Asset Price Bubbles, Price Stability, and Monetary Policy: Japan's Experience

Kunio Okina and Shigenori Shiratsuka

Japan's economy has experienced an extremely large swing against the backdrop of the emergence, expansion, and bursting of asset price bubbles. When examining the emergence and bursting of the bubble economy from the viewpoint of monetary policy management, should the Bank of Japan have given more consideration to asset price fluctuations in formulating its monetary policy? Or, should the Bank not have been perplexed with asset price fluctuations and conducted policies focusing only on the general price level such as inflation targeting? In answering these questions and deciding policy actions, to what extent should the Bank consider financial system problems? This paper aims at forming some tentative answers to these questions.

Key words: Monetary policy; Asset price bubble; Price stability; Financial stability

Kunio Okina: Director, Institute for Monetary and Economic Studies, Bank of Japan (E-mail: kunio.okina@boj.or.jp)
Shigenori Shiratsuka: Senior Economist, Institute for Monetary and Economic Studies, Bank of Japan (E-mail: shigenori.shiratsuka@boj.or.jp)

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I. Introduction

Since the latter half of the 1980s, Japan's economy has experienced an extremely large swing against the backdrop of the emergence, expansion, and bursting of asset price bubbles. When looking back at the emergence, expansion, and bursting of asset price bubbles from the viewpoint of monetary policy management, should the Bank of Japan (hereafter, BOJ) have given more consideration to asset price fluctuations in formulating its monetary policy? Or should the BOJ not have been perplexed with asset price fluctuations and conducted policies focusing only on the general price level such as inflation targeting?

In general, if asset prices are at levels consistent with economic fundamentals, then various assets are most effectively utilized in a way consistent with real economic activity, and thus asset price fluctuations will not be a serious problem in monetary policy management. However, asset prices can, for various reasons, diverge from economic fundamentals and form a so-called bubble. In some cases, a bubble will emerge due to excessive optimism with respect to fundamentals. Such optimistic expectations will sooner or later be betrayed. In other cases, while market participants recognize excess in asset prices compared with economic fundamentals, they might continue bullish investment thinking that such excess will continue. But in such cases, it is impossible that such rises in asset prices can be sustained forever beyond levels consistent with economic fundamentals. Therefore, when asset prices contain an element of a bubble, there will inevitably be, sooner or later, a correction.

A rise and fall in asset prices, which contain an element of a bubble, affect real economic activity mainly through the following routes: (1) on consumption through the wealth effect, and (2) on investment through a change in external finance premium due to changes in collateral and net asset values.[1] Therefore, when asset prices are rising, they affect the economy in a favorable way even though such a rise is occasioned by a bubble and the adverse effects are not thoroughly recognized.

However, once the economy enters a downturn, the above favorable cycle reverses. In particular, when a favorable cycle has been occasioned by a bubble, the economy will face a severe reaction. That is, the harmful effects of a bubble will emerge, exerting stress on the real side of the economy and financial system due to an unexpected correction of asset prices. In such a case, if intensified bullish expectations that previously supported the bubble are left unchecked, expansion and subsequent bursting of the bubble will become bigger, affecting the real economy directly or, by damaging the financial system, indirectly. In light of Japan's experience, it seems to be a characteristic that effects of a bubble are asymmetrically larger in the bursting period than in the expansion period.

1. Bernanke and Gertler (1995) explain that frictions in financial markets, such as imperfect information and costly enforcement of contracts, generate a difference in costs between external funds such as bond financing, and internal funds such as retaining earnings. They call the above wedge the external finance premium, and emphasize that the external finance premium fluctuates coincidentally with business cycles, thereby propagating the conventional effect of interest rates on aggregate demand.

When looking back at the experience during the asset price bubble in the late 1980s, the rate of inflation shown in statistics was relatively moderate, but expectations that low interest rates would continue over time had been generated in the meantime, making economic agents' expectations extremely bullish with respect to the future.[2] What should be noted about the asset price bubble in Japan is that it is not a rational bubble as modeled in Blanchard and Watson (1982), which is expressed as a divergence from economic fundamentals and whose probability of bursting is recognized among economic agents and thus incorporated into asset price formation. Rather, it is characterized by euphoria, that is, excessively optimistic expectations with respect to future economic fundamentals, which lasted for several years and then burst. Therefore, during the bubble period Japan faced difficulty in evaluating *ex ante* whether it was the arrival of a new era or simply euphoria.[3]

In general, a stable financial system and macroeconomic environment are regarded as a necessary condition for enhancing economic stability and efficiency.[4] Hence, in light of Japan's experience, it seems extremely important to accurately analyze what asset price fluctuations imply and to accurately evaluate how "expectations" illustrated in such fluctuations are sustainable.[5]

This paper is composed as follows. Section II summarizes the characteristics of asset price bubbles in the late 1980s based on Japan's historical experience of asset price inflation in the postwar period. Section III verifies the relationship between monetary policy management and asset prices in the process of the emergence of the bubble based on a standard view of policy rules. In Section IV, after summarizing the effects of the bursting of the bubble on financial system stability, the impact on monetary policy is considered, and Section V rounds up the discussion and presents a conclusion. The appendices summarize Japan's experience with respect to (1) the relationship between the emergence and bursting of asset price bubbles and structural problems, and implications for monetary policy management; and (2) the fact that the border of monetary policy and prudential policy becomes extremely blurred when the financial system is in a critical condition.

II. Japan's Asset Price Bubble since the Late 1980s

In this section, we summarize the characteristics of asset price bubbles in the late 1980s, based on Japan's historical experience of asset price inflation in the postwar period.

2. Okina, Shirakawa, and Shiratsuka (2001) examine this point in detail.
3. If an increase in asset prices is caused by a rational bubble, evaluation on economic fundamentals will remain unchanged, and thus existence of the bubble will not affect assessment on an output gap. On the contrary, since euphoria cannot be generated independent of a recognition that economic fundamentals have shifted upward, assessments on economic fundamentals and an output gap are inevitably two sides of one coin. Such difference between a rational bubble and euphoria is crucially important in considering the implications of the asset price hikes on the monetary policy management.
4. See Okina, Shirakawa, and Shiratsuka (2001), and Shiratsuka (2001a).
5. See Shiratsuka (2001b, c).

A. Japan's Asset Price Bubbles in the Post-WWII Period

Let us review the major characteristics of the emergence and bursting of Japan's asset price bubble.[6] Figure 1 plots major financial and economic indicators, including asset prices such as stock and land prices. The figure plots stock prices and land prices as indicators for asset prices (upper panel), the consumer price index (CPI), the domestic wholesale price index, and the GDP deflator as indicators of the general price level (second upper panel), the growth rate of real GDP, and unemployment rate as indicators for demand-supply conditions (second lower panel), and M2+CDs and nominal GDP (lower panel). This figure shows the three major boom-bust cycles in asset prices: (1) the Iwato boom in the second half of the 1950s; (2) from the boom arising from Prime Minister Tanaka's "remodeling the Japanese archipelago" project to the first oil crisis; and (3) the Heisei boom in the late 1980s to early 1990s.

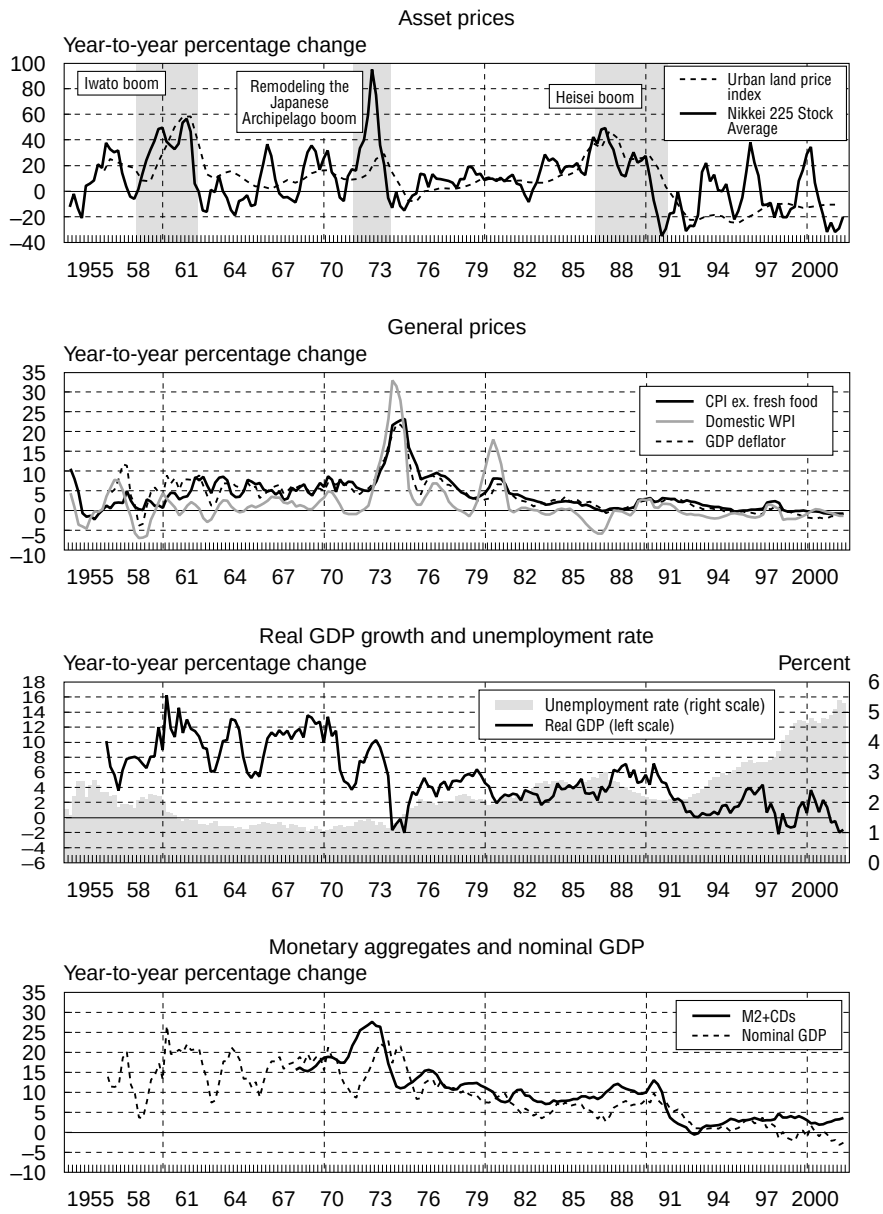
First, at the time of the Iwato boom, while investment demand due to technological innovation replaced post-World War II reconstruction demand as the main driver and ushered in the high-economic growth period, asset prices increased rapidly and, on the price front, consumer prices rose while wholesale prices remained generally stable, thus leading to "productivity difference inflation." However, the real economic growth rate exceeded 10 percent per annum, and the increase in asset prices mainly reflected an improvement in fundamentals due to technological innovation.

Second, during the period from the "remodeling the Japanese archipelago"[7] boom to the first oil crisis, asset prices first increased and then the general price level sharply increased due to the excessively high growth of money stock and oil price hikes stemming from the first oil crisis, while real economic growth rapidly declined, marking an end to the high economic growth period.

Third and finally, in the Heisei boom, asset prices increased dramatically under long-lasting economic growth and stable inflation, a period that is frequently referred to as the "bubble era." The phenomena particular to this period were stable CPI inflation parallel with the expansion of asset prices and the long adjustment period after the peaking of asset prices. Asset prices skyrocketed during the bubble era but then declined rapidly from their peaks at the period from end-1989 to 1990, and land prices continued declining while stock prices remained stagnant with unstable fluctuation. In the meantime, real GDP growth was generally flat with temporary fluctuations, and the growth of money stock in M2+CDs declined rapidly, from the latest peak of 11.7 percent in 1990 to 0.6 percent in 1992. Although the growth of money stock was stable thereafter, it was lower than that in the 1980s. However, nominal GDP growth was lower than that of M2+CDs, thus the velocity of money, defined as money stock divided by nominal GDP, continued to fall, as shown in Figure 2.

6. This subsection extends the analysis in section 1 of Shiratsuka (2001b).
7. Kakuei Tanaka, who became prime minister in 1972, effected extremely aggressive public investment based on his belief (remodeling the Japanese archipelago) that it was necessary to resolve overpopulation and depopulation problems by constructing a nationwide *Shinkansen* railroad network, which led to an overheated economy.

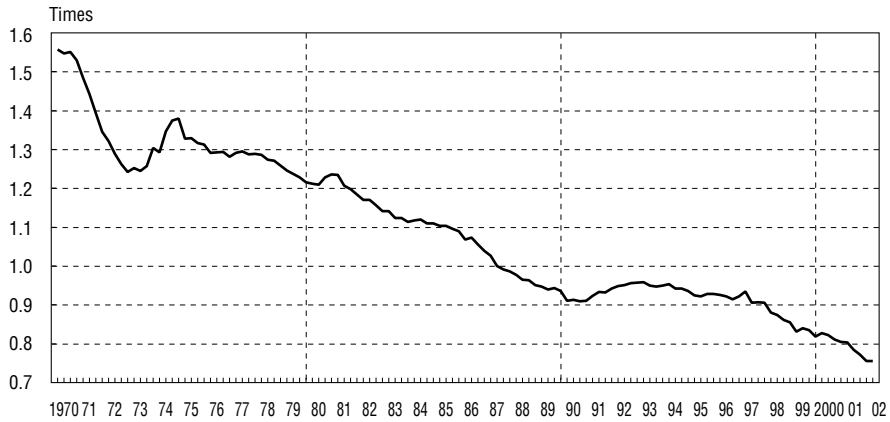
Figure 1 Asset Prices, General Prices, and Economic Environment



Notes: 1. Urban land price index denotes figures for commercial land in six major cities.
2. Regarding the CPI before 1970 and the domestic WPI before 1960, the prewar base series is connected with the current series.
3. Unemployment rate is seasonally adjusted.

Sources: Bank of Japan, *Financial and Economic Statistics Monthly*; Japan Real Estate Institute, *Urban Land Price Index*; Ministry of Public Management, Home Affairs, Posts and Telecommunications, *Consumer Price Index*, *Labor Force Survey*; Cabinet Office, *National Accounts*.

Figure 2 Velocity of Money



Sources: Bank of Japan, *Financial and Economic Statistics Monthly*; Cabinet Office, *National Accounts*.

B. Emergence and Bursting of Asset Price Bubble and Monetary Policy

From the viewpoint of the relationship between soaring asset prices and monetary policy, there is much literature that points out the failure of monetary policy during the early 1970s and late 1980s. During the process in which bullish expectations were formed, stemming from the "Japanese archipelago remodeling" boom in the case of the former period and the virtuous circle induced by the emergence of the bubble economy in the latter period, euphoric optimism about the economic outlook prevailed. On the monetary policy front, in the early 1970s, monetary easing—effected in response to concerns over a possible deflationary shock induced by the collapse of the fixed foreign exchange rate regime of ¥360 per U.S. dollar—accelerated inflation by way of providing excess liquidity. In both cases, it cannot be denied that monetary policy at the time did, in a sense, support euphoria. In the late 1980s, continuing monetary easing under international policy coordination for the sake of correcting the external imbalance led to expectations of protracted low interest rates.

However, in the process of subsequent tightening and easing, the 1990s faced a longer and more serious economic stagnation than in the 1970s. From this viewpoint, it seems that the bursting of asset price bubbles in the 1990s not only amplified swings in the business cycle but—more so than the 1970s, which experienced the oil shocks—also triggered a substantial and permanent reduction in Japan's potential economic growth rate.

In addition, the bursting of the bubble steadily eroded the basis for Japan's economic growth during the 1990s, and a characteristic of Japan's financial system founded mainly on bank-based finance further worsened the situation. Since such adverse effects do not materialize until a certain threshold is reached under bank-based financial systems, this prevented economic agents from recognizing that the shock stemming from the bursting of the bubble would have a prolonged impact, and made it difficult to pursue drastic resolution of financial system problems.

As such, by taking more than 10 years, the enormous fluctuation in asset prices gradually led to the deterioration of Japan's economy in various ways, forcing it to the brink of a deflationary spiral, and made the conduct of monetary policy extremely difficult for the central bank.

Of course, many structural problems inherent in Japan's economy, which had been pointed out since the 1970s and 1980s, had surfaced in the 1990s.[8] In addition, the emergence and bursting of the bubble delayed such structural problems from materializing, thus postponing action to cope with the problems and amplifying the difficulties.

However, even though the principal reasons for prolonged economic stagnation were the various structural problems faced by Japan's economy, and the emergence of a bubble could not be prevented by monetary policy alone, it is an undeniable fact that monetary policy failed to prevent large fluctuations in asset prices or ensure sustained stability of the financial and economic environment. As will be mentioned later, an important feature of Japan's experience seems to be that the large fluctuation in asset prices induced serious financial distress rather than the central bank overlooked the fact that asset price fluctuations precede price fluctuations. This does not necessarily suggest that there was a factor more important for a central bank than price stability, its first mandate. From the viewpoint of price stability, what happened in Japan was that since effects of asset price fluctuations on the financial system had been undervalued, such a stance resulted in a situation where prices were stable during the bubble period but were not stable when the bubble burst, which exposed the economy to severe deflationary pressure.[9]

III. Monetary Policy and Asset Prices during the Emergence and Bursting of the Bubble

Japan's stagnant economy in the 1990s is conspicuous, and against such a backdrop the BOJ's monetary policy during the period has often been criticized. However, some sort of objective benchmark becomes necessary to evaluate such criticisms. In this regard, what is most interesting is a verification of Japan's monetary policy based on the Taylor rule and its variant.

8. Recognized as structural problems in Japan are (1) erosion of financial institutions' balance sheets resulting from the generation and bursting of the bubble, (2) inefficient non-tradable goods industries, (3) a corporate management system that is incompatible with change, and (4) a savings-investment imbalance (excess savings due to demographic factors and other reasons). These problems (except [1]) did not emerge in the 1990s, though many had already been recognized and action called for since the 1980s and, as early as the 1970s with respect to improving productivity and the delayed exit of industries. Maeda, Higo, and Nishizaki (2001) provide the detailed analysis on the structural problems in Japan. See also Appendix 1 for discussion on the relationship between the resolution of structural problems and monetary policy.
9. With respect to price stability as an objective of monetary policy, Shiratsuka (2001a) elaborates on concepts of "measured price stability" and "sustainable price stability." Measured price stability expresses price stability in numerical terms to set a tolerable target range for the inflation rate, such that "price stability corresponds to a rate of inflation from zero to 2 percent." On the other hand, sustainable price stability emphasizes the importance of achieving a stable macroeconomic environment as a fundamental condition for sustainable growth, rather than merely pursuing measured price stability in terms of a particular price index. Taking account of effects on the financial system, asset prices will be included in such an environment depending on the structure of the financial system.

A. Evaluation of Monetary Policy Based on the Policy Rule

In order to achieve sustainable price stability, how should a central bank respond to an asset price rise?[10] The prevailing consensus among economists and central bankers is that monetary policy should not directly target asset prices, but should respond to the effects of asset price fluctuations on real economic activity and inflation.[11] In this regard, research by Bernanke and Gertler (1999, 2001) deserves attention. This is because Bernanke and Gertler (1999) argue that "central banks can and should treat price stability and financial stability as consistent and mutually reinforcing objectives" by adopting a strategy of "flexible inflation targeting."[12]

Let us examine such a strategy according to the Taylor rule, which has been widely used as a central bank's policy reaction function. We would like to emphasize that the following analysis aims at examining the role of asset prices in monetary policy management in line with Japan's experience by using the Taylor rule as a benchmark. Therefore, we do not discuss what policy rule would have been desirable by comparing the Taylor rule with other rules, such as the McCallum rule or nominal GDP targeting, with stochastic simulation analysis in a macroeconomic model in terms of the optimality and robustness of such rules.[13] We selected the Taylor rule as a benchmark because it is currently the most popular policy reaction function and there is abundant literature such as Bernanke and Gertler (1999, 2001) dealing with it in relation to the role of asset prices in policy formulation.

In the most basic formulation, the Taylor rule considers that the operational target level of the interest rate should be determined according to the divergence of the inflation rate and output gap from their equilibrium level (Taylor [1993]). Specifically, the rule can be expressed as

$$i_t = \bar{i} + \beta(\pi_t - \pi^*) + \gamma(y_t - y_t^*), \qquad (1)$$

where i_t denotes nominal interest rate (operational target interest rate of a central bank) at period t, $\bar{i}$ the nominal interest rate at long-run equilibrium, π_t the inflation rate at period t, π^* a target inflation rate, y_t the output gap at period t, and y_t^* the equilibrium level of the output gap.

The standard interpretation of the Taylor rule is that a central bank has two objectives on the level of economic activity, inflation and the output gap, whose relative importance is evaluated by the coefficients of each objective variable. However, if we regard the output gap as a proxy of future inflationary pressure,

10. This subsection draws on section 3 of Shiratsuka (2001b).
11. For example, Crockett (1998) states that "the prevailing consensus is that monetary policy should not target asset prices in any direct fashion but should rather focus on achieving price stability in goods markets and creating financial systems strong enough to survive asset price instability."
12. Bernanke and Gertler (1999) further argue that "[by] focusing on the inflationary or deflationary pressures generated by asset price movements, a central bank can effectively respond to the toxic side effects of asset booms and busts without getting into the business of deciding what is fundamental and what is not." We will discuss this point in the following.
13. Needless to say, any superior policy rule cannot be a panacea. In Taylor (1999), while he admits the effectiveness of an analysis based on a macroeconomic model, he regards financial economic theory as not perfectly reliable in guiding future monetary policy and emphasizes that historical analysis such as case studies of past episodes is also useful, and thus proposes complementary use of both analyses.

the Taylor rule can be interpreted as a rule that responds to current and future price developments.[14]

In this case, asset price fluctuations work as inflationary/deflationary pressures by affecting the output gap through (1) wealth effects on expenditure activities, and (2) the effect of changes in the external finance premium on investment activities. In view of the Taylor-type policy reaction function, asset price fluctuations can be incorporated into the monetary policy response in two ways. First, because effects of asset price fluctuations are included in changes in the current output gap, guiding short-term nominal interest rates in line with the Taylor rule will enable a central bank to deal with potential inflationary pressure in a preemptive manner. Second, a standard Taylor-type rule should be extended to incorporate asset price information directly.

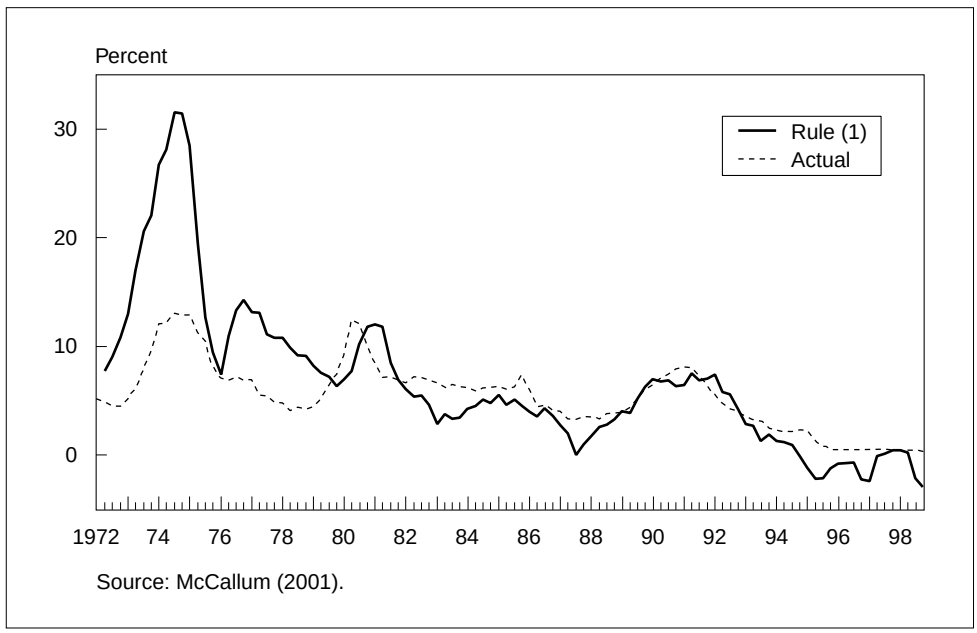
B. Reexamining Monetary Policy during the Period When the Bubble Emerged

Bearing in mind the above, let us reexamine typical criticisms of Japan's monetary policy during the period since the latter half of the 1980s.

1. Criticism of Japan's monetary policy

A typical criticism against Japan's monetary policy based on the policy rule discussion can be found in McCallum (2001), whose estimates of the targeted values of the policy interest rate based on the Taylor rule are shown in Figure 3. The main point of his criticism is that monetary policy had been consistently too tight since 1993.

Figure 3 Policy Rule (1): McCallum's Estimation

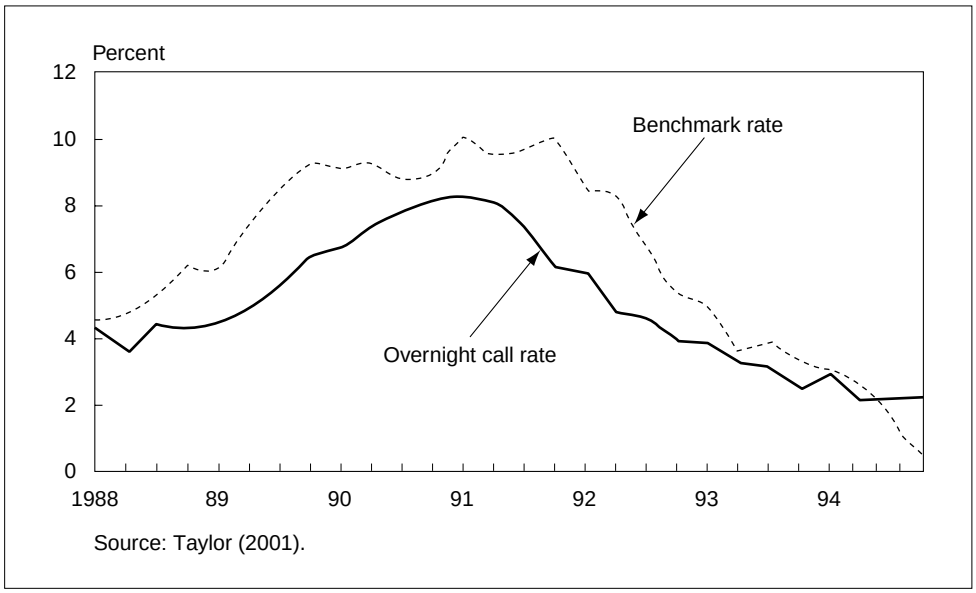


14. For example, Meyer (2000) states that the Taylor rule depends on two objectives of a central bank, inflation and the output gap, as well as incorporates a preemptive element in the sense that the output gap is a leading indicator of inflation. In addition, interpreting the inflation rate and the output gap as variables in the Taylor rule, Goodhart (1999) states that these two variables are core variables in forecasting future inflation.

However, when looking at the period of expansion of the bubble, the policy rule used by McCallum suggests interest rates would decline in 1987, and after the bursting of the bubble the policy reversal toward monetary easing would be lagging compared with actual policy. Such a lagged tendency is commonly observed in Taylor's own estimate of the Taylor rule as shown in Figure 4 (Taylor [2001]).

However, such results do not accord with the general criticism of the BOJ with respect to its policy management during the bubble period: the protracted period of excessive monetary easing, and delay in lifting monetary tightening after the bursting of the bubble. What does this signify? One standpoint is to say that the BOJ should have focused more on asset prices.[15] In fact, taking account of rises in asset prices such as stocks and land, it was difficult to reduce policy interest rates during the period from 1987 to 1988, and, since stock prices peaked in 1989 and subsequently declined rapidly in 1990—some 40 percent compared with the previous year—if stock prices were considered as a policy target or information variable, they would have strongly urged a reduction in interest rates. When one considers the policy rule from such a standpoint, it will be interpreted that the BOJ should have made policy changes by adding asset price fluctuations to policy rate changes suggested by the Taylor rule.[16]

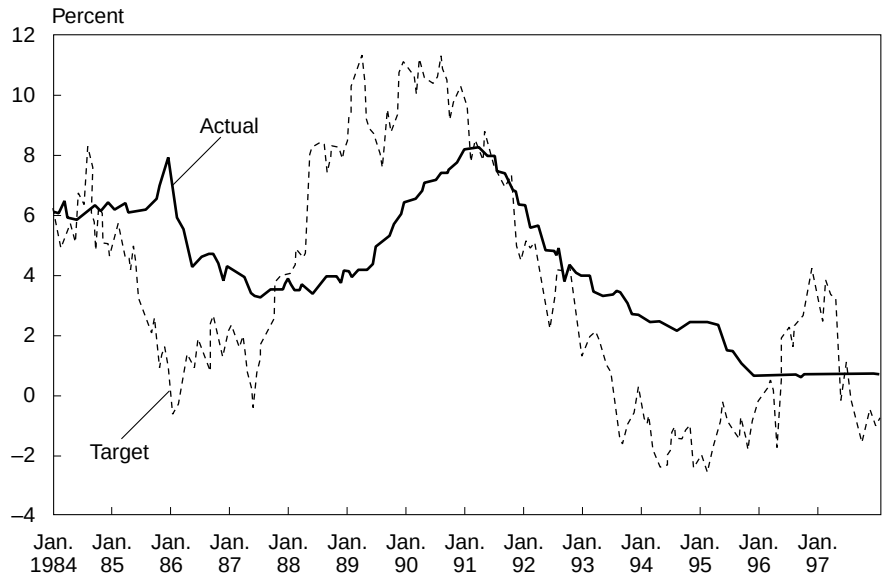
Figure 4 Policy Rule (2): Taylor's Estimation



15. Another standpoint is to insist that there are problems with the Taylor rule itself. McCallum (2001) also presents results obtained by the McCallum rule that utilize base money, but comparison between other policy rules and the Taylor rule goes beyond the main topic of this paper.
16. However, information content of asset prices is not necessarily high in terms of forecasting the rates of inflation and real GDP growth. Asset prices are more informative during the bubble expansion period than the bursting period, while usefulness is not necessarily high compared with other information variables. Therefore, according to our empirical analyses it seems unlikely to improve the Taylor rule by incorporating asset prices.

Against such a view, Bernanke and Gertler (1999, 2001) hold a negative view on assigning monetary policy to control asset price fluctuations. In support of their view, Bernanke and Gertler (1999) point out that a central bank aiming at stabilizing asset prices itself is problematic for various reasons, one of which is that it is difficult to distinguish whether asset price fluctuations are induced by fundamentals or other factors, or both. Upon such reasoning, they presented simulation results that the BOJ should have been able to achieve better performance if it had pursued a Taylor-type rule which discards asset price fluctuations (Figure 5).

Figure 5 Policy Rule (3): Bernanke and Gertler's Estimation



Source: Bernanke and Gertler (1999).

What is especially striking about these results is that despite Bernanke and Gertler focusing only on the inflation and the output gap, their policy rule implied the need for rapid tightening such as raising the interest rate from 4 to 8 percent in 1988. In response to this, BOJ Deputy Governor Yamaguchi argued at a conference sponsored by the Federal Reserve Bank of Kansas City, at which the simulation results of Bernanke and Gertler (1999) were reported, that "I don't see how a central bank can increase interest rates to 8 percent or 10 percent when we don't have inflation" (Yamaguchi [1999a]).

There are two important points in Yamaguchi's (1999a) remarks: one is how to identify inflationary pressure, and the other is—granted that there is inflationary pressure—to what extent should a central bank rapidly increase interest rates or smooth such a rise in interest rates. The latter point can be rephrased as, whether led by asset prices or the Taylor rule, what would be the likely interest rate hike range a central bank could rapidly implement without putting too much of a burden on the

financial system? This issue will be taken up later, when we discuss the relationship between the financial system and monetary policy management, but here we further explore the former issue.

2. Assessment of policy rule simulation

Why do the estimation results of Bernanke and Gertler shown in Figure 5, despite focusing only on the inflation and output gap, seem to imply early and rapid monetary tightening that contrasts with the estimation results derived from the standard Taylor rule as in Figures 3 and 4?

First, let us look at developments in Japan's CPI and output gap, both of which form the basis for calculating target values of policy interest rate based on a Taylor-type policy rule (Figure 6). As a whole, the CPI shows smooth swings, but it rose rapidly in 1989 and 1997, respectively reflecting the introduction of a 3 percent consumption tax and then an increase to 5 percent. With respect to the output gap, we used the difference between real GDP and its trend obtained by applying the Hodrick-Prescott filter (hereafter, HP filter).[17] We will later describe problems with respect to estimating the output gap.[18]

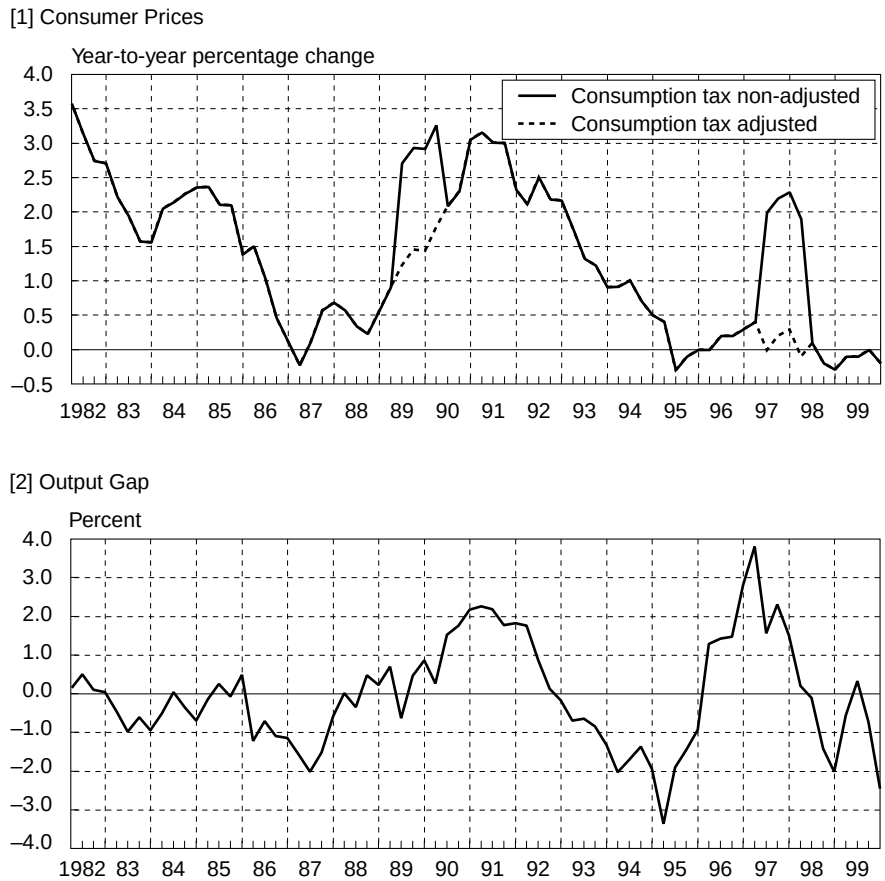
Next, when we compare the McCallum-Taylor formula and the Bernanke-Gertler formula, the largest difference is that the former uses a backward-looking Taylor rule based on realized inflation, while the latter uses a forward-looking Taylor rule which assumes perfect foresight with respect to inflation for one year ahead. In addition, the Bernanke-Gertler formula puts greater weight on inflation and less on the output gap. As a result, in a simulation using the Bernanke-Gertler formula, "future" fluctuations of inflation strongly affect the current target value of the policy interest rate.

By following the Taylor rule formulas that McCallum (2001) and Bernanke and Gertler (1999) assume in their estimations, we have used the above-mentioned CPI and output gap and tried to reproduce the target rate, as shown in Figure 7. The top panel of Figure 7 shows our estimated results of a backward-looking Taylor rule that corresponds to what McCallum estimated (Figure 3), and the bottom panel our estimated results of a forward-looking Taylor rule that corresponds to the estimate by Bernanke-Gertler (Figure 5).[19] You can see that our estimates have reproduced qualitatively similar results compared with those of McCallum and Bernanke-Gertler.

In our backward-looking Taylor rule, target levels of policy interest rate are as a whole higher than those of McCallum, which results in a substantially shorter zero interest rate period and implies rather tighter monetary policy overall, but can avoid the impractical consequence of embarking on zero interest rates as early as 1987.

17. For an explanation of the HP filter, see, for example, Higo and Nakada (1998).
18. There is no explanation in McCallum (2001) of how he measured potential GDP or the output gap. However, since he assumes the equilibrium real interest rate as constant (3 percent), it is highly likely that he used the difference between a log-linear trend and real GDP as the output gap. Bernanke and Gertler (1999) measure the output gap using monthly data, namely, the difference between the industrial production index (output) and its quadratic trend.
19. Backward- and forward-looking Taylor rules were derived following formulations of McCallum (2001) and Bernanke and Gertler (1999). They used weights for the inflation rate and output gap of 1.5 and 0.5, and 2.00 and 0.33, respectively. While McCallum (2001) and Bernanke and Gertler (1999) make their estimation assuming the equilibrium real interest rate as constant, we estimate the output gap by using an HP filter, and thus, taking into account effects of a declining potential growth rate since entering the 1990s, we regard the growth rate of the HP-filtered trend for the past year as the real interest rate to derive the Taylor rule.

Figure 6 Data for Estimating the Taylor Rule



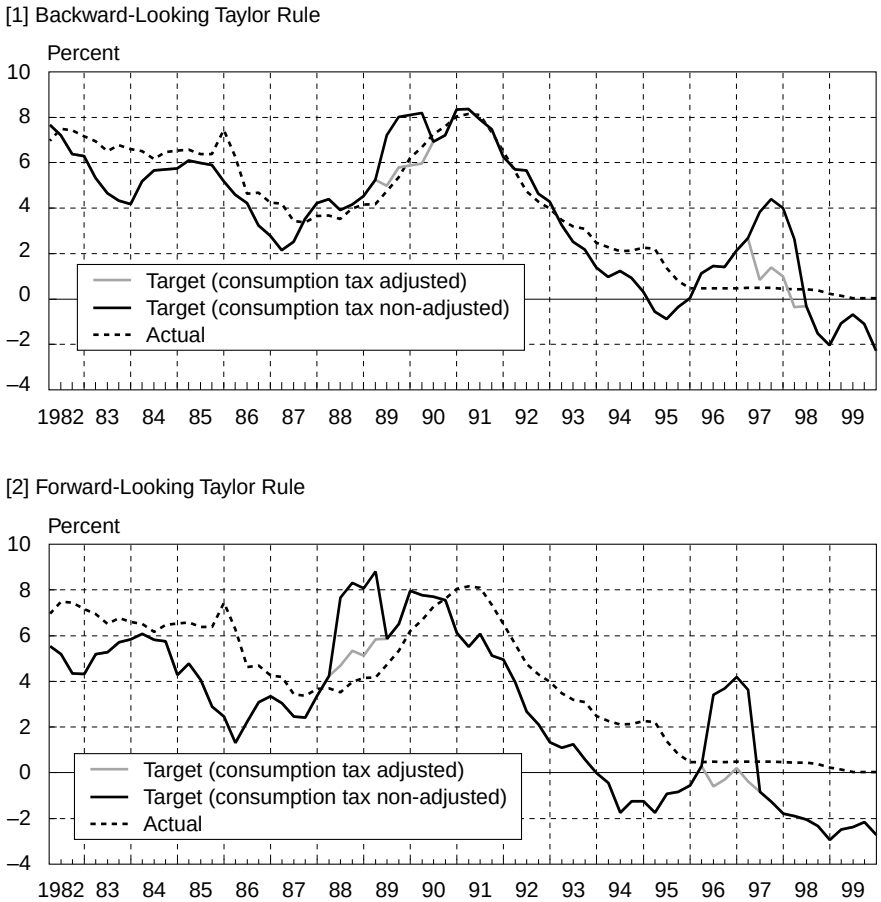
Notes: 1. Figures for the CPI are adjusted for the impact of consumption tax.
2. Output gaps are computed as a difference between actual and HP-filtered series for the real GDP. HP-filtered series computed for the sample period from 1955/II to 2000/IV with the smoothing parameter λ = 1,600.

Sources: Ministry of Public Management, Home Affairs, Posts and Telecommunications, *Consumer Price Index*; Cabinet Office, *National Accounts.*

On the other hand, our forward-looking Taylor rule, despite quarterly and monthly differences, follows well the estimation results of Bernanke-Gertler as a whole.

One point that can be derived from these results is the delay in the pace of reducing interest rates since 1993 and, according to the policy rule, the pace of monetary easing indeed slowed when the BOJ was about to face a then record-low official discount rate of 2.5 percent that was reached during the period of expansion of the bubble. At this stage, we leave it until the next section to examine in more detail the period of monetary easing, and focus on the period of expansion of the bubble. During this period, there were two humps in the estimate of McCallum, from 1989 to 1990, and in that of Bernanke-Gertler, from 1988 to 1989. When we look at

Figure 7 Examination of the Taylor Rule



Note: Taylor rule is defined as follows:

Basic equation: $R_t = r_t^* + \pi^* + \alpha \cdot (\pi_{t+T} - \pi^*) + \beta \cdot (Y_t - Y^*)$

r_t^*: Equilibrium real short-term interest rate at period t

π^*: Targeted rate of inflation

R_t: Uncollateralized overnight call rate at period t

π_t: Rate of CPI inflation at period t

$Y_t - Y^*$: Output gap at period t

The rates of inflation in the second term of the right-hand side are those for the current period ($T = 0$) and one-year ahead ($T = 4$), respectively.

Sources: Bank of Japan, *Financial and Economic Statistics Monthly*; Ministry of Public Management, Home Affairs, Posts and Telecommunications, *Consumer Price Index*; Cabinet Office, *National Accounts.*

the basic data, the first hump seems to have resulted from the introduction of the consumption tax (3 percent) in April 1989. If we adjust for this factor and conduct a similar estimation, the first hump disappears for both backward- and forward-looking Taylor rules.

If we consider that one-time price increases induced by an introduction of the consumption tax should not be offset by monetary tightening, then realized development of the call rate from the late 1980s to the early 1990s more or less followed what had been derived as the target rate from the backward-looking Taylor rule. This result implies that while one cannot say the BOJ delayed tightening when viewed from developments in the inflation rate at the time, one can say it did if perfect foresight of core inflation rates for one year ahead is practically feasible. Even in the latter case, it might be difficult, as Deputy Governor Yamaguchi said, to insist on the pursuit of rapid monetary tightening such as raising the interest rate from 4 to 8 percent in 1988, as Bernanke and Gertler pointed out.

Then, to what extent is core inflation, which excludes special effects such as a hike in the consumption tax, predictable? A major factor that affects predictability is no doubt the accuracy of measuring the output gap.

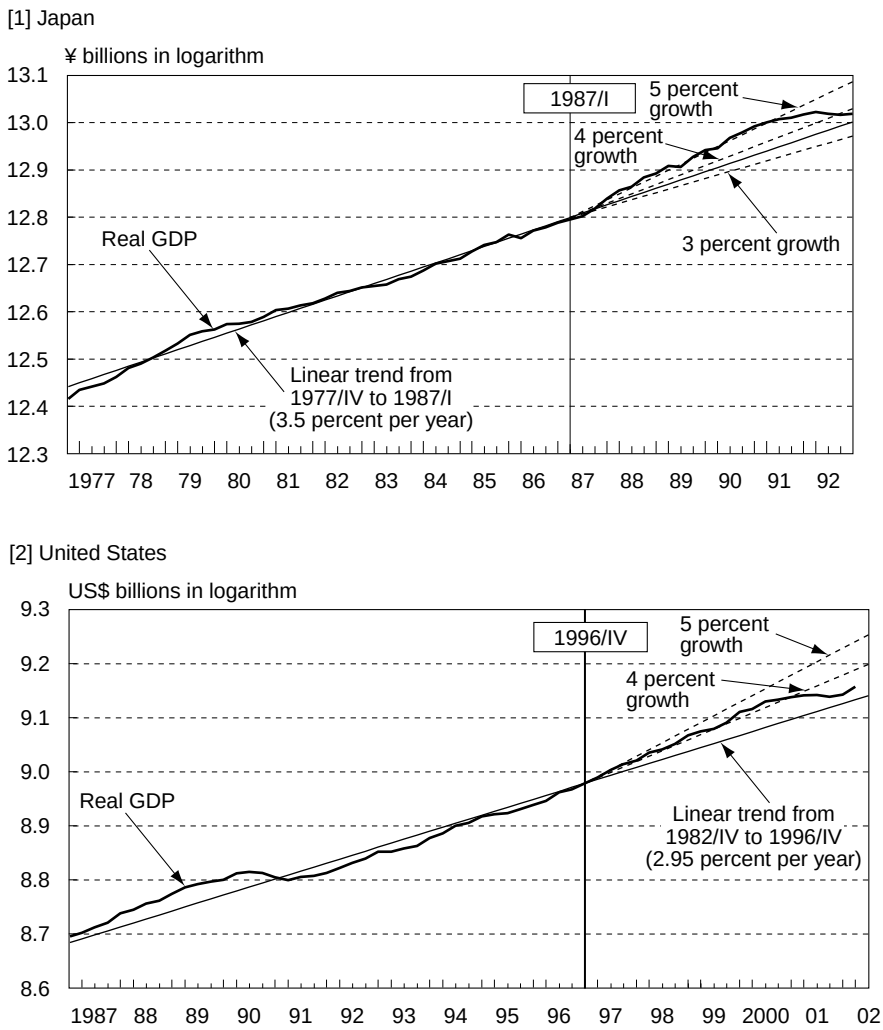
C. Measuring the Output Gap and Asset Price Bubbles

The discussion above reveals that in accurately assessing monetary policy management, it is crucial to gauge inflationary pressure by carefully examining its basic data of prices and real GDP. In so doing, a serious problem with respect to the output gap is that, since the level of the output gap will vary depending on the estimates of potential GDP, the derived optimal value of the interest rate might differ, even from the same observed inflation rate, GDP level, and same target rate. In other words, prevailing expectations during the period of emergence of the bubble that Japan was entering a new era of economic development corresponded to optimistic expectations for potential growth. Thus, the path of optimal interest rates will differ depending on whether one adopts the optimistic expectations at the time or accepts the potential growth rate adjusted with the benefit of hindsight that such expectations were nothing more than euphoria.

What typically shows this point is, as illustrated in the upper panel of Figure 8, the evaluation of the real GDP growth path on a real-time basis. The period 1987/I is the bottom of the yen appreciation recession prior to the bubble period. At this point, when we plot a linear trend line from 1977/IV to 1987/I, it almost corresponds to the growth trend, which is almost 3.5 percent annually. However, from 1987/I to mid-1991, real GDP expanded following the trend line of 5 percent growth. If an increase in asset prices reflects euphoria, the perceived potential output path will shift upward as economic expansion is prolonged, resulting in the underestimation of inflationary pressure in view of the output gap. On the contrary, in the case of a rational bubble in which market participants correctly recognize fundamental values of asset prices as well as the sustainability of currently overvalued asset prices, an output gap is assessed based on a recognition that the potential output path remains unchanged, which leads to the same judgment as one reaches with the benefit of hindsight that the asset price increase was based completely on euphoric expectations.

A similar argument seems to be applicable to the recent U.S. experience (the lower panel of Figure 8). Meyer (2000) states that a major challenge for U.S. monetary policy as of March 2000 was to determine how "to allow the economy to realize the full benefits of the new possibilities while avoiding an overheated

Figure 8 Impact of Trend Shift in Real GDP



Sources: Japan: Cabinet Office, *National Accounts.*
United States: Bureau of Economic Analysis, U.S. Department of Commerce, *National Income and Products Accounts*.

economy." He also emphasizes the importance of assessing the level of potential GDP in evaluating inflationary pressure, against the background of enormous changes in economic structure (namely the "new economy"), behind rising U.S. stock prices. This argument is quite convincing, but in applying Meyer's argument to Japan's bubble period, we had to judge what portion of increase in the growth rate should have been tolerated as an upward trend shift of real GDP in order to enjoy the benefits of the productivity improvement. With the benefit of hindsight, most of the trend shift was temporary, and should not have been accommodated.

It should be noted that continued economic expansion gradually makes it difficult to decompose a rising growth rate into cyclical and trend components. The difficulty in such decomposition according to Japan's data has been clearly shown in recent literature on measurement errors in the output gap using real-time data. For example, Kamada and Masuda (2001) examine the magnitude of measurement errors in the output gap in terms of estimation procedures and historical revision of data. The production-function approach to estimate the output gap generally assumes a 100 percent capacity utilization rate in the non-manufacturing sector and defines the fitted trend to the Solow residual as total factor productivity (TFP). They show that this approach, however, is vulnerable to the effects of data accumulation, altering trend estimates. Miyao (2001) also points out, based on the same methodology to compute the output gap, that the output gap estimates crucially depend on how to specify the trend to fit the Solow residual, i.e., how to extract changes in the TFP from the behavior of the Solow residual.

Regarding the measurement of the output gap and fundamentals of stock prices, Bernanke and Gertler (2001) state that "[a]dmittedly, the output gap is difficult to measure, but we are more confident in economists' ability to measure the output gap than to measure the fundamental component of stock prices," and "[i]n addition, the behavior of inflation provides a real-time indicator of the magnitude of the output gap, whereas there is no analogous indicator to provide confirmation of estimates of stock fundamentals." However, Japan's experience shows that central banks are unlikely to evaluate potential inflationary pressure stemming from asset price fluctuations "without getting into the business of deciding what is a fundamental and what is not" (Bernanke and Gertler [1999]), and their argument thus seems to be too optimistic. Unfortunately, Japan's experience suggests the following: first, even though we carefully watched inflation data, the inflation rate itself did not necessarily provide a predominant real-time indicator of the magnitude of the output gap. Second, therefore, one could not have estimated at the time a correct potential growth path unless one could have identified whether then-prevailing expectations that the world was entering a new era of economic development that induced asset price rises corresponded to euphoria or not.[20]

At the same time, the above argument denies the effectiveness of asset prices during the period of emergence of the bubble as a leading indicator of inflation or as a policy objective variable. Rather, Japan's experience implies that when the nation is in a state of euphoria or experiencing a new economy, evaluation of inflationary pressure and also the fundamental values of asset prices are to a considerable extent two sides of the same coin. In such a case, in order to judge the validity of monetary tightening during periods of asset price rises, other criteria such as minimization of maximum loss under uncertainty will become necessary, which also requires a judgment that takes account of effects on the financial system when an asset price rise was induced by a bubble or euphoria.

20. Okina, Shirakawa, and Shiratsuka (2001) point out that the stock price yield spread widened to about 6 percent in 1990, which implies that the market expected the economy to grow at about 8 percent on a nominal basis if the risk premium is assumed at 2 percent. This estimate typically shows that it is inevitable that excessively optimistic growth expectations and asset price bubbles can never be assessed separably.

However, it is possible to think that, even though a central bank cannot judge whether it is a bubble or the debut of a new economy during the period of emergence of a bubble, thus giving up tightening, it can aggressively pursue monetary easing in the process of the bursting of the bubble. If this line of thinking is correct, it might be possible to say that the information content of asset prices, i.e., effectiveness as an information variable, differs during the emergence of a bubble and its bursting, and asset prices have higher information content when a bubble collapses. This point should be empirically tested, and we will briefly examine it based on Japanese data in the next section.

D. Preemptive Monetary Policy Mindful of Financial System Stability

Another remaining point of discussion with respect to the period of emergence of bubble is that, given that the bursting of a bubble induces financial system instability, how much of a rise in interest rates would have been desirable and possible in the process of emergence of the bubble to ensure financial system stability?

1. Is an interest rate rise supported?

One popular view is that, to contain excessive asset price hikes and minimize maximum losses, it would be necessary to increase interest rates at an early stage even when it is difficult to judge whether there is a bubble or the arrival of a new economy. In this case, however, most of the possible fruit of the new economy, which Meyer (2000) expects, would be lost, but financial system instability that throws an economy into catastrophe might be contained. This standpoint advocates that the most effective responses would be to contain the accumulation of excessive risks *ex ante* and ensure continuing stability of the financial system. Such early monetary tightening might not receive the understanding of the public. In the Iwato boom of the 1950s, the necessity of early monetary tightening was discussed in the context of stable growth versus high growth, but stable growth gained less support at the time.[21] There was deep-rooted suspicion about the necessity of monetary tightening during the bubble period. Therefore, it seems to be no easy task to achieve a consensus that a substantial and real-time interest rate increase is desirable at a stage when it is difficult to judge whether there is a bubble or the arrival of a new economy.

2. How does a large increase in interest rates affect the financial system?

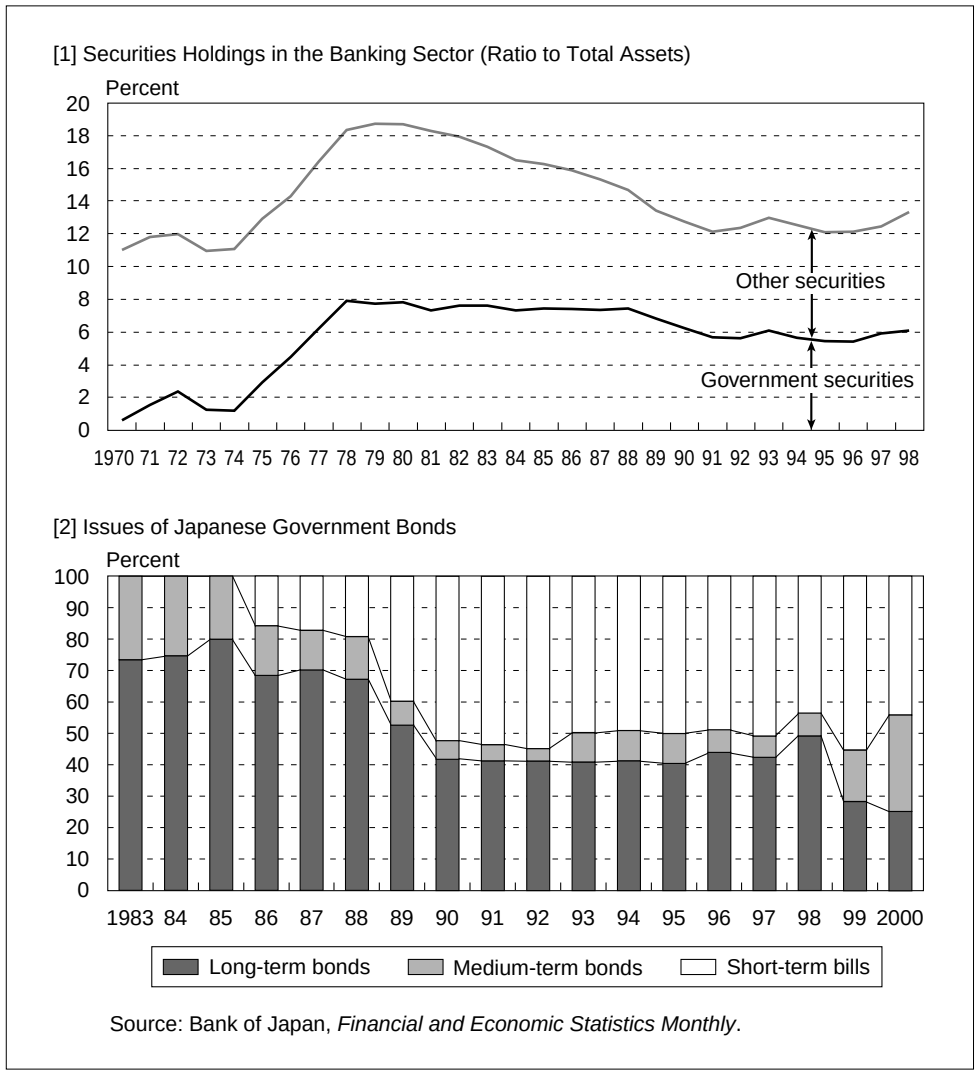
Expectations became extremely bullish during the period of emergence and expansion of the bubble, and thus a substantial increase in interest rates would have been necessary to correct such expectations.[22]

Therefore, in examining whether a prompt interest rate increase can prevent asset price bubbles from ballooning, it becomes important to examine effects of rapid monetary tightening on the financial system. In fact, although they did not take account of the effects of a rapid interest rate hike on the financial system in their simulation model, Bernanke and Gertler (1999) also emphasize that it is important to ensure financial system stability in considering the relationship between asset prices and monetary policy.

21. See the Committee for Compiling One-Hundred-Year History of the Bank of Japan (1986).
22. See Okina, Shirakawa, and Shiratsuka (2001).

Then, how we should consider the potential adverse effects on financial institutions and the financial system of a substantial rise in interest rates? When we look at the size of bond portfolios held by the banking sector at the time from flow of funds statistics (Figure 9, upper panel), in the late 1980s the share of government bonds to total assets had been a little less than 8 percent, slightly higher than the present 6 percent. If we include bonds other than government bonds such as corporate bonds, the figure was 14–16 percent compared with the present 12–13 percent. While the average duration of such bond portfolios is unknown, bearing in mind that the issuance of government bonds in the late 1980s had predominantly been long-term ones as shown in the bottom panel of Figure 9, it is highly likely that the duration was longer than the recent average of about five to six years.

Figure 9 Securities Investment Portfolio for the Banking Sector



Source: Bank of Japan, *Financial and Economic Statistics Monthly*.

Based on the above consideration, if we boldly assume the total assets of the banking sector in the late 1980s to be ¥600 trillion, of which ¥100 trillion represented bond holdings (a ratio to total assets of 16.6 percent), and estimate interest rate risk by changing the duration from three to seven years and the interest rate from 50 to 400 basis points, the results would be as shown in Table 1. Under a duration of five years and an upward shift in the yield curve of 200 basis points, an assumption that is relatively moderate, the estimated result indicates a capital loss of ¥10 trillion in the portfolio, which is about half of the then ¥20 trillion net capital of the banking sector.

The estimation here is quite rough and thus there are reservations, but at the same time, bearing in mind that Japan's financial institutions also hold a massive amount of stocks whose price volatility risk is larger than that attaching to bonds,[23] it is difficult to deny that effects of rapid monetary tightening on the financial system might have been extremely large. Therefore, from the viewpoint of avoiding financial system instability, it seems that the BOJ had no choice but to adopt gradual tightening by taking account of interest rate smoothing.[24]

Table 1 Interest Rate Risks for Securities Portfolio

¥ trillions

Changes in interest rates (basis points)	Average duration (years)								
	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
50	–1.5	–1.8	–2.0	–2.3	–2.5	–2.8	–3.0	–3.3	–3.5
100	–3.0	–3.5	–4.0	–4.5	–5.0	–5.5	–6.0	–6.5	–7.0
150	–4.5	–5.3	–6.0	–6.8	–7.5	–8.3	–9.0	–9.8	–10.5
200	–6.0	–7.0	–8.0	–9.0	–10.0	–11.0	–12.0	–13.0	–14.0
250	–7.5	–8.8	–10.0	–11.3	–12.5	–13.8	–15.0	–16.3	–17.5
300	–9.0	–10.5	–12.0	–13.5	–15.0	–16.5	–18.0	–19.5	–21.0
350	–10.5	–12.3	–14.0	–15.8	–17.5	–19.3	–21.0	–22.8	–24.5
400	–12.0	–14.0	–16.0	–18.0	–20.0	–22.0	–24.0	–26.0	–28.0

23. While a 4 percent interest rate rise has a direct shock on bank balance sheets, such shock can be amplified by turbulence on the real side of the economy due to a possible stock price plunge and rapid appreciation of the yen. However, equity portfolios of financial institutions at the time held enormous unrealized gains since they were evaluated by the lower-of-cost-or-market method, and were considered to be a sufficient buffer against a stock price plunge. Therefore, if compared with the present situation where prolonged sluggish stock prices and the write-off of nonperforming loans has drained such unrealized gains and financial institutions have to adopt market price valuation, the effects of stock price fluctuation risk on bank management and the financial system might have been small at the time. In fact, according to flow of funds statistics, stocks held by the banking sector at the time were about 3–4 percent of total assets, which is almost equivalent to banks' net capital. However, it should be noted that flow of funds statistics evaluated stocks held by the banking sector by book value before 1994.

24. As a reason for interest rate smoothing, Goodfriend (1991) points out the possibility that financial institutions' portfolios would incur huge capital losses when the interest rate has been unexpectedly and substantially raised. Of course, it might be the case that such a central bank's behavior to formulate its action by considering the capital loss of private financial institutions could induce moral hazard vis-à-vis their portfolio investment behavior. However, it is established as a practice of central banks worldwide, including that in Japan, to avoid unexpected large changes in interest rates. Thus, it is undeniable that ignoring such practices might trigger financial system turbulence.

IV. Asset Prices, Financial System Problems, and Monetary Policy during the Bursting of the Bubble

In this section, we summarize Japan's experience during the period when the bubble burst, especially focusing on destabilizing effects on the financial system, and discuss their implications on monetary policy.

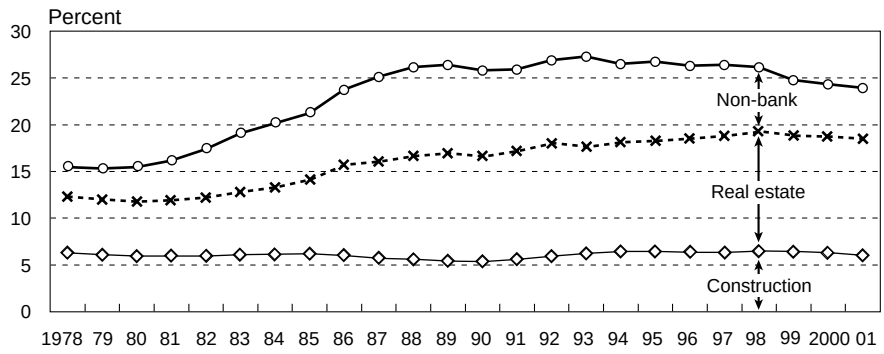
A. The Bubble and Japan's Financial System

Looking back at Japan's experience of the period when the bubble burst, it can be characterized by the fact that financial system instability was intensified, thereby seemingly amplifying the adverse impacts of the bursting of the bubble.

Bearing this in mind, let us look back at the emergence and bursting of the bubble from the aspect of the financial system. Against the background of financial liberalization, fund-raising by major firms had been rapidly liberalized since around 1980 as evidenced by a shift from bank-based to capital market-based financing, but banks were only allowed to enter the securities business gradually, and thus they were very concerned that major firms would become less dependent on them for funding. In the meantime, since interest rates on deposits had gradually been liberalized, banks forwent the rent stemming from accepting deposits with regulated interest rates and were inclined to aggressively extend loans to small and medium-sized enterprises against real estate collateral as well as real estate-related loans at low interest rates (Figure 10).

In retrospect, such aggressive lending at low interest rates seems to have been pursued by financial institutions taking excessive risks compared with their profit outlook (Figure 11). In particular, since financial institutions lacked recognition of risk concentration and interactions, they tended to concentrate lending on specific industries such as construction companies, the real estate sector, and non-banks. However, loan concentration on such specific industries could be seen as a natural

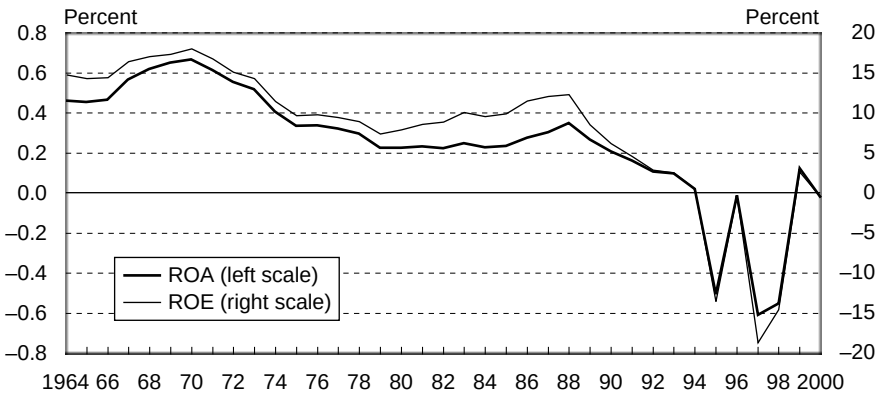
Figure 10 Bank Lending to Real Estate-Related Industries



Note: Real estate-related industries correspond to real estate, construction, and non-banks.

Source: Bank of Japan, *Financial and Economic Statistics Monthly.*

Figure 11 Profitability of the Banking Sector



Notes: 1. Figures are for domestically licensed banks (summation of city banks, regional banks, regional banks II, trust banks, and long-term credit banks).
2. The definitions of ROA and ROE are as follows:
ROA = (Profit for the term)/(total assets – acceptances and guarantees).
ROE = (Profit for the term)/(total stockholders' equity).

Source: Japanese Bankers Association, *Financial Statements of All Banks.*

shift to promising industries and not as a risk if a rise in real estate prices had not been misunderstood as resulting from a change in economic fundamentals. It was only when the bursting of the bubble materialized that such concentration was eventually recognized as a risk.

One factor that derailed risk judgment at the time was a surge in collateral value due to rising real estate prices. Originally, there is information asymmetry between firms and financial institutions, namely, financial institutions are not able to accurately grasp the reality of a firm's financial conditions, and hence changes in the net worth of firms due to the emergence and bursting of asset price bubbles led to ups and downs in collateral value, which in turn resulted in amplifying credit expansion and contraction. Such a mechanism, which might be characterized as a financial accelerator, induced the financial system as a whole to amplify the swings in the business conditions, an effect that was especially serious when the bubble burst.

However, the materialization of effects was not even between the real side of the economy and the financial system. There was a temporary economic recovery until around 1997, despite the economy's shouldering of the adverse effects in the financial system due to asset price declines. Economic recovery from late 1995 was relatively robust, and the growth of business investment in particular turned positive in fiscal 1995 after an interval of three years, led mainly by investment in electronic and telecommunications-related areas. Stock prices also rallied rapidly from mid-July and recovered the 20,000 level in the Nikkei 225 Stock Average at year-end. In fiscal 1996, in addition to public investment by the government, favorable private-sector performance strongly propelled the economy, resulting in a high growth rate of 5 percent.

Reflecting such developments in the real economy, the target interest rate according to the backward-looking Taylor rule (Figure 7), which had once reached the zero bound by early 1995, rose at a fairly rapid pace up to 1997. On the other hand, the BOJ's actual policy rate had rapidly declined since 1995 and crossed the target rate based on the Taylor rule. The background to such divergence seems to be the concerns over the serious balance-sheet adjustment in nonfinancial and financial sectors, constraining the economic recovery. In fact, even though the economy had been recovering at a rather rapid pace, the nonperforming loans of financial institutions had been increasing (Figure 12), thus indicating that balance-sheet adjustment had not necessarily progressed during the period of this recovery.

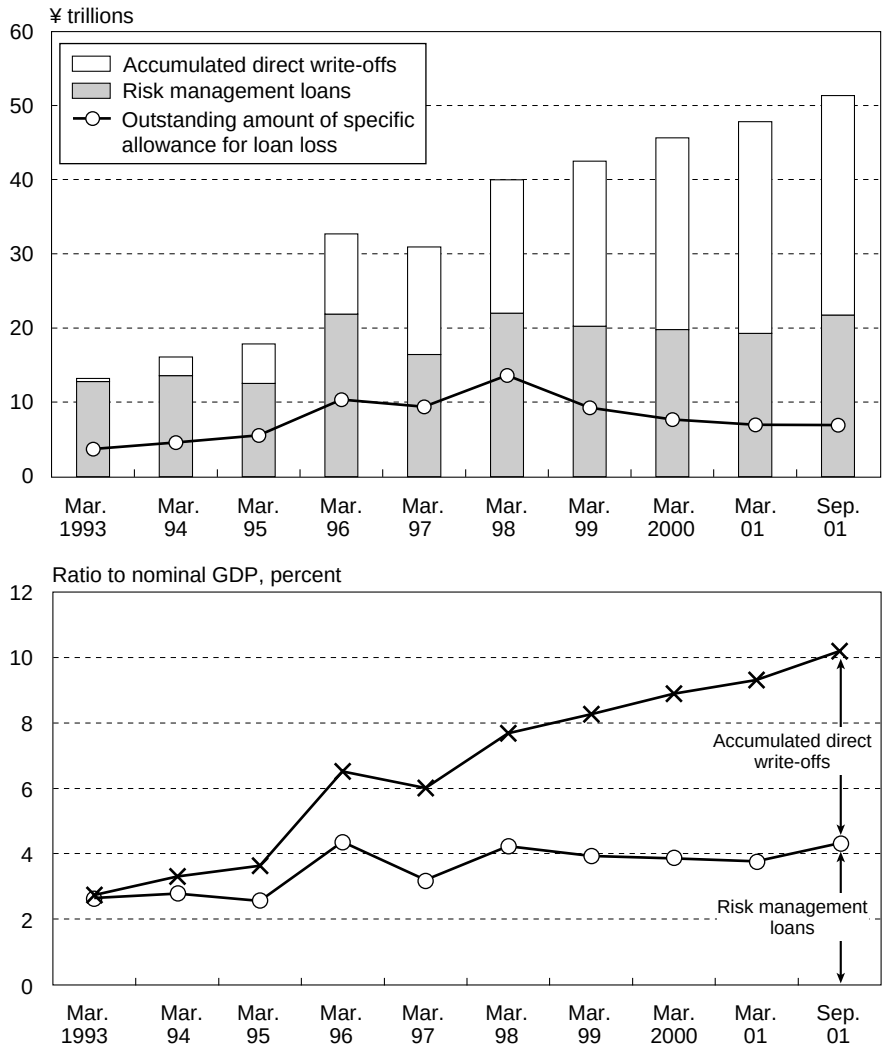
Why were there conflicting moves between real economic activity and the financial system? One possible answer is that Japan's financial system had historically heavily relied on bank-based financing (Table 2). Under a bank-based financial system, banks accumulate internal reserves when the economy is sound and absorb losses stemming from firms' poor business performance or bankruptcy during a recession, and hence financial intermediation plays a buffer role against short-term shocks.[25] However, such a risk-smoothing function attaching to the financial system, observed in normal times, will be suddenly lost if the system encounters a shock that erodes banks' net capital to the extent it threatens their soundness. Therefore, the effects of the bursting of the bubble on the financial system seem to be an invisible headwind up to a certain "critical point," after which they suddenly materialize.

In fact, in autumn 1997 when the economy experienced a slowdown parallel with the government's moves toward fiscal consolidation that included a consumption tax hike and coincided with East Asian economic crises, financial instability materialized triggered by the collapse of major financial institutions such as Sanyo Securities, Hokkaido-Takushoku Bank, and Yamaichi Securities. Such financial system instability, together with other factors, seems to have exerted extremely strong deflationary pressure on the economy. As a consequence, Japan experienced a serious recession where real GDP (68SNA basis) declined for five consecutive quarters from the fourth quarter of 1997.[26]

As such, the characteristic of a bank-based financial system, wherein financial effects stemming from the bursting of the bubble materialized rapidly beyond a certain critical point, together with a lack of disclosure and underdeveloped safety net measures, made it all the more difficult to deal promptly with the nonperforming-loan problem. To resolve financial system problems, it was desirable to inject public funds and promptly deal with the nonperforming-loan problem, including the disposal of failed financial institutions. However, until the effects of financial instability materialized, the financial supervisory authorities had been concerned over the possibility of a financial crisis, triggered by the disclosure of the actual financial conditions of the banking sector. Given such a lack of disclosure, the public was apathetic about the injection of public funds, and consequently the resolution of

25. Baba and Hisada (2002) discuss the characteristics of Japan's financial system in detail.
26. However, using the current 93SNA basis, during the five quarters between 1997/IV to 1998/IV there were only two, 1998/I and III, when real GDP recorded negative growth.

Figure 12 Nonperforming Loans



Notes: 1. Figures are summations of city banks, long-term credit banks, and trust banks (figures for all banks and all deposit-taking institutions are impossible to retroact before fiscal 1995).
2. Risk management loans are summations of loans to borrowers in legal bankruptcy, past-due loans in arrears by six months or more, and loans in arrears by three months or more and less than six months.

Sources: Financial Services Agency (http://www.fsa.go.jp); Cabinet Office, *National Accounts.*

the financial system problem was postponed. It was from 1997 to 1998, when the financial system was driven to the brink of malfunctioning, that public recognition changed, but by then the magnitude of the problem had become so extensive that drastic steps were increasingly difficult to take.

Table 2 Financial Structure of Three Major Countries

[1] Financial Liabilities Held by Nonfinancial Corporations (Ratio to Total Financial Liabilities)

Percent

	Japan	United States	Germany
Borrowing	38.8	12.1	33.3
Bonds	9.3	8.2	1.3
Shares and equities	33.8	66.6	54.3
Others	18.1	13.0	11.0

[2] Financial Assets Held by Households (Ratio to Total Financial Assets)

Percent

	Japan	United States	Germany
Currency and deposits	54.0	9.6	35.2
Bonds	5.3	9.5	10.1
Investment trusts	2.3	10.9	10.5
Shares and equities	8.1	37.3	16.8
Insurance and pension	26.4	30.5	26.4
Others	3.9	2.2	1.1

Notes: 1. Figures are those for the end of 1999.
2. Regarding financial debt for enterprises, stocks are evaluated at the market value, and thus do not necessarily correspond to the accumulated funding by enterprises. In addition, U.S. figures include solely those for proprietorships, and regard their net worth as proprietors' equities in the household sector. Thus, it should be noted that the ratio of equities to total assets is likely to be higher, compared to those for other countries. For details, see Bank of Japan, Research and Statistics Department (2001).

Source: Bank of Japan, Research and Statistics Department (2001).

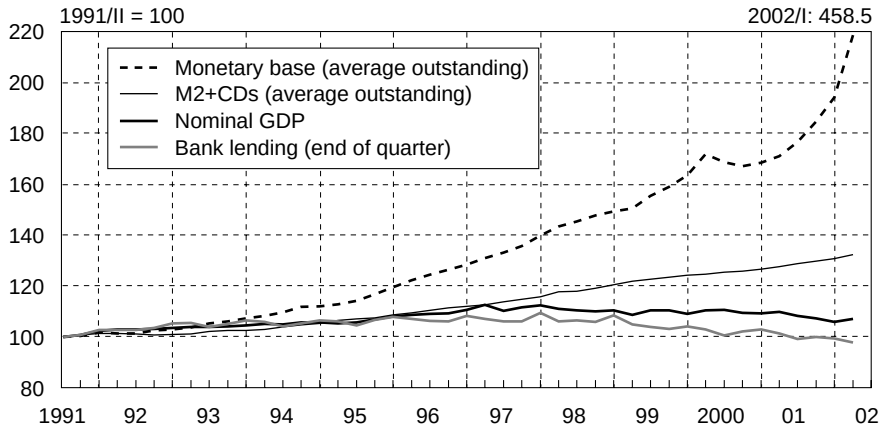
B. Financial System Instability Due to the Bursting of Asset Price Bubbles and Monetary Policy

Next, let us examine to what extent monetary easing effects were offset during the period when the bubble burst because of financial system problems.

It is difficult, however, to give a direct answer to this question. Nevertheless, looking at the quantitative growth of financial indicators from the viewpoint of financial system problems and monetary easing effects, the current monetary easing phase is different and unusual compared with past easing phases, because while assets of the BOJ and monetary base (which are the liabilities of the BOJ) have been showing marked growth, money supply (M2+CDs) has been growing at a low rate and bank loans have been declining (Figure 13). On the fund allocation front, while loans to manufacturing industries, which are believed to carry relatively high profitability, declined throughout the 1990s, loans to the real estate industry followed an increasing trend until 1998 (Figure 14).

The high growth of the monetary base and the contrasting, continuous decline in private lending and rigidity in lending to low-profit industries strongly imply that problems which hamper the effectiveness of monetary policy lie in the malfunctioning of the financial system stemming from balance-sheet problems of firms and financial institutions. The evidence described above suggests the possibility of two mechanisms: (1) an increase in nonperforming loans erodes the net capital of

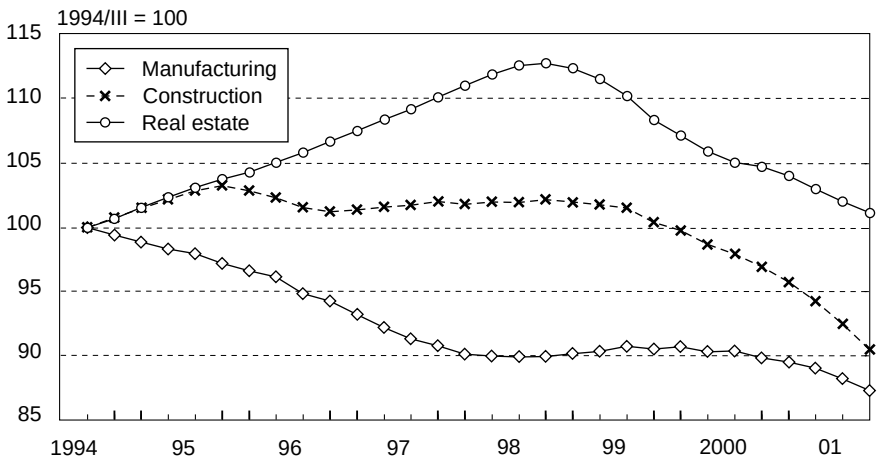
Figure 13 Monetary Aggregates



Note: Figures for monetary base, M2+CDs, and nominal GDP are seasonally adjusted. Figures for bank lending are seasonally non-adjusted.

Sources: Bank of Japan, *Financial and Economic Statistics Monthly*; Cabinet Office, *National Accounts.*

Figure 14 Loans Outstanding by Industry



Source: Bank of Japan, *Financial and Economic Statistics Monthly.*

financial institutions, resulting in a decline in risk-taking ability (a credit crunch); and (2) even though firms become unprofitable, financial institutions continue lending to them to prevent losses from materializing (forbearance lending). Under such circumstances, loans to unprofitable firms become fixed and funds are not channeled to growing firms, holding down economic activity.

As such, when the financial system carries problems stemming from the bursting of a bubble, the effectiveness of the central bank's monetary easing will be substantially counteracted. To restore effectiveness, it seems desirable to restore financial system soundness.

Once a financial system tumbles into a critical situation, the boundary between monetary and prudential policies becomes extremely ambiguous. Japan's experience contains interesting lessons on this point, but since such discussion departs from the main topic of this paper, issues related to asset price bubbles, we will introduce them in Appendix 2.

C. Early Response to Financial Crises

We have stated that, when taking account of effects on the financial system, the BOJ had no choice but to pursue a gradual monetary policy during the period of emergence of the bubble. Then, could the BOJ have effected substantial monetary easing at an earlier stage when the bubble burst?

Mori, Shiratsuka, and Taguchi (2001) examine the above question based on four criteria, i.e., monetary aggregates, equity yield spread, the Taylor rule, and real short-term interest rates, and point out that "the reaction of monetary policy was rather swift to the extent it was taken against the background of a normal business contraction with stock adjustments." In fact, McCallum's assessment based on the policy rule shows that the tempo and magnitude of the reduction in interest rates up to around 1993 was just about appropriate, compared with inflation and the output gap at the time.

In contrast, the pace of the BOJ's reduction of interest rates from late 1993 to autumn 1995 was, according to the Taylor-type policy rule, slowed when the BOJ was about to face a record-low official discount rate of 2.5 percent during the period of expansion of the bubble, suggesting the possibility that the BOJ was rather reluctant to pursue additional easing. There are conflicting views with respect to the delay in the pace of interest rate reduction since 1993: one argument holds that interest rates should have been reduced at a quicker pace, while another advocates that even if interest rates had been reduced more quickly the effects would have been limited since the financial system was already substantially damaged. In light of the subsequent development of Japan's economy and with the benefit of hindsight, a view that prompt interest rate reduction more faithful to the Taylor rule was desirable seems to be convincing.

However, based on an observation that the financial system was already substantially damaged in the period after 1993 and the effectiveness of monetary easing was limited, what might be worth trying was a more drastic than normal interest rate reduction before 1993, even though it was adequate in light of the Taylor rule. In the previous section, in line with Okina, Shirakawa, and Shiratsuka (2001), we pointed out that expectations become extremely bullish during a period of euphoria and thus a substantial increase in interest rates would have been necessary to induce a change in such expectations. Put differently, even if interest rates had been high, the effect of monetary tightening would not have materialized to any great degree until such expectations had been adjusted downward. If such expectations had been adjusted

downward, the adverse effects on the economy would inevitably have been quite large due to the combined effect of the rise in interest rates itself and the revision of euphoric expectations. This presumption might lead us to the conclusion that an early interest rate reduction was indeed necessary.

In fact, while the BOJ rapidly raised interest rates in 1989, the Nikkei 225 Stock Average steadily rose and peaked at end-December, but then rapidly fell in 1990. Taking such developments into account, one could argue that the central bank needed to swiftly reduce interest rates when effects of previous interest rate rises were confirmed. In addition, if it had been judged that the collapse of euphoric expectations would lead to a persistent fall in real estate prices and could trigger financial system instability, further drastic monetary easing might have been exercised. However, here again an important point is the predictability of the effects of a bubble bursting, and therefore it seems that the BOJ, similar to the case during the emergence and expansion of the bubble, should have made a judgment as to what extent the potential output path would continue to shift downward as a result of the effects of the bursting of the bubble on the financial system (i.e., to what extent a decline in asset prices would be permanent).

When making such a difficult judgment, do the asset price developments mentioned above provide additional information? As previously mentioned, one hypothesis is that the forecasting power of asset prices might not be strong during the period when asset price bubbles are being generated, since it is difficult to identify whether there is excessive optimism or indeed the arrival of a new era due to structural changes, but a rapid or continuous decline in asset prices when a bubble is bursting might to some extent include direct information with respect to the degree of pessimism on the outlook for the economy and indirect information with respect to problems that the financial system might have to face in the future. If this hypothesis holds, it might imply that asset prices are more useful during the period when a bubble is bursting as an information variable for monetary policy.

D. Asset Prices as an Information Variable during a Bursting Bubble Period

In this subsection, we empirically verify the usefulness of asset prices as an information variable; in particular, we comprehensively test their forecasting power for the rates of inflation and real economic growth by examining the periods when the bubble emerged and also when it burst.[27]

By following Stock and Watson (2001), we estimate models for forecasting price inflation (measured by the CPI) and output growth (real GDP) forecasting models with quarterly data. The forecasting models employ the variable of interest for h-quarter ahead y^h_{t+h} as a dependent variable, and lagged dependent variable y_t and a candidate indicator x_t as independent variables. That is,

$$y^h_{t+h} = \alpha + \beta(L)y_t + \gamma(L)x_t + \varepsilon^h_{t+h}, \qquad (2)$$

27. Effectiveness of asset prices as information variables for monetary policy will be comprehensively discussed in a forthcoming paper from the Institute for Monetary and Economic Studies.

where α is a constant term, $\beta(L)$ and $\gamma(L)$ are lag polynomials for the dependent variable and indicator variable, respectively, and ε_{t+h}^{h} is an error term.

We employ two, four, and eight quarters ahead as a forecasting horizon h, and 40 variables as a candidate indicator, such as the level of economic activities (index of industrial production, unemployment rate, and business condition DI, etc.), price, wage, and commodity prices (wholesale price index, wage index, and oil prices, etc.), money (M2+CDs, bank lending, etc.), asset prices (long- and short-term interest rates, foreign exchange rates, stock prices, and land prices, etc.). We use both nominal and real variables, if available, and apply various transformations, including original, log-transformed, first-differenced, and HP-filtered values. In sum, the total numbers of information variables are 148 and 147 series for inflation and output growth forecasts, respectively (Table 3).

Figure 15 summarizes the performances of the aforementioned forecasting models in two periods: one is the period for the expansion of the bubble (1987–90), and the other is the period for the bursting of the bubble (1991–94). The plotted figures in the figure are relative mean squared forecast error (relative MSFE) of the forecasting model for each information variable, standardized by the absolute MSFE of benchmark autoregressive (AR) model. Therefore, a relative MSFE of less than one implies that out-of-sample forecastability is improved by adding the information variable in the forecasting model. The figure shows that forecastability is not necessarily improved by adding a candidate variable, and information content of these variables varies, depending on the external environments.[28]

Let us focus on the forecasting performances of asset price indicators. With respect to the inflation forecasts, foreign exchange rate indicators contribute to improving the forecastability for the period of the bursting of the bubble. Long-term interest rate indicators also show relatively good performance in a four-quarter-ahead forecast for the period of the bursting of the bubble. In the meantime, regarding the output growth forecasts, stock price indicators have high forecastability four and eight quarters ahead, and their forecastability is improved in the period of the bursting of the bubble. Foreign exchange rate indicators generally contribute to improving forecasting performances, and land price indicators are also effective in the period of the bursting of the bubble. Comparing the inflation and output growth forecasts, asset price indicators generally show better performances in the latter case. This might be a case in which asset prices contain relevant information on output fluctuation via the wealth effect and the credit channel.

28. In doing the out-of-sample forecast exercises, the parameters for forecasting models are updated by conducting rolling regression with the previous 40-quarter data. This is because the forecasting performance is improved, compared with those obtained by fixing the beginning of the sample and extending quarter by quarter. This is consistent with the fact that information content of the information variables is highly dependent on the financial and economic conditions.

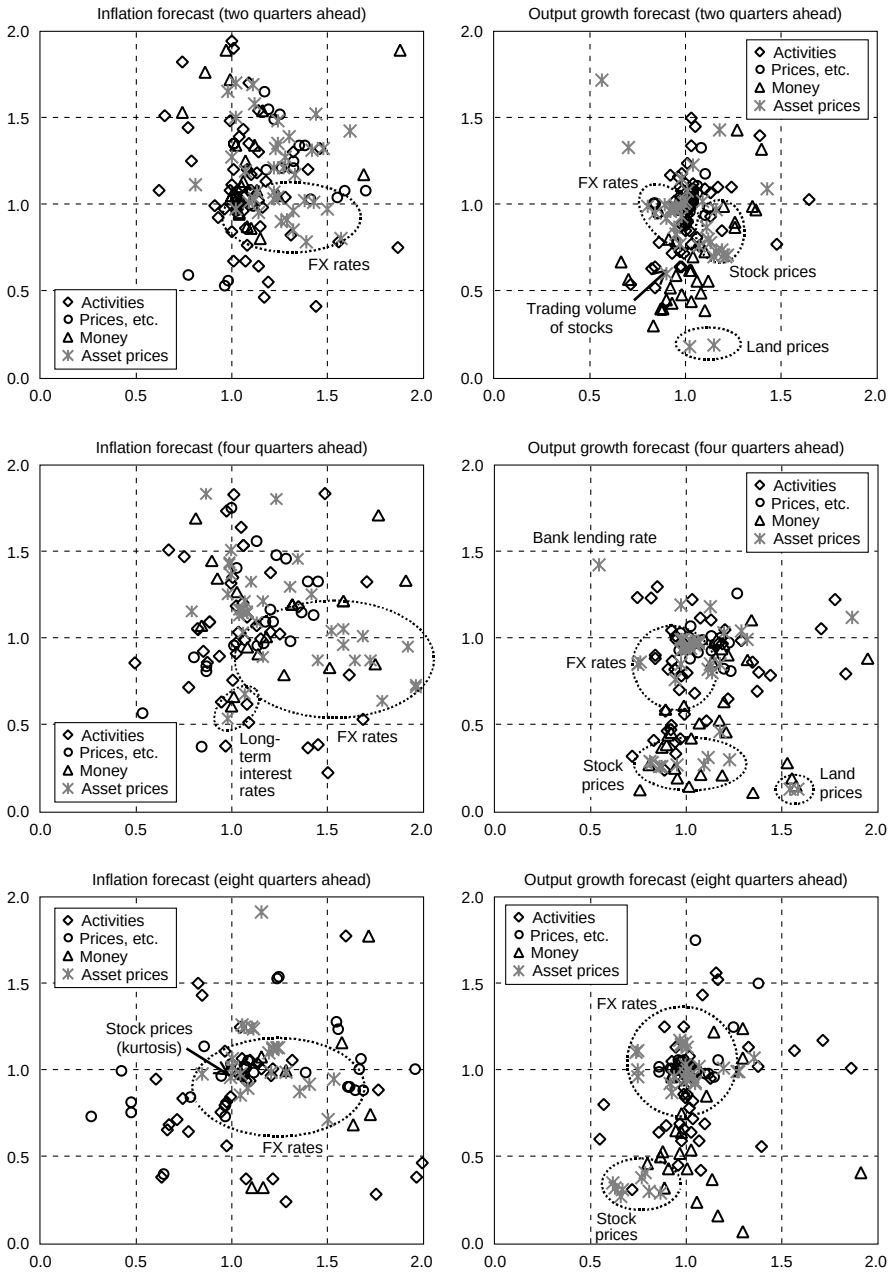
Table 3 Data for Forecasting Exercises

Variables	Code	SA	Nominal/real		Ave./end		Transformation			
			N	R	Ave.	End	Level	Log	Dif	Gap
			—	r	av	ed	lev	ln	ln1d	gap
Real GDP	rgdp	SA	—	○	○	—	—	—	○	○
Industrial production	ip	SA	—	○	○	—	—	—	○	○
Territorial industry	sanji	SA	—	○	○	—	—	—	○	○
Capacity utilization	capu	SA	—	○	○	—	—	—	○	○
Business condition DI	tnkzen	SA	—	○	○	—	○	—	—	○
Business condition DI (manufacturing)	tnksei	SA	—	○	○	—	○	—	—	○
Business condition DI (non-manufacturing)	tnkhi	SA	—	○	○	—	○	—	—	○
Unemployment rate	unemp	SA	—	○	○	—	○	—	—	○
Ratio of job offers to applicants	kyujin	SA	—	○	○	—	○	—	—	○
Machinery orders (private demand)	kijmi	SA	—	○	○	—	—	—	○	○
Machinery orders (manufacturing)	kijse	SA	—	○	○	—	—	—	○	○
Machinery orders (non-manufacturing)	kijhi	SA	—	○	○	—	—	—	○	○
Orders received for construction (total)	kenjal	SA	—	○	○	—	—	—	○	○
Orders received for construction (private demand)	kenjmi	SA	—	○	○	—	—	—	○	○
Orders received for construction (non-manufacturing)	kenjhi	SA	—	○	○	—	—	—	○	○
Value of public works contracted (total)	ukeall	SA	—	○	○	—	—	—	○	○
Value of public works contracted (central government)	ukekun	SA	—	○	○	—	—	—	○	○
Value of public works contracted (local government)	ukechi	SA	—	○	○	—	—	—	○	○
New dwellings started (units)	juckko	SA	—	○	○	—	—	—	○	○
New dwellings started (floor area)	juckme	SA	—	○	○	—	—	—	○	○
Building construction started (floor area)	ckhime	SA	—	○	○	—	—	—	○	○
Registration of new passenger cars	car	SA	—	○	○	—	—	—	○	○
Sales of large-scale retail stores	kouri	SA	—	○	○	—	—	—	○	○
Sales of department stores	hyaka	SA	—	○	○	—	—	—	○	○
Customs clearance exports (U.S. dollars, yen)	expt	SA	—	○	○	—	—	—	○	○
Customs clearance imports (U.S. dollars, yen)	impt	SA	—	○	○	—	—	—	○	○

Table 3 (continued)

Variables	Code	SA	Nominal/real		Ave./end		Transformation			
			N	R	Ave.	End	Level	Log	Dif	Gap
			—	r	av	ed	lev	ln	ln1d	gap
Nominal GDP	ngdp	SA	○	—	○	—	—	—	○	—
GDP deflator	pgdp	SA	○	—	○	—	—	—	○	—
CPI	cpi	SA	○	—	○	—	—	—	○	—
Domestic WPI	wpi	NSA	○	—	○	—	—	—	○	—
DWPI intermediate materials	wpiin	NSA	○	—	○	○	—	—	○	—
Import price index	ipiav	NSA	○	—	○	—	—	—	○	—
IPI raw materials	ipiso	NSA	○	—	○	○	—	—	○	—
Wage index	earn	SA	○	○	○	—	—	—	○	—
Oil prices (U.S. dollars, yen)	oil	NSA	○	○	—	○	—	—	○	—
Domestic commodities	commed	NSA	○	○	—	○	—	—	○	—
Reuters index (U.S. dollars, yen)	reu	NSA	○	○	—	○	—	—	○	—
CRB index (U.S. dollars, yen)	crb	NSA	○	○	—	○	—	—	○	—
Gold (U.S. dollars, yen)	gld	NSA	○	○	—	○	—	—	○	—
Monetary base	mon0	SA	○	○	○	—	—	—	○	—
M1	mon1	SA	○	○	○	—	—	—	○	—
M2+CDs	mon2	SA	○	○	○	—	—	—	○	—
Fund-raising by domestic nonfinancial sector	mon4	SA	○	○	—	○	—	—	○	—
Bank lending	lended	SA	○	○	—	○	—	—	○	—
Money multiplier	mlp	SA	○	—	○	—	○	—	—	○
M2+CDs velocity	velo	SA	○	—	○	—	—	—	○	○
Banknotes	note	SA	○	○	○	—	—	—	○	○
JGB 10-year	jgb	NSA	○	○	○	○	○	—	—	—
Long-short spreads	sprd	NSA	○	—	—	○	○	—	—	—
Loan contract rates	alnd	NSA	○	○	○	—	○	—	—	—
Yen/dollar FX rate	rate	NSA	○	○	○	○	—	—	○	○
Effective FX rate	efrat	NSA	○	○	○	○	—	—	○	○
Nikkei 225 stock prices	nik	NSA	○	○	○	○	—	—	○	—
TOPIX stock prices	tpx	NSA	○	○	○	○	—	—	○	—
TSE trading volume	tosho	NSA	—	○	○	—	—	○	○	—
Land price index	land	NSA	○	○	—	○	—	—	○	—

Figure 15 Out-of-Sample Forecastability



Notes: 1. Plotted figures are relative mean squared forecast errors (relative MSFE), standardized by the absolute MSFE of the benchmark autoregressive model.
2. Horizontal and vertical axes are figures for 1987–90 and 1991–94, respectively.

In addition, we compute the combination indicators for each category: the level of economic activities; prices, wages, and commodity prices; money; and asset prices (Tables 4 and 5). We employ median, trimmed mean as combination indicators by considering the potential effects of outliers in forecasts.[29] Although the combined asset price forecast of inflation does not provide improvements over the AR benchmark, that of output growth contributes to improving forecast accuracy. However, other combined forecasts, including the level of economic activities and money, also perform well.

Table 4 Inflation Forecastability of Combined Indicators

	Two quarters ahead		Four quarters ahead		Eight quarters ahead	
	1987–90	1991–94	1987–90	1991–94	1987–90	1991–94
Benchmark model (absolute RMSFE)						
AR model	1.60	0.81	1.27	0.85	0.88	1.10
Univariate forecast (relative MSFE)						
RW model (1)	1.44	1.19	2.00	1.10	3.97	0.79
RW model (4)	2.46	3.82	1.00	0.88	2.39	0.85
Bivariate forecast (relative MSFE)						
Economic activities						
Median	1.01	0.94	0.96	0.78	0.78	0.75
Trimmed mean (1)	1.02	0.95	0.93	0.79	0.69	0.71
Trimmed mean (2)	1.02	0.95	0.94	0.80	0.74	0.72
Prices, wages, and commodity prices						
Median	0.95	0.93	0.84	0.81	0.60	0.87
Trimmed mean (1)	0.98	0.84	0.85	0.73	0.53	0.82
Trimmed mean (2)	0.96	0.86	0.87	0.77	0.58	0.85
Money						
Median	1.01	1.02	1.05	0.89	1.09	0.70
Trimmed mean (1)	0.94	0.97	0.96	0.87	1.13	0.54
Trimmed mean (2)	1.02	0.97	1.03	0.89	1.18	0.64
Asset prices						
Median	1.16	1.07	1.04	1.05	0.98	0.93
Trimmed mean (1)	1.08	1.10	1.02	1.03	1.04	0.92
Trimmed mean (2)	1.09	1.11	1.02	1.04	1.02	0.92
All variables						
Median	1.02	0.95	0.97	0.82	0.92	0.85
Trimmed mean (1)	1.00	0.94	0.90	0.82	0.72	0.74
Trimmed mean (2)	1.00	0.94	0.91	0.83	0.73	0.76
Trimmed mean (6)	1.01	0.95	0.93	0.83	0.78	0.80

Notes: 1. RW models (1) and (4) conduct inflation forecasting by assuming that log differences of price levels from one and four quarters ago follow a random walk pattern.
2. Trimmed means (1), (2), and (6) compute the average after excluding the largest/smallest, largest/smallest two, and largest/smallest three forecasts, respectively.

29. In computing the combined indicators, we exclude information variables with poor forecasting performance (relative MSFE is greater than two), and choose one from among those with high correlation. As a result, we employ 44 series out of 148 and 40 out of 147 in inflation and output growth forecasts, respectively.

Table 5 Real GDP Growth Forecastability of Combined Indicators

	Two quarters ahead		Four quarters ahead		Eight quarters ahead	
	1987–90	1991–94	1987–90	1991–94	1987–90	1991–94
Benchmark model (absolute RMSFE)						
AR model	2.51	2.38	1.98	2.65	1.71	2.72
Univariate forecast (relative MSFE)						
RW model (1)	1.01	1.66	1.02	1.15	1.06	0.93
Bivariate forecast (relative MSFE)						
Economic activities						
Median	0.96	0.71	0.94	0.55	0.97	0.72
Trimmed mean (1)	0.95	0.68	0.93	0.56	0.89	0.68
Trimmed mean (2)	0.96	0.68	0.93	0.55	0.91	0.69
Prices, wages, and commodity prices						
Median	1.00	1.00	1.01	0.98	0.99	1.01
Trimmed mean (1)	1.01	0.98	1.02	0.97	0.98	1.00
Trimmed mean (2)	1.01	0.99	1.01	0.98	0.98	1.01
Money						
Median	0.87	0.39	0.94	0.22	0.96	0.42
Trimmed mean (1)	0.84	0.32	0.92	0.19	0.96	0.40
Trimmed mean (2)	0.86	0.36	0.93	0.21	0.97	0.43
Asset prices						
Median	0.93	0.80	0.80	0.80	0.84	0.89
Trimmed mean (1)	0.97	0.68	0.79	0.49	0.70	0.64
Trimmed mean (2)	0.97	0.71	0.80	0.54	0.74	0.69
All variables						
Median	0.96	0.68	0.95	0.60	0.96	0.74
Trimmed mean (1)	0.93	0.60	0.88	0.47	0.85	0.62
Trimmed mean (2)	0.93	0.61	0.89	0.49	0.87	0.64
Trimmed mean (6)	0.94	0.65	0.92	0.55	0.91	0.96

Notes: 1. RW models (1) conduct output growth forecasting by assuming that log differences of price levels from one quarter ago follow a random walk pattern.
2. Trimmed means (1), (2), and (6) compute the average after excluding the largest/smallest, largest/smallest two, and largest/smallest three forecasts, respectively.

To sum up the empirical exercise of the information content of asset prices, the usefulness of asset prices as an information variable seems higher in the period of the bursting of the bubble than that of the expansion of the bubble. However, their usefulness is unlikely to be significantly high, compared with other information variables. Therefore, if information with respect to financial system stability is crucial to the conduct of monetary policy, then firsthand information obtained through on-site bank examination can also be extremely important data for monetary policy management, as Federal Reserve economists often argue.[30]

30. For example, see Peek, Rosengren, and Tootell (1999).

V. Conclusions

In this paper, we have reviewed the process of the emergence, expansion, and bursting of Japan's asset price bubble during the period from the latter half of the 1980s to date, from the viewpoint of monetary policy management. Preliminary conclusions can be drawn as follows.

First of all, Japan's experience does not necessarily suggest that asset prices need to be included in the targets of monetary policy. In this regard, the conclusion of Bernanke and Gertler (1999) is correct. However, the assertion of Bernanke and Gertler (1999), that a central bank can accomplish effectively and comprehensively both macroeconomic stability and financial system stability by adopting a strategy of "flexible inflation targeting" to commit to an inflation target in the long run, is not automatically guaranteed.

A critical point is that the bubble period in Japan was based on excessively optimistic expectations with respect to the future, which might be described as euphoria with the benefit of hindsight, rather than a rational bubble, as modeled by Blanchard and Watson (1982), which assume market participants accurately recognize the fundamentals. Under continued price stability, the perceived potential output path shifted upward as economic expansion continued, resulting in the emergence of euphoria and underestimation of inflationary pressure in view of the output gap. However, an increase in asset prices during this period also failed to deliver a sufficient clue to assess whether such an increase was the consequence of an advent of a new economy or just euphoria. After all, in light of Japan's experiences, a central bank cannot take an appropriate policy response without evaluating whether expectations for a new stage of development induced by asset price hikes are euphoric or not, and forecast a correct path for the potential growth rate. In this sense, it cannot reasonably be assumed that direct inclusion of asset prices in a policy target could have led to a more appropriate policy judgment.

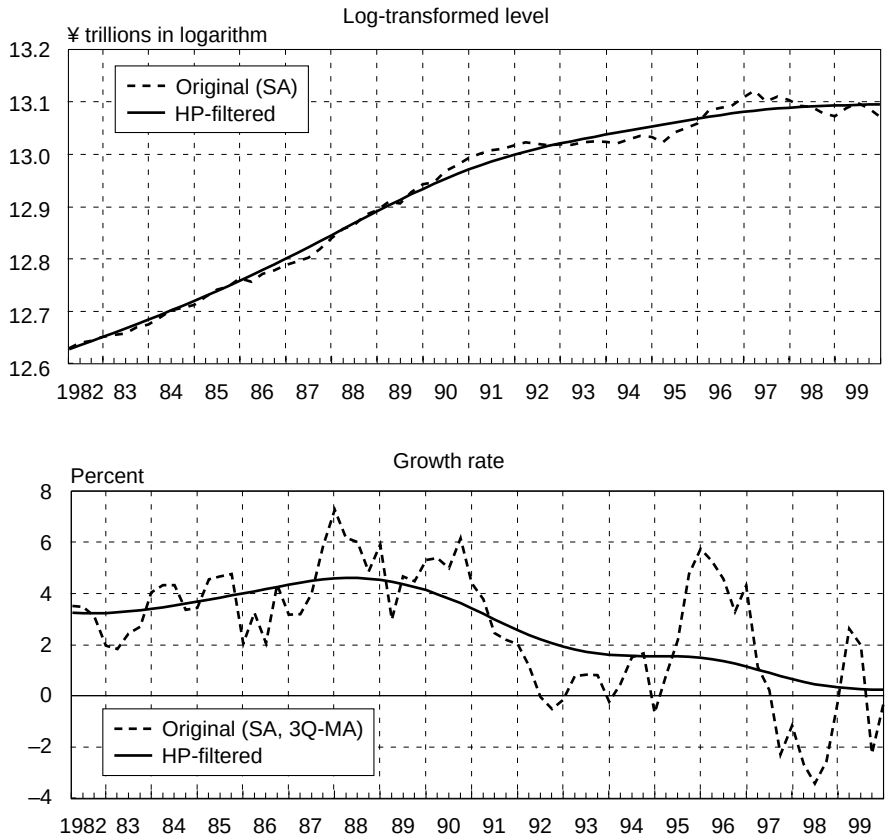
In addition, Japan's experience seems to suggest that it would be worth trying to carry out early and drastic monetary easing when a bubble bursts. However, in the case of Japan, the characteristic of a bank-based financial system, wherein the effects of the bursting of the bubble on the financial front suddenly materialized at a stage beyond a certain critical value, made it difficult for the central bank to recognize that the shock of the bubble's bursting would have a prolonged impact beyond the normal business cycle at an early stage of the bursting. To this end, similar to the case during the period of emergence and expansion of the bubble, the central bank cannot make a policy judgment without evaluating to what extent the potential output path will continue to shift downward by taking account of the effects of the bubble's bursting on the financial front.

APPENDIX 1: ASSET PRICE BUBBLES, STRUCTURAL PROBLEMS, AND MONETARY POLICY

Appendix 1 reviews the relationship between the generation and bursting of Japan's bubble and so-called structural problems, and the implications for monetary policy management.

The potential growth rate of Japan's economy declined substantially in the 1990s. In order to intuitively grasp the trend of the potential growth rate, Appendix Figure 1 shows, as a proxy for the potential growth rate, the logarithm level and growth rate of HP-filtered trend of real GDP. These values are the same as those used in Section III.A to calculate the output gap in verifying policy rules. From the figure, one can see that the potential growth rate had risen to about 4.5 percent in the latter half of the 1980s but subsequently declined throughout the 1990s to some 0.2 percent by around 1999.

Appendix Figure 1 Potential Growth Rate



Note: Figures for real GDP are 63SNA basis. The HP-filtered series is computed for the period from 1955/II to 2000/IV by using smoothing parameter λ = 1,600.

Sources: Bank of Japan, *Financial and Economic Statistics Monthly*; Cabinet Office, *National Accounts.*

Of course, the HP-filtered trend does not necessarily correspond to growth rates as viable over the medium to long run. However, it would be true that when the economy is facing various structural problems, growth rates which are viable in the short run are substantially below the growth rate of true potential output.

A. Approach to Structural Problems

Then, what kind of structural problems did Japan's economy confront in the 1990s? Recognized as such problems are (1) the erosion of financial institutions' balance sheets resulting from the generation and bursting of the bubble, (2) inefficient non-tradable goods industries, (3) a corporate management system that is incompatible with change, and (4) a savings-investment imbalance (excess savings due to demographic factors and other reasons).[31]

The necessity and measures to cope with these four problems (except [1]) had been recognized as early as the 1970s, but the emergence of asset price bubbles had unfortunately worked in a way to temporarily disguise the problems. The inefficiency of non-tradable goods industries and incompatibility of the corporate management system with the changing environment were both hidden by the emergence of euphoria and good corporate profits under the generation of asset price bubbles, and the external imbalance stemming from the savings-investment imbalance seemed to have temporarily disappeared.

Therefore, there was much procrastination as to how to deal with structural problems throughout the 1980s. In addition, in the early 1990s when the bubble burst, people were trapped in an illusion based on the experience of asset price bubbles that all problems would be resolved once asset prices recovered. Furthermore, in the latter half of the 1990s, there was some biased argument that the problem was solely attributable to the net capital erosion of firms and financial institutions stemming from the bursting of asset price bubbles.

B. Structural Problems, Asset Prices, and Monetary Policy

However, it should be noted that structural problems, once deferred by the emergence of the asset price bubble, materialized when the bubble burst. From this viewpoint, an important issue regarding the structural problems would be that return on equity (ROE) of firms centering on inefficient non-manufacturers had been low, and therefore asset prices had not recovered, resulting in deferring resolution of the balance-sheet problem.

In this context, it is necessary not only to resolve financial system problems in a narrow sense but also to pursue comprehensive structural reform to restore the potential growth rate. Put differently, policy responses to asset price deflation should be included in policy responses to escape from the current prolonged stagnation. Under such economic conditions, structural rather than cyclical factors become crucial as fundamental reasons attributable to the current deflationary economic situation, and as a corresponding policy response, it becomes necessary not to

31. Maeda, Higo, and Nishizaki (2001) give more comprehensive analysis on structural problems. Unfortunately, however, this paper is available only in Japanese.

accumulate policies that offset cyclical factors but to pursue those that exclude structural factors. In this sense, monetary policy cannot be a panacea for economic rehabilitation and cannot substitute for a policy that aims at resolving the structural problem on the supply side of the economy (Yamaguchi [1999b] and Shirakawa [2000]).

As a monetary policy response to pursue structural reform, there is a view that since an ultra-low interest rate policy makes it easy to defer the problem, interest rates should be maintained at some high level in order not to give an incentive to postpone the problem. However, since structural reform urges inefficient firms to exit from the market, there is the dilemma that nonperforming loans will increase during the process of structural reform, thereby worsening economic conditions, at least in the short run. Therefore, in promoting structural reform, monetary policy should, despite the above-mentioned problem of giving an incentive for forbearance, be pursued to realize effective monetary easing to mitigate the pain accompanying structural reform.

APPENDIX 2: THE BOUNDARY BETWEEN MONETARY AND PRUDENTIAL POLICIES

In Appendix 2, we summarize Japan's experience with respect to a situation in which once financial distress materializes, the boundary between monetary and prudential policies becomes extremely ambiguous, based on the argument in Saito and Shiratsuka (2001).

During the financial crises in 1997 and 1998, the serious liquidity constraint prevailing in the banking sector adversely affected the behavior of banks, as evidenced by depressed loan activity, limited arbitraging, and poor market-making in financial markets. As a consequence, arbitraging among various financial markets, including short-term money and foreign exchange markets, were restricted, and financial markets became segmented. Such a mechanism, whereby the behavior of liquidity-constrained banks leads to illiquid financial markets, may carry several important implications for monetary policy conducted by a central bank during financial crises.[32]

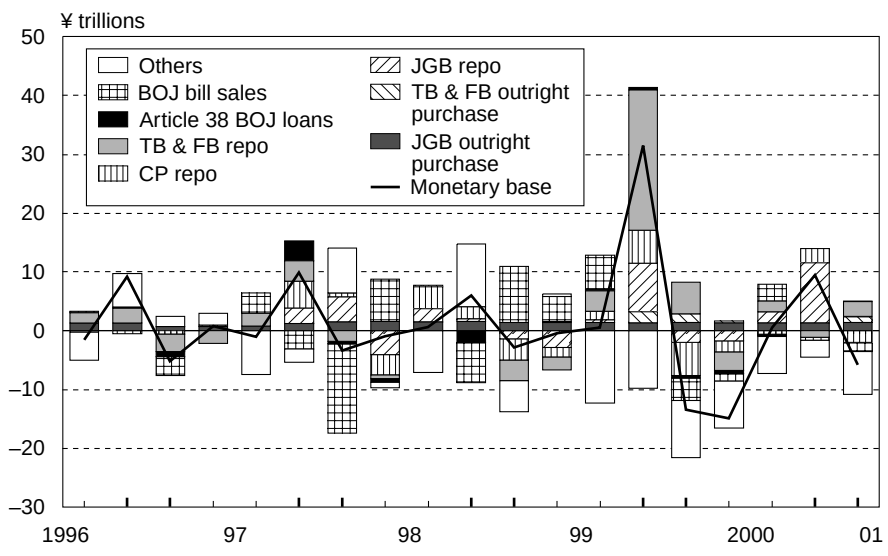
A central bank usually attempts to control policy-targeted interest rates, for example, the uncollateralized overnight call rate in Japan, by guiding market participants' expectations via daily open market operations. In a normal situation, once the policy-targeted rate is set at a desirable level from the perspective of monetary policy, a central bank expects the thus-determined policy-targeted rate to be transmitted to other longer-term interest rates through arbitrage in the financial markets. During financial crises, however, the above transmission mechanism is unlikely to work properly because the behavior of financial institutions is severely restricted by a liquidity constraint. Financially stressed banks tend to have serious difficulties not only with lending, but also arbitraging and dealing in financial markets, thus hampering the transmission mechanism from the policy-targeted rate to longer-term rates, resulting in market segmentation among various financial markets.

32. For details of theoretical and empirical analysis with respect to intensifying liquidity constraint and policy responses by the BOJ during the financial crises in 1997 and 1998, see Saito and Shiratsuka (2001).

Thus, it could be extremely important for a central bank to intervene in various financial markets to fix segmented markets, thereby restoring market liquidity and the proper interest rate transmission mechanism. The monetary operation motivated by the above consideration may be rather different from that conducted in a normal situation. That is, the monetary operation would require not only adjusting the aggregate amount of liquidity in financial markets by increasing and lowering short-term interest rates, but also fixing the allocation of liquidity among financial markets to reactivate the transmission mechanism from a policy-targeted rate to longer-term rates.

In this regard, the money market operations conducted by the BOJ since 1997 can be interpreted as being motivated by both the sufficient provision of liquidity and the proper allocation of liquidity among segmented markets. First, during the financial crisis from 1997 to 1998, as Saito and Shiratsuka (2001) point out, the BOJ intervened in several money markets simultaneously to fix market segmentation. The BOJ implemented a "dual operation" to facilitate year-end and fiscal year-end funding, that is, it injected longer-term funds while absorbing excess funds in the overnight transactions (Appendix Figure 2). Second, with respect to the zero interest rate policy conducted from February 1999 to August 2000, Fujiki and Shiratsuka (2001) empirically show that the zero interest rate along with future commitment had a powerful easing effect as a result of two factors. One is the effect on market expectations regarding the future course of monetary policy actions, thereby flattening and stabilizing the yield curve at a very low level. The other is mitigating the liquidity constraints of financial institutions, as witnessed by a significant reduction in term spreads.

Appendix Figure 2 Money Market Operations by the BOJ



Source: Bank of Japan, *Financial and Economic Statistics Monthly.*

These policy experiences suggest that it would be important to consider not only controlling the aggregate amount of liquidity, but also correcting the allocation of liquidity during a financial crisis, thereby resolving market segmentation and restoring the interest arbitraging mechanism. It should be noted, however, that such easing effects only mitigated the liquidity constraint of financial institutions and failed to be transmitted outside the financial system, since the transmission channel between financial and nonfinancial sectors was not functioning sufficiently.

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