists between the real money stock, real GDP, and the opportunity cost, we could say that money demand rises in line with increase in real

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12. Kobayashi and Kato (2001) called it "Debt Overhung", which originally came from F. Myers (1977) and O. Lamont (1995).
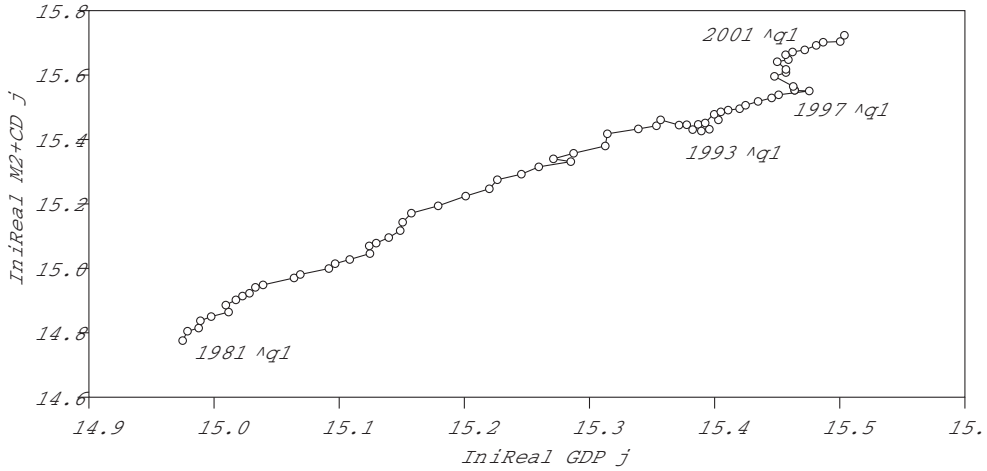
Figure 15. Relation Between Real Money and Real GDP (1981-2001)
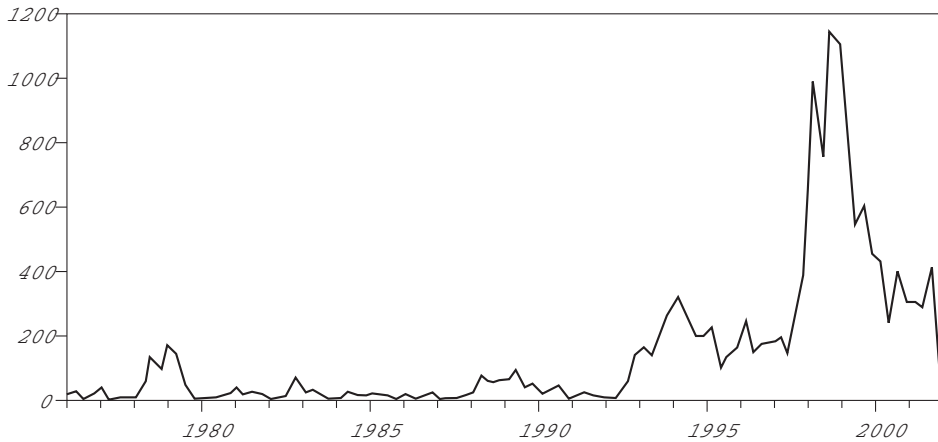
Figure 16. Financial Anxieties

GDP or decline in the opportunity cost. The system model is described by the VECM in the following:

$$\Delta rm(t) = c_{m0} + \alpha_m ect(t-1)$$
$$+ \sum_{i=1}^{k} c_m^i \Delta rm(t-i) + \sum_{i=1}^{k} d_{mi} \Delta y(t-i) + \sum_{i=1}^{k} e_m^i \Delta r(t-i) + \varepsilon_m(t) \tag{1}$$

$$\Delta y(t) = c_{y0} + \alpha_y ect(t-1)$$
$$+ \sum_{i=1}^{k} c_y^i \Delta rm(t-i) + \sum_{i=1}^{k} d_y^i \Delta y(t-i) + \sum_{i=1}^{k} e_y^i \Delta r(t-i) + \varepsilon_y(t) \tag{2}$$

$$\Delta r(t) = c_{r0} + \alpha_r ect(t-1)$$
$$+ \sum_{i=1}^{k} c_r^i \Delta rm(t-i) + \sum_{i=1}^{k} d_r^i \Delta y(t-i) + \sum_{i=1}^{k} e_r^i \Delta r(t-i) + \varepsilon_r(t) \tag{3}$$

$$ect(t) = rm(t) + \beta_y y(t) + \beta_r r(t) + const. \tag{4}$$

where

Table 1. Results of Cointegration Tests

(1) 1980Q1 to 1997Q4

	Johansen's Cointegration Test		Parameter estimated				
Sample period 80/1Q – 97/4Q	Maximum Eigenvalue Test	Trace Test	β_y	β_r	α_m	α_y	α_r
	19.6528** (21.132)	33.2316*** (29.797)	-1.5777 (0.0374)	0.0259 (0.0055)	-0.0170 (0.0425)	0.0747 (0.0414)	-7.1550 (1.7843)
With Anxiety	21.3320** (21.132)	37.6709*** (29.797)	-1.5766 (0.0340)	0.0200 (0.0052)	-0.0191 (0.0655)	0.125 (0.0432)	-6.3601 -1.8729

(2) 1980Q1 to 2002Q4

	Johansen's Cointegration Test		Parameter estimated				
Sample period 80/1Q – 02/4Q	Maximum Eigenvalue Test	Trace Test	β_y	β_r	α_m	α_y	α_r
	17.6228** (21.132)	25.7871 (29.797)	-1.4816 (0.2122)	0.1311 (0.0354)	-0.0072 (0.0060)	0.0002 (0.0070)	-1.1423 (0.2819)
With Anxiety	21.6630** (21.132)	30.0835** (29.797)	-1.6939 (0.1067)	0.0809 (0.0186)	-0.0050 (0.0251)	0.0088 (0.0123)	-2.1096 -0.4616

(3) 1980Q1 to 2004Q1

	Johansen's Cointegration Test		Parameter estimated				
Sample period 80/1Q – 04/1Q	Maximum Eigenvalue Test	Trace Test	β_y	β_r	α_m	α_y	α_r
	17.7412 (21.132)	27.5022 (29.797)	-1.2351 (0.5417)	0.3399 (0.0943)	-0.0027 (0.0022)	0.0002 (0.0026)	-0.4276 (0.1047)
With Anxiety	19.3739* (21.132)	29.3085* (29.797)	-1.7797 (0.1610)	0.1225 (0.0292)	-0.0038 (0.0164)	0.007 (0.0082)	-1.3566 -0.3144

Note: *, ** and *** indicate rejection of null hypothesis at 1%, 5% and 10% significance level

$rm(t)$ is real money stock

$y(t)$ is real GDP

$r(t)$ is opportunity cost

$ect(t)$ is an error correction term

Our results of cointegration test are as follows in Table 1.

1. A long-run equilibrium relationship between real money stock, real GDP, and the opportunity cost can be found in the sample period before late 1997.
2. However, the long-run equilibrium relationship can no longer be detected in the sample period expanded beyond late 1997, when financial anxieties over the Japanese financial system emerged.

The reason why the relationship between the money stock and economic activity has been unstable seems to be related to the financial anxiety which rapidly increased after the sudden collapse of big financial institutes in 1997. The financial anxieties drastically

Table 2   Estimation of TARCH model (1976Q3-2005Q1)

	Coefficient	td. Error	Sz-Statistic	Prob.
β_0	0.053084	0.236598	0.224364	0.8225
β_1	-0.000344	0.008962	-0.038433	0.9693
β_2	-0.026407	0.009873	-2.674603	0.0075

Variance Equation

α_0	1.240864	0.879154	1.411429	0.1581
α_1	0.058104	0.117175	0.495876	0.6200
γ	0.256846	0.145875	1.760722	0.0783
β	0.573227	0.196519	2.916904	0.0035

increased the precautionary demand by both firms and household.

We need to comprise a new variable to explain the rise of precautionary demand for money after 1997. The new variable has to capture the psychological change of people due to the financial anxieties. We used the Corporate Financial Position Diffusion Index issued quarterly by Bank of Japan known as TANKAN in order to qualify the unobservable variable.

We formulate the model as follows. [13]

$$\Delta DI_t = \beta_0 + \beta_1 \Delta rate_t + \beta_2 \Delta rate_{t-1} + \varepsilon_t$$

where DI is the diffusion index for the financial position, $rate$ is the interest rates on loans and ε_t is an error term, which shows the influence of irregular or unexpected factors other than interest rates on loan. The financial anxieties can be captured as the variance of this error term. [14]

We here introduce TARCH (Threshold Autoregressive Conditional Heteroscedasticity) or Threshold ARCH model for the error term with asymmetric variance property. The TARCH model with asymmetric variance property for the conditional variance of the innovations is

$$h_1^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta h_{t-1}^2 + \gamma \varepsilon_{t-1}^2 I_{t-1} \qquad (4)$$
$$\text{where } I_{t-1} = 1 \text{ if } \varepsilon_{t-1} < 0$$
$$= 0 \text{ otherwise}$$

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13.   The original model was used by Kimura and Fujita (1999). However their model has some problems coming from the naive application of time series data. So we use here the modified model. See in detail J. Rahman, S. Miyagawa, and Y. Morita (2005). We checked the time series property of DI and rate by KPSS and PP test. The results showed that DI is integrated of order one, I (1) and rate is stationary.

14.   The sample in TANKAN is taken from about 700 companies listed in stock exchange. The diffusion indexes for the financial position are made as follows, for example. Companies are asked to choose one out of three answers, 1 tight, 2 not so tight, 3 easy. The percentage share of those which answered 3 is subtracted from those which answered 1.

In this model, for TARCH effect, the asymmetry term $\gamma > 0$ and the condition for non-negativity will be $\alpha_0 \geq 0$, $\alpha_1 \geq 0$, $\beta \geq 0$ and $\alpha_1 + \gamma \geq 0$. The conditional variance h_t^2 is subject to an impact α_1 from good news $(\varepsilon_{t-1} \geq 0)$, while an impact $(\alpha_1 + \gamma)$ from bad news $(\varepsilon_{t-1} < 0)$. This kind of asymmetric property corresponds to the situation such that the psychological change of people due to the financial anxieties increases the precautionary demand and that an easy financial position does not rise the precautionary demand.

Estimation results are shown in Table 2. The sign of all parameters seem to be reasonable in economic sense. Since a rise of DI_t implies easy financial position and a rise of $\Delta rate_t$ means that of interest rate, $\beta_1 + \beta_2$ should take a negative value. The parameter γ of $\varepsilon_{t-1}^2 I_{t-1}$ takes a positive value and hence the conditional variance is shown to exhibit asymmetric property, though the significance levels of some parameters are not sufficient. Figure 16 depicts the behavior of h_1^2 as a variable of financial anxieties.

Anxieties variable denoted by $DV_t (= h_t^2)$ is seen to rise at first from 1992 to 1994 (the first financial anxiety in Japan), when small credit unions and cooperative failed because of an increase in the nonperforming loan caused by the rapid decline of stock and land price after the bust of the bubble. The Japanese economy began to show the modest recovery in late 1995, when real GDP began to increase and the official estimation of NPLs decreased.[15] The Ministry of Finance had issued a report entitled "Reorganizing the Japanese Financial system (kinyu shisutemu no kinoukaifuku nituite)" in June 1995, in which they showed diehard attitude to tackle with the NPLs problems by officially disclosing the magnitude of bad loans totaled 40 trillion yen (about 4 percent of the loans held by depository institutions).

Furthermore MOF had strongly pledged the complete deposit guarantee by March 2001, the reform of the Deposit Insurance Corporation and Prompt Corrective Act, which had been already implemented with a success in the United States in 1991 after the financial crisis in the end of 1980s. As a result the financial anxieties had been dispelled in

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15. Hutchison and McDill (1999) also estimated the financial crisis by using the probit model and got the similar results as ours. Their results indicate that the likelihood of a banking problem sharply rose in 1991, reached at a peak in 1992, and sharply declined after 1993, while it was very small (bellow 10 percent) until 1990. The following Figure is taken exactly as in Hutchison and McDill (1999).
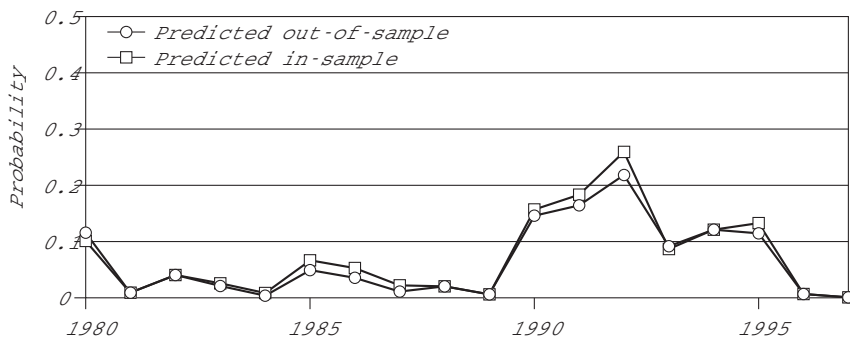
1995.

However, the economy sharply decline in 1997 when Prime Minister Ryutaro Hashimoto had declared the rise of the consumption tax from 3 to 5 percent and the end of temporary income tax cut. Hokkaido Takushoku, one of the biggest banks and Yamaichi, one of the Big Four securities had failed in November 1997 (the second financial anxiety in Japan). Japan Premium, which is the additional rate Japanese banks have to pay for raising funds in the international money market, jumped by around 100 basis points. People feel that no financial institute is immune from failure when government took a very negative view to use public funds to help affected banks. People anxieties tremendously increased, as indicated in the rise of DV in 1998.

Then DV rapidly decrease after 1999. The decline can be seen as follows. The Bank of Japan had adopted an aggressive monetary easing policy to reduce the inter-bank money rate to a low level in February 1999. Thanks to this so-called zero interest policy, the uncollateralized overnight call rate was lowered to 0.01 percent and further declined to 0.001 percent when the BOJ had took the so-called quantitative easy policy in March 2001. The Japanese government also decided to inject the public fund to the banking sector; the amounts are 1.8 trillion yen in 1998, 7.8 trillion yen in 1999. Both efforts of the BOJ and the government had succeeded in dispelling the financial anxiety. Thus, DV rapidly decrease after 1999 when the BOJ began to take an aggressive policy and the government decided to inject public fund to stabilize the financial system.

The results of the cointegration test taking the financial anxiety into consideration are also shown in Table 1. We performed the Johansen's cointegration test in the same model as equation (1)-(4) by taking into account a new variable of financial anxieties. However we can not directly contain a new variable into Eq. (4) because anxieties variable denoted by $DV_t(h_t^2)$ is stationary. The estimation procedure is shown in Appendix. Our results suggest that there still exists a long-run equilibrium relationship among real money stock, real GDP, share price, and financial anxiety, though the equilibrium relationship has been broken down in the model ignoring the financial anxiety.

conclusion

The lessons from the prolonged Japanese depression would be summarized as follows.

1. The BOJ targeted the nominal exchange rate in the monetary policy. It tried to manipulate the nominal exchange rate to correct the current account imbalance between Japan and US that was originally caused by structural imbalance between domestic savings and investment. They should have paid attention to the behavior of money stock. Both inflation and deflation are monetary phenomenon in the long run. Money stock as information variable is still important.

2. The BOJ did not realize the scare of deflation. The BOJ kept the position that monetary policy should be used neither to raise the stock price nor to save the financial institutes even after the burst of the bubble. Such BOJ's stance provided

very negative effects on the financial institutions and stock prices. At the early stage of the recession, the BOJ thought that some downward pressure on prices was what has been referred to as "good deflation," resulting from technical change and the increase of cheap products from China and deregulation in Japan' rigid service sector.

3. It was often said at the time that Tokyo is the most expensive city. Even after the burst of the bubble. the "myth of ever-rising land price" survived, which made policy makers and banks too optimistic in the sense that they expected the land price and economy to recover so soon. That would be one reason why BOJ' policy was too late and too timid. Deflation has raised the debt burden substantially.

4. Monetary conditions should have been eased quickly and more aggressively. The BOJ officials often says that monetary conditions were already extremely easy which might hamper the effort of both firms and banks to adjust the damaged balance sheets. Further low interest policy was thought to incur the moral hazard.

5. The government was reluctant to disclose the nonperforming loan statistics. They thought those problem would be rapidly improved once the anticipated recovery occurred. They took the forbearance policy. They published NPLs of only the then 21 major banks in 1992, and published the statistics for each of banks in 1993. The regional banks only started to disclose in 1994, The published value of NPLs was widely admitted as underestimated by the flexible definition of nonperforming loans.

6. Both the BOJ and the government had lacked in adequate prudential policy. Thus, they have to take "buying time" policy, to gain time to make the adequate policy and construct the safety net.

7. Money stock is still important as an information variable. The BOJ has to pay close attention to its behavior. Inflation targeting policy might be necessary if money stock remains stagnant.

References

Ahearne, A., J. Gagnon, J. Haltmair, and S. Kamin, 2002, "Preventing Deflation: Lessons from Japan's Experience in the 1990s," *International Finance Discussion Papers*, Board of Governors of Federal Reserve System No. 729.

Bank of Japan, 1997 "M2+CD to keizaikannkei ni tuite (On the relationship between M2+CD and economic activity in Japan)," *Bank of Japan Monthly Review*, 101-123 (in Japanese).

Bank of Japan, 2003 "The Role of the Money Stock in Conducting Monetary Policy," *Bank of Japan Research Papers*, Policy Planning Office.

Bollerslev, Tim, Ray Y. Chou, and Kenneth F. Kroner, 1992, "ARCH modeling in Finance: A Review of the Theory and Empirical Evidence," *Journal of Econometrics* 52, 5-59.

Cargil T., M. Hutchison, and I. Takatoshi, 2000 *Financial Policy and Central Banking in Japan*, The MIT Press, Cambridge and London.

Fisher I. 1933 "The Debt-Deflation Theory of Great Depression," *Econometrica*, 11, 337-57.

Elliott, G., T. J. Rothenberg and J. H. Stock, 1996, "Efficient Tests for an Autoregressive Unit Root," *Econometrica*, 64, 813-836.

Engle, R. F. and C. Granger, 1987, "Co-Integration and Error Correction: Representation,

46

Estimation and Testing," *Econometrica*, 55, 251-276.

Engle, Robert F. and Victor K. Ng, 1991, "Measuring and Testing the Impact of News on Volatility," *University of California*, San Diego, Mimeo.

Fujiki, H., C. Hsioo, and Y. Shen, 2002 "Is There a Stable Money Demand Function under the Low Interest Policy ? A Panel Data Analysis," BOJ *Monetary and Economic Studies*.

Hamilton, J.D. 1994, *Time Series Analysis*, Princeton, NJ: Princeton University Press.

Hutchison, M. and K. McDill, 1999, "Empirical determinants of banking crisis: Japan's experience in international perspective, in C. Freeman, ed., *Why Did Japan Stumble? Causes and Cures,* Edward England.

Kobayashi, K. and S.Kato, 2001, *Nippon Keizai no Wana (The trap of Japanese economy)*, Nippon Keizai Shinbunsha (in Japanese).

Kimura, T. and S. Fujita, 1999, "Kiyufuan to mane, jittaikeizai, bukka no kankeinituite (The relationship between financial anxieties, money, real economy, and prices)" *Working Paper* 99-6, Bank of Japan (in Japanese).

Kwiatkowski, D., P.C.B. Phillips, P. Schmidt and Y. Shin ,1992, "Testing the Null Hypothesis of Stationarity Against the Alternatives of a Unit Root: How Sure Are We That Economic Time Series Have a Unit Root?," *Journal of Econometrics*, 54:159-178.

Lamont, O. 1995, "Corporate-Debt Overhang and Macroeonomic Expectations," *American Economic Review* 85, 116-117.

MacKinnon, J., 1991, "Critical Values for Cointegration Tests," in, Engle, R. and C. Granger, (eds.), *Long-Run Economic Relationships: Readings in Cointegration*, Oxford University Press, Oxford.

Mori, N. S. Shiratsuka. and H. Taguchi, 2001 "Policy Responses to the Post-Bubble Adjustments in Japan: A Tentative Review," BOJ *Monetary Economic studies* (Special Edition).

Myers, S.C.1977, "Determinants of Corporate Borrowing." *Journal of Financial Economics*, 5, 147-175.

Nishimura, Y., 2003, *Nippon no kinyu kaikaku (The Reform of the Japanese Financial System)*, Tohyokeizai (in Japanese).

Nishioka, S. and N. Baba, 2004, "Dynamic Capital Structure of Japanese Firms," BOJ *Working Paper Series*, No. 04-E-16.

Okada, Y. and Y. Iida, 2004 Kinyuseisaku no Shippai ga Maneita Choukiteitai (Long-lastetd Recession Caused by Failure of Monetary Policy) in Hamada and Okada ed. *Ronsou; Nippon no Keizai Kiki, (Economic Crisis in Japan)*, Ch. 5 Nippon Keizai Shinbunsha, (in Japanese).

Suzuki, Y. 1993 *Nippon no Kiyuseisaku, (Monetary Policy in Japan)*, Iwanami Shoten (in Japanese).

Appendix

Since financial anxieties $h(t)$ and $h^2(t)$ are stationary, we cannot directly contain the variable $h(t)$ and $h^2(t)$ in the cointegration relationship in Eq.(4). In order to overcome this difficulty, we introduce the following assumption:

[Assumption] Denoting financial anxieties $DV1(t)$ and $DV2(t)$ and precautionary demand $DV(t)$ respectively as

$$DV1(t) \equiv h(t+1) \quad \text{and} \quad DV2(t) \equiv h^2(t+1)$$

$$Precautionary\ Demand\ DV(t) \equiv c_1 DV1(t) + c_2 DV2(t), \tag{A-1}$$

money is adjusted by precautionary demand:

$$rm_{new}(t) \equiv rm(t) - DV(t). \tag{A-2}$$

Remark: Precautionary demand can be defined in a more general form of $\tilde{c}_1 DV(t) + {}_2 DV(t-1) + \cdots$. For simplicity of calculation, we only adopt the simultaneous term in Eq. (A-1).

We shall consider the system model of new variables $(rm_{new}(t), y(t), r(t))$ which is just the same as that in Eqs.(1) to (4) with the variable $rm(t)$ replaced by a new one $rm_{new}(t)$. Notice that, from Eq.(A-2), $\Delta rm_{new}(t) \equiv \Delta rm_{new}(t) - \Delta DV(t)$.

Equation(1) for $\Delta rm_{new}(t)$ can be described by using $rm(t)$ and $DV(t)$.

$$\Delta rm(t) = c_{m0} + \Delta DV(t) + \alpha_m ect(t-1)$$
$$+ \sum_{i=1}^{k} c_m^i (\Delta rm(t-i) - \Delta DV(t-i)) + \sum_{i=1}^{k} d_m^i \Delta y(t-i) + \sum_{i=1}^{k} e_m^i \Delta r(t-i) + \varepsilon_m(t)$$
$$= c_{m0} + (c_1 \Delta DV1(t) + c_2 \Delta DV2(t)) + \alpha_m ect(t-1)$$
$$+ \sum_{i=1}^{k} c_m^i (rm(t-i) - c_1 \Delta DV1(t-i) - c_2 \Delta DV2(t-i))$$
$$+ \cdots + \varepsilon_m(t) \tag{A-3}$$

where an error correction term is calculated for the set of variables
$$((rm(t) - DV(t)), y(t), r(t))$$

[Estimation of c_1 and c_2]

[Case-1](no cointegration) If cointegration property does not hold, then Eq.(A-3) without $ect(t-1)$ can be estimated as nonlinear estimation problem by gmm (generalized method of moment) and estimated c_1 and c_2 produce a new money variable $rm_{new}(t)$ from Eq.(A-2).

[Case-2](cointegration) If there holds cointegration property, then the folloing algorithm is applied to find out the parameter c_1 and c_2.

(i) Set initial values of c_1 and c_2 as the estimated values in [case-1].

(ii) Calculate a new variable $rm_{new}(t) \equiv rm(t) - DV(t)$.

(iii) Calculate VECM and an error correction term $ect(t-1)$ for variables $(r\widetilde{m}_{new}(t), y(t), r(t))$ in Eqs.(1) to (4).

(iv) Insert $ect(t-1)$ into Eq.(A-3) and estimate c_1 and c_2 along with the procedure of [case-1].

(v) Using the estimated c_1 and c_2 obtained in the above (iv), go to the procedure (ii) and iterate (ii) to (iv) till estimated c_1 and c_2 converge to some constants.

The above procedures of estimation are carried out in the interval (1980q1, 2002q1) and the estimated results for c_1 and c_2 in Eq.(A-1) are given below:

$$DV(t) \equiv c_1 DV1(t) + c_2 DV2(t)$$
$$= 0.081054 DV1(t) - 0.00759 DV2(t)$$

Hence, Eq.(A-2) is given by

$$rm_{new}(t) \equiv rm(t) - DV(t)$$
$$\equiv rm(t) - (0.081054 DV1(t) - 0.00759 DV2(t))$$

VECM with financial anxieties

After deciding the parameters c_1 and c_2, the system model in Eqs.(1) to (4) is rewritten with new adjusted variable $rm_{new}(t)$:

$$\Delta rm_{new}(t) = c_{m0} + \alpha_m ect(t-1)$$
$$+ \sum_{i=1}^{k} c_m^i \Delta rm_{new}(t-i) + \sum_{i=1}^{k} d_m^i \Delta y(t-i) + \sum_{i=1}^{k} e_m^i \Delta r(t-i) + \varepsilon_m(t) \tag{A-4}$$

$$\Delta y(t) = c_{y0} + \alpha_y ect(t-1)$$
$$+ \sum_{i=1}^{k} c_y^i \Delta rm_{new}(t-i) + \sum_{i=1}^{k} d_y^i \Delta y(t-i) + \sum_{i=1}^{k} e_y^i \Delta r(t-i) + \varepsilon_y(t) \tag{A-5}$$

$$\Delta r(t) = c_{r0} + \alpha_r ect(t-1)$$

$$+ \sum_{i=1}^{k} c_r^i \Delta rm_{new}(t-i) + \sum_{i=1}^{k} d_r^i \Delta y(t-i) + \sum_{i=1}^{k} e_r^i \Delta r(t-i) + \varepsilon_r(t), \qquad \text{(A-6)}$$

where $ect(t)$ is an error correction term defined by

$$ect(t) = rm_{new}y(t) + \beta_y(t) + \beta_r r(t) + const. \qquad \text{(A-7)}$$