On Self-fulfilling Deterioration in an Economy in the Accommodative Monetary Policy Regime

Yoshihiro KUROKI

Introduction

What rules of monetary policy best describe the actual practice of contemporary central banks? Do central banks react to forecasts of inflation and the output gap in a stabilizing manner?

This paper attempts to answer these practical questions more precisely by refining the findings of previous works. We estimate the forward-looking policy reaction functions for the Bank of Japan for the period from 1979 to 1997, following recent contributions by Bernanke and Gertler (1999), Clarida, Gali and Gertler (1998, 2000), Jinushi, Kuroki and Miyao (2000) and Taylor (1993). We believe that the experience of the Bank of Japan has important implications for other contemporary central banks, as our experiment provides unfortunate, for the Japanese economy, but valuable evidence that an accommodative or passive monetary policy rule can actually destabilize an economy.

Specifically, we make contributions in three respects. Previous works such as Bernanke et al., ibid. and Clarida et al., ibid. estimated
that the Bank of Japan responded actively to inflation from 1979 to the late 1990s. These works, amongst others, replaced the expectations of variables in a policy reaction function with actual realized values of the variables and applied an instrumental variables method, using as instruments only those variables known at time t-1 or earlier.

Here, as Rigobon and Sack (2003) did, we replace expectation variables with \textit{forecasted} values by the private sector, instead of the past \textit{realized} values. Then, we find that the Bank of Japan was poorly committed to inflation stabilization. That is, the Bank of Japan did not raise the nominal interest rate by more than the increase in expected inflation, but implemented an “inflation accommodating policy”. This result is qualitatively quite different from that of previous works, which concluded that the Bank did enough to satisfactorily control inflation during this period.

Moreover, using forecasted values allows us to capture more precisely how far forward-looking a central bank is than previous works (such as Clarida \textit{et al.} (2000)) have done. In this paper, we find that the Bank of Japan had been considerably forward-looking in stabilizing inflation, whilst it had not cared about controlling future output for the period up to 1985. The policy stance of the Bank then became quite different after 1985. The Bank became short-sighted in inflation stabilization, but instead was forward-looking in stabilizing the output gap.

The second contribution that we would like to make is to identify when the Bank of Japan accommodated inflation. In general, the real interest rate is affected by price shocks as well as output shocks and exchange rate shocks. However, when a central bank conducts an in-
flation accommodating policy and it does not care about exchange rates, the central bank sets the \textit{real} interest rate reacting solely to the output gap, although it changes the \textit{nominal} rate in response to inflation. Then, the real interest rate tends to be influenced not by price shocks but mainly by output shocks. Therefore, we can identify when the bank accommodated inflation by investigating the relationship between the real interest rate and output shocks.

Another purpose of this paper is to verify that the inflation accommodating policy actually assisted a self-fulfilling deterioration in the Japanese economy. There are arguments on what gave rise to the prolonged stagnation in the Japanese economy in the 1990s. For example, Hayashi and Prescott (2002) argue that a low productivity growth was mainly responsible for the lost decade. However, Clarida \textit{et al.} (2000) show that supply shocks alone cannot account for the persistent inflation (deflation) without an accommodative monetary policy. Furthermore, the theoretical findings by Bernanke and Woodford (1997) and the simulation results by Bernanke and Gertler (1999) suggest that such a policy can give rise to a devastated economic situation. These findings imply a possibility that monetary policy was an important sustainable force of the boom-bust cycle in the late 1980s and the successive deflation over the decade.

These previous works, however, lack empirical evidence that a poor commitment to stabilizing inflation led to the self-deterioration in economies because they did not have an experience to test. Fortunately (or unfortunately), the Japanese economy has had such an experience. By estimating a recursive structural VAR, we show that such a passive or accommodative policy indeed failed to stabilize both
inflation and the output gap.

We should note that the results of this paper do not imply that the Bank of Japan was always accommodating in its policy reaction to expected inflation (deflation). We find that the Bank of Japan aggressively stabilized expected inflation during the period of Governor Maekawa (1979–84), who is well known as the most anti-inflationary governor. Moreover, such an active or preemptive policy succeeded in stabilizing not only inflation but also the output gap and the exchange rate gap. The problem was that the Bank of Japan became short-sighted and adopted an inflation accommodating policy after 1985. Consequently, we allowed self-fulfilling deterioration in our economy under the accommodative policy regime.

The policy implication of this paper is quite straightforward. Monetary policy should actively and preemptively offset incipient inflationary or deflationary pressures.

The remainder of the paper is organized as follows. In Section 1, we examine the past performance of monetary policy in Japan by estimating forward-looking policy reaction functions. We check the robustness of the estimated results in Section 2. To verify the estimated properties in Section 1 and Section 2, we present some illustrative but important relationships between output shocks and the real interest rate in Section 3 and provide a narrative analysis in Section 4. In Section 5, we show that the accommodating policy rule since 1985 failed to control inflation (deflation) and output, based on the recursive structural VAR method. Section 6 concludes with some policy implications.
1. Monetary policy reaction function

In this section, we estimate policy reaction functions for the Bank of Japan to see how aggressively it reacted to expected inflation.

1.1. The forward-looking policy reaction function

The estimated form of the policy reaction function is quite similar to Clarida et al. (1998), Bernanke et al. (1999) and Jinushi et al. (2000), which include the inflation gap, the output gap and the exchange rate gap.

\[ i_t = \alpha + \rho i_{t-1} + \beta E[\pi_{t+j} | \Omega_t] + \gamma E[Y_{t+m} - Y^* | \Omega_t] + \delta E[Z_{t+n} - Z^* | \Omega_t] + \epsilon_t \]  

(1)

where \( i_t \) is the nominal level of the overnight call rate in period \( t \) and \( i_{t-1} \) is the lagged rate, assuming that the Bank of Japan tended to smooth changes in the call rate. \( \pi_{t+j} \) is the rate of inflation measured by the Consumer Price Index between periods \( t \) and \( t+j \) and \( Y_{t+m} \) is the log level of the real GDP in period \( t+m \). We add an exchange rate gap term, where \( Z_{t+n} \) is the log level of the nominal yen-dollar rate in period \( t+n \). \( Y^* \) and \( Z^* \) are respective target values for the real GDP and the exchange rate levels defined in the Data Appendix. \( E \) is the expectation operator and \( \Omega_t \) is the information available to the Bank of Japan at the time it sets the policy interest rate. In addition, equation (1) assumes a first-order partial adjustment mechanism of the overnight call rate.

Equation (1) is a forward-looking version of the simple backward-looking reaction function introduced by Taylor (1993) and is the same
as the baseline specification in Clarida et al. (1998). The latter paper concluded that the Bank of Japan was forward-looking in the sense that it responded to forecasted inflation, as opposed to lagged inflation. We adopt the forward-looking reaction function here, based on their contribution. This type of a policy reaction function is known to be optimal for a central bank that has a quadratic loss function over inflation, the output gap and the exchange rate gap, given the linear macroeconomic structure.\(^1\)

Our estimation method is different from previous works cited above in several respects. Several comments are required. First, similar to Rigobon and Sack (2003), we utilize private-sector forecasts of the CPI inflation rate, the real GDP level and the nominal-yen-dollar rate as \(E[\pi_{t+j}|\Omega_t]\), \(E[Y_{t+m}|\Omega_t]\) and \(E[Z_{t+n}|\Omega_t]\), as the forecasts of the Bank of Japan are not available.\(^2\) The previous works usually replace the expectation variables in equation (1) with actual realized values of the variables and apply an instrumental variables methodol-

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1) Even under a nonlinear economic structure, the optimal reaction function can be expressed in this type. Please see, for example, Corsetti and Pesenti (2005).

2) Bernanke and Woodford (1997) showed that attempts to target inflation forecast might lead to multiplicity of rational expectations equilibrium for a broad class of policies, and thus give rise to arbitrary volatilities in inflation, output and other variables.

Here, we don’t argue anything about inflation-forecast targeting, but we just try to find out how far the Bank of Japan was forward-looking and how aggressively it reacted to macroeconomic variables. Therefore, we don’t rule out the possibility that the Bank has utilized useful information from private-sector forecasts of macroeconomic variables other than inflation such as output, interest rates, and exchange rates. Actually, we have never heard that the Bank of Japan targeted inflation forecast in its history.

3) Data sources of these forecast variables are in the Data appendix.
ogy, using as instruments only those variables known at time $t-1$ or earlier.

However, an important problem is that the method uses past actual values of the variables in its estimation although policy (equation (1)) is assumed to respond to *anticipations* of the variables rather than
those actual values. Thus, analysis based on the method might not be able to correctly capture how aggressively and how far in the future the Bank of Japan reacted to expected inflation.

Here, as Rigobon and Sack (2003) did, we adopt the forecast values of the variable in (1), assuming that those values are formed based on the set of information available for the Bank of Japan at the end of the previous quarter. If this assumption is reasonable, the orthogonality condition between the explanatory variables and the error term is satisfied and we can use the ordinary least squares (OLS) method.  

Second, we do not adopt a time trend variable and a filtered series as proxies of $Y^*$ and $Z^*$. Actually, we do not quite understand what rationale exists for the use of a time trend or a particular type of filtering method as potential levels of output and the exchange rate. For example, Haltmaier (2001) suggests that the recent Japanese output gap is considerably larger than a simple Hodrick-Prescott filter would suggest, and therefore the estimates using the filter may be unreliable. Bernanke and Gertler (ibid. endnote 25) believe that Japan’s output has been well below its potential output since about 1990, and hence they do not use a simple quadratic trend through 1989 for their potential output series.

Taking account of a strong possibility that the Japanese output gap in the 1990s was considerably larger than that estimated by a quadratic trend or a Hodrick-Prescott filter, we use capital and labor utilization to obtain the potential output level of the real GDP (see the

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4) Taking account of the possibilities of serial correlations and heteroskedasticity of error term, we compute standard errors and t statistics by the Newey-West (HAC consistent covariance) estimators.
Data appendix II). As a target variable of the yen-dollar rate, $Z^*$, we adopt the relative Purchasing Power Parity (hereafter PPP)—the ratio of Japan’s CPI to that of the U.S., based on similar reasoning.

Finally, our sample period is from the first quarter of 1979 to the third quarter of 1997. It starts in the first quarter of 1979 as the series of our potential output is only available from the first quarter of 1978 and we will take four lags of variables in a VAR model introduced later. The reasons why our sample ends in the third quarter of 1997 are as follows. After the successive bankruptcies of major financial institutions in November 1997, the Bank of Japan began to utilize monetary policy in order to eradicate anxiety about the lack of financial stability. It lowered the call target rate when the Russian crisis occurred in August 1998, as it feared that the crisis would damage the banking sector and the financial system. Moreover, a so-called “zero-interest rate policy” was adopted in the early 1999, which implies the lowest bound of the policy instrument. These successive reductions of the call rate to protect the financial stability and to exercise constraint on variations of the policy instrument are likely to contaminate estimation of a standard policy reaction function to inflation, real output and exchange rates. Hence, we exclude the period after the third quarter of 1997 from our sample.⁵)

1.2. Estimation results

We turn to the estimation results for the policy reaction functions

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⁵) Please see Honda and Kuroki (2006) for the precise arguments on the Japan’s monetary policy in the 1990s.
Table 1–A: Bank of Japan’s reaction functions (Full sample, 1979: I-97: III)

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>1-quarter forecast</th>
<th>2-quarter forecast</th>
<th>3-quarter forecast</th>
<th>1-year forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation rate</td>
<td>1.011**</td>
<td>1.063**</td>
<td>1.088**</td>
<td>1.081**</td>
</tr>
<tr>
<td></td>
<td>(2.680)</td>
<td>(3.532)</td>
<td>(3.313)</td>
<td>(2.735)</td>
</tr>
<tr>
<td>Output gap</td>
<td>0.269**</td>
<td>0.266**</td>
<td>0.281**</td>
<td>0.310**</td>
</tr>
<tr>
<td></td>
<td>(3.283)</td>
<td>(2.946)</td>
<td>(2.876)</td>
<td>(3.026)</td>
</tr>
<tr>
<td>Exchange rate gap</td>
<td>0.042*</td>
<td>0.042*</td>
<td>0.041*</td>
<td>0.038†</td>
</tr>
<tr>
<td></td>
<td>(2.165)</td>
<td>(2.097)</td>
<td>(1.959)</td>
<td>(1.877)</td>
</tr>
</tbody>
</table>

a) **, * and † denote that the parameter estimates are statistical significant at 1, 5 and 10 percent, respectively. Numbers in parentheses are t-values.
b) Both standard errors and t statistics are computed by the Newey-West (HAC consistent covariance) estimators.
c) We list here the cases of estimation including GDP gap only with the same forecast interval as inflation.
d) Exchange rate gaps: we use the 2-quarter forecast value of the yen-dollar rate for the estimations with the 2- to 4-quarter forecasts of inflation rate. We adopt 1-quarter forecast value for the estimation with 1-quarter forecast length of CPI.

shown in Table 1–A to 1–C. For the entire sample period (Table 1–A), estimates of the reaction to expected inflation look quantitatively different from those found in the previous works while those to the output gap are rather similar (≈0.3). For the entire 1979–97 period, we estimate that the Bank of Japan was not preemptively resisting inflationary and deflationary forces, but was passively accommodating them. The estimated coefficients of policy reaction to inflation are only slightly larger than one for all the forecasted values (1.011–1.088), with the statistical significance level of 1 percent. The result indicates that the Bank of Japan was poorly committed to inflation stabilization on average over the full sample period.

However, inspection of the data suggests two very different policy regimes during this period. We separate the entire period into two
subsample periods, being before and after the resignation of Governor Maekawa, who was well known as an aggressive anti-inflationary policy maker. The separation date is the end of 1984.\footnote{6}

Table 1–B shows that, for the Maekawa period (1979–84), the Bank of Japan maintained a strong commitment to inflation stabilization while it did not actively respond to the output gap ($\gamma$s are negative and statistically insignificant). All of the estimated reactions to inflation are considerably larger than 1.20 and are statistically significant at the 1 percent level.\footnote{7} Furthermore, the Bank of Japan responded more aggressively to expected inflation in the long term than to ex-

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>1-quarter forecast</th>
<th>2-quarter forecast</th>
<th>3-quarter forecast</th>
<th>1-year forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>\textit{Inflation rate}</td>
<td>1.197(^{**}) ((7.514))</td>
<td>1.595(^{**}) ((9.393))</td>
<td>2.591(^{**}) ((6.262))</td>
<td>6.119(^{**}) ((6.876))</td>
</tr>
<tr>
<td>\textit{Output gap}</td>
<td>(-0.035) ((0.465))</td>
<td>(-0.085) ((1.157))</td>
<td>(-0.135) ((0.866))</td>
<td>(-0.239) ((0.859))</td>
</tr>
<tr>
<td>\textit{Exchange rate gap}</td>
<td>0.083(^{**}) ((5.965))</td>
<td>0.140(^{**}) ((7.277))</td>
<td>0.256(^{**}) ((4.865))</td>
<td>0.651(^{**}) ((5.654))</td>
</tr>
</tbody>
</table>

\(\text{\footnotesize a) } ^{*}, \; ^{*}\text{ and } ^{'}\text{ denote that the parameter estimates are statistical significant at 1, 5 and 10 percent, respectively. Numbers in parentheses are } t\text{-values.}\)
\(\text{\footnotesize b) Both standard errors and } t\text{ statistics are computed by the Newey-West (HAC consistent covariance) estimators.}\)
\(\text{\footnotesize c) See also the footnote of Table 1-A.}\)

\(\footnote{6}\text{ We conducted a predictive test for a structural break based on GMM method below. We found that there was a structural break in 1984 at least at the 5 percent level, in all cases except for the case using one-quarter forecast value of the explanatory variables.}\)
\(\footnote{7}\text{ Bernanke and Gertler (1999), p. 35, state, “Values less than 1.3 or so indicate a weak commitment to inflation stabilization.”}\)
pected inflation in the short term. For instance, the estimated reaction for the one-year inflation forecast is 6.119 while those for the two-quarter and the one-quarter forecasts are 2.591 and 1.595, respectively. These results imply that the Bank of Japan was strongly and preemptively committed to stabilizing the inflation rate during the Maekawa period.

For the second half of the entire sample, we can detect different results. As Table 1–C shows, after 1985 the Bank of Japan not only greatly weakened its commitment to inflation stabilization, but it also became rather short-sighted. The Bank of Japan was only concerned about expected inflation for the next quarter. The estimated reaction for the one-quarter forecast on inflation is 1.207, which is quite similar to the estimate for 1989–97 in Bernanke and Gertler (1999).

In contrast, all the estimated coefficients for the expected output gaps are statistically significant at the 1 percent level and most of

<table>
<thead>
<tr>
<th>Table 1–C: Bank of Japan’s reaction functions (After the Maekawa period, 1985: I–97: III)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explanatory variables</td>
</tr>
<tr>
<td>Inflation rate</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Output gap</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Exchange rate gap</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

a) **, * and † denote that the parameter estimates are statistical significant at 1, 5 and 10 percent, respectively. Numbers in parentheses are t-values.
b) Both standard errors and t statistics are computed by the Newey-West (HAC consistent covariance) estimators.
c) See also the footnote of Table 1-A.
those have values larger than 0.36, which in turn are not only larger than the corresponding estimates by Bernanke et al. ibid, but also relatively larger than the estimates for the entire sample period. We interpret the high and significant estimated values of $\gamma$ as indicating that the Bank of Japan preemptively responded to expected output gaps and actively attempted to stabilize them for the 1985–97 period. In Section 3, we confirm this shift of relative weight from inflation stabilization to output control by investigating the relationship between a real interest rate and output shocks.

2. Robustness of the estimated properties

So far, we have assumed that the forecast values of the variables in (1) are formed based on the information available at the end of the previous quarter. However, this assumption might be rather strong because we can not entirely deny a possibility that the private sectors might utilize new information released in the current period ($t$) as well as the information available at the end of the previous quarter ($t-1$) when they form their forecast values. For instance, information on exchange rates is almost continuously available from worldwide markets, and preliminary data of the consumer price index might be released in the early days of the current quarter. If this is the case, the orthogonality conditions between the explanatory variables and the error term fail.

Taking account of this possibility, we estimate the equation (1) based on the Generalized Method of Moments in order to check robustness of the estimated properties in the previous section. The estimation results are shown in Table 2–A to 2–C.
Actually, we can confirm most of the properties obtained in the previous section. In particular, the estimation results for the Maekawa period (Table 2-B) show remarkable correspondence. First, the Bank of Japan maintained a strong and preemptive commitment to inflation stabilization while it did not respond to the output gap. All of the estimated reactions to inflation are considerably larger than 1.20 and are statistically significant at the 1 percent level. Second, the Bank responded more aggressively to expected inflation in the long term than to expected inflation in the short term. The GMM estimates for the one-year inflation forecast is 6.539 while those for the two-quarter and the one-quarter forecasts are 2.157 and 1.548, respectively, and these parameter estimates are quite close to those based on the least squares.8)

Table 2-A: Bank of Japan’s Reaction Function based on the GMM (Full sample period, 1979: I-97: III)

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>1-quarter forecast</th>
<th>2-quarter forecast</th>
<th>3-quarter forecast</th>
<th>1-year forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation rate</td>
<td>1.124**</td>
<td>2.044**</td>
<td>1.874**</td>
<td>1.726**</td>
</tr>
<tr>
<td></td>
<td>(2.829)</td>
<td>(11.671)</td>
<td>(11.064)</td>
<td>(10.027)</td>
</tr>
<tr>
<td>Output gap</td>
<td>0.365**</td>
<td>0.289**</td>
<td>0.201*</td>
<td>0.215**</td>
</tr>
<tr>
<td></td>
<td>(3.757)</td>
<td>(2.801)</td>
<td>(2.174)</td>
<td>(2.432)</td>
</tr>
<tr>
<td>Exchange rate gap</td>
<td>0.020</td>
<td>0.001</td>
<td>0.017</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td>(1.054)</td>
<td>(0.030)</td>
<td>(0.988)</td>
<td>(1.529)</td>
</tr>
<tr>
<td>( \pi^* )</td>
<td>17.22</td>
<td>2.37</td>
<td>2.82</td>
<td>3.34</td>
</tr>
</tbody>
</table>

a) **, * and \( ^{t} \) denote that the parameter estimates are statistical significant at 1, 5 and 10 percent, respectively. Numbers in parentheses are t-values.

b) The instrument set includes 22 variables; a constant, plus \( \pi(-1) - \pi(-4), y(-1) - y(-4), z(-1), i(-1) - i(-2) \) and \( \pi_1Q(-1), \pi_2Q(-1), \pi_3Q(-1), \pi_4Q(-1), y_1Q(-1), y_2Q(-1), y_3Q(-1), y_4Q(-1), z_1Q(-1) \) and \( z_2Q(-1) \). where, \( \pi_jQ(-1): j \)-quarter forecast value of inflation rate of \( t-1 \), \( y_jQ(-1): j \)-quarter forecast value of the output gap of \( t-1 \), and \( z_jQ(-1): j \)-quarter forecast value of the exchange rate gap of \( t-1 \).
Table 2–C shows the estimation results for the second half of the entire sample. We can verify that the Bank of Japan greatly weakened its commitment to inflation stabilization after Governor Maekawa had stepped down. In contrast, all the estimated coefficients for the expected output gaps are statistically significant at the 1 percent level.

### Table 2–B: Bank of Japan’s Reaction Function based on the GMM (The Maekawa period, 1979: IV-84: IV)

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>1-quarter forecast</th>
<th>2-quarter forecast</th>
<th>3-quarter forecast</th>
<th>1-year forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inflation rate</strong></td>
<td>1.229** (156.24)</td>
<td>1.548** (279.383)</td>
<td>2.157** (273.451)</td>
<td>6.539** (31.239)</td>
</tr>
<tr>
<td><strong>Output gap</strong></td>
<td>-0.025 (5.476)</td>
<td>-0.471 (310.559)</td>
<td>-0.063 (9.020)</td>
<td>-0.707 (34.594)</td>
</tr>
<tr>
<td><strong>Exchange rate gap</strong></td>
<td>0.086** (98.996)</td>
<td>0.139** (202.345)</td>
<td>0.225** (51.327)</td>
<td>0.783** (30.313)</td>
</tr>
<tr>
<td><strong>π</strong></td>
<td>9.85</td>
<td>6.26</td>
<td>3.55</td>
<td>1.05</td>
</tr>
</tbody>
</table>

a) ***, * and † denote that the parameter estimates are statistical significant at 1, 5 and 10 percent, respectively. Numbers in parentheses are t-values.
b) Please also see the footntes of Table 2-A.

### Table 2–C: Bank of Japan’s Reaction Function based on the GMM (After the Maekawa period, 1985: I-97: III)

<table>
<thead>
<tr>
<th>Explanatory variables</th>
<th>1-quarter forecast</th>
<th>2-quarter forecast</th>
<th>3-quarter forecast</th>
<th>1-year forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Inflation rate</strong></td>
<td>0.427 (1.047)</td>
<td>0.098 (0.155)</td>
<td>0.186 (0.351)</td>
<td>0.220 (0.435)</td>
</tr>
<tr>
<td><strong>Output gap</strong></td>
<td>0.405** (4.774)</td>
<td>0.390** (3.761)</td>
<td>0.349** (3.987)</td>
<td>0.311** (3.629)</td>
</tr>
<tr>
<td><strong>Exchange rate gap</strong></td>
<td>0.023 (0.820)</td>
<td>0.033 (1.155)</td>
<td>0.039† (1.899)</td>
<td>0.045* (2.497)</td>
</tr>
<tr>
<td><strong>π</strong></td>
<td>-3.55</td>
<td>-2.31</td>
<td>-2.62</td>
<td>-2.78</td>
</tr>
</tbody>
</table>

a) ***, * and † denote that the parameter estimates are statistical significant at 1, 5 and 10 percent, respectively. Numbers in parentheses are t-values.
b) Please also see the footntes of Table 2-A.
with values of 0.311–0.405, which are also close to the least squares estimates.8)

Some comments are required for the entire period. As we expected, the estimated reactions to expected inflation are relatively larger than those obtained in the previous section. In particular, the GMM estimates for the two-quarter inflation forecast is 2.044, which is exceptionally close to the estimates by Clarida, et al. (1998) and Bernanke and Gertler (1999). This similarity makes us infer that these previous works concluded that the Bank of Japan responded actively to inflation from 1979 to the late 1990s.

However, the respective estimates for the three-quarter and the one-year inflation forecasts are 1.874 and 1.726, and the estimate for the one-quarter forecast is only 1.124. These values are clearly smaller than the estimates by these previous works, and are not large enough to assert that the Bank was strongly committed to inflation stabilization. Therefore, we might be able to argue that previous works based only on the GMM utilizing past actual values overestimated the policy reactions to expected inflation (in particular, reactions in the long term).

In summary, the additional estimations in this subsection verified most of the results obtained in the previous section.

8) The t-statistics are large in Table 2-B and this fact might be indicating overfitting. However, it does not alter the results and arguments obtained in the previous section at all. Previous works such as Clarida et al. (1998) and Bernanke et al. (1999) also reveal the same defect.

9) Although the estimations by the GMM do not detect the property that the Bank of Japan became short-sighted in controlling future inflation, they can confirm the result that the Bank did not respond to anticipated inflation in the longer term than one quarter.
3. Output shocks and the movement of the real interest rate

So far, we have estimated monetary policy reaction functions for the Bank of Japan and found that the Bank was poorly committed to inflation stabilization after 1985, while it aggressively reacted against inflation during the Maekawa period. In this section, we confirm the results by investigating the relationship between output shocks and real call rate movements.

3.1. The relationship between output shocks and the real call rate

As in previous works such as Ball (1997), Bernanke and Woodford (1997), and Svensson (1997), we assume that our economic structure can be expressed by a (expectational) Keynesian IS curve and a Phillips curve with nominal rigidities for adequate periods. Suppose also that the Bank of Japan minimizes a loss function with respect to an output gap, an exchange rate gap and an inflation gap.

If the Bank of Japan cares only about output deviations in these conditions, output fluctuations are simply a function of the contemporaneous IS shock. That is, the real interest rate tends to be dominantly influenced by output shocks (η) when a central bank follows an inflation accommodating policy. Then, the optimal policy procedure for the Bank of Japan collapses to:

\[ i_t - E (\pi_{t+j} | \Omega_t) = \gamma \eta_t, \quad \gamma > 0 \] (2)

---

10) Please see Ball (1997), Bernanke and Woodford (1997), and Svensson (1997) for the details.
In general, the real interest rate is affected by price shocks as well as output shocks and exchange rate shocks. However, when a central bank fully accommodates inflation and strengthens its commitment to output control and when it does not care about exchange rates, the bank sets the real interest rate by reacting only to the output gap, although it changes the nominal rate in response to inflation.

The estimation results in the last section show that the Bank of Japan’s average reaction to inflation is one for the entire period. For the period after 1985, the Bank weakened its commitment to inflation stabilization and preemptively responded to the output gap. Also, the Bank was not significantly committed to the exchange rate gap. Now, the real interest rate is likely to be influenced mainly by output shocks, but not by price shocks. Therefore, we can identify when the Bank of Japan accommodated inflation by investigating the relationship between the real interest rate and output shocks.

### 3.2. Estimation method

In order to obtain output shocks, we use a recursive structural VAR, assuming that error terms in each regression equation are not correlated with the error in the preceding equations. Our system consists of four variables, being the exchange rate gap, the real GDP gap, the CPI inflation rate and the call rate. Thus, we can obtain the VAR residuals from the output equation as the estimate of output shocks.\(^{11}\)

---

\(^{11}\) We assume that all the gap variables as well as the call rate can be characterized as I(0) for the sample period of 1979–97. Actually, we rejected the null hypothesis of a unit root for all four variables at least at the 10% level, when we tested it based on the GLS-detrended Dickey-Fullar test (Elliot, Rothenberg and Stock (1996)) with the optimal lag length chosen by SBIC.
Before moving on to the estimation, we should note some points. First, we formulate our VAR system in gap terms (except for inflation rate and the call rate), instead of levels or differences. The main reason why we use this formula is derived from the theoretical foundation such as Ball (1997), Bernanke and Woodford (1997), Clarida, Gali and Gertler (1998) and Svensson (1997), which assume a macro model in gap terms with nominal rigidities to analyze the policy reactions and the optimal monetary policy rules. We also maintain consistency with the analysis in the previous section by using gap terms.

Second, we must be careful about the order of the variables since the estimation results often depend on it. The order of the variables is the exchange rate gap, the output gap and inflation rate, and we put the call rate in last place. This is because we would like to see the effects of accommodative monetary policies responding to both aggregate price and output shocks.1213

Analogous to Stock and Watson (2001), we incorporate the policy reaction function into the recursive VAR system.14 The error term of the policy reaction function can be thought of as a monetary policy shock, as it represents the extent to which actual call rate deviates

---

12) The macro models in Ball (1997) and Svensson (1997) assumed a recursive structure from an interest rate to the GDP gap and inflation rate. Although we put the call rate in last place assuming an accommodative monetary policy, setting the call rate in first place does not alter the results below.
13) For instance, BOJ Governor Sumita officially announced in May 1989 that the BOJ would often use accommodative monetary policy from that time. In addition, theoretical works such as Corsetti and Pesenti (2005) assume an accommodative monetary policy.
14) The policy reaction function becomes the interest rate equation in the recursive structural VAR.
from the forward-looking Taylor rule. This shock can be estimated by a regression with:

\[ i_t = \alpha i_{t-1} + \beta E[\pi_{t+1} | \Omega_t] + \gamma E[y_{t+m} | \Omega_t] + \delta E[z_{t+n} | \Omega_t] \]

as the dependent variable, and a constant and lags of the exchange rate gap, the GDP gap, inflation rate and the call rate as the independent variables.

3.3. Estimation results

The estimated output shocks as residuals in the output equation are shown in Figure 3. It also plots the real call rate, which we define as the difference between the nominal call rate and the one-year forecast of the CPI inflation rate. Again, we reiterate that the real interest rate is solely determined by output shocks when monetary policy is implemented in an accommodative manner.

Figure 3 clearly shows that these two variables move very closely in some particular periods. Those particular periods are from the beginning of 1987 to the first half of 1989 and from late 1993 to the end of the estimation period. The former period roughly corresponds to what is called the “bubble period” and the latter period is when the Japanese economy suffered from a deflation cycle. In contrast, in the period up to the mid-1980s, we cannot detect a close relationship between the real call rate and the estimated output shocks. This result evidently indicates that the Japan’s monetary policy after the Maekawa period (1985–97) remained poorly committed to inflation stabilization.
Figure 3: Output shocks and the real call rate

Figure 4: Exchange rate shocks and the real call rate

Note) The real call rate is the difference between the nominal call rate and the one-year forecast value of the CPI inflation rate. The output and the exchange rate shocks are the residuals from the corresponding equations in the recursive structural VAR.
4. Confirmation by a narrative analysis

In this section, we try to confirm the estimation results obtained in Section 1 through Section 3 by a narrative analysis. Table 3-A and 3-B show a record of the Bank of Japan’s monetary policy stance since 1979. These tables document relevant quotations of public or official announcements regarding the Bank of Japan’s judgments and policy goals from its *Monthly Bulletin* and the *Nikkei* newspaper. We can detect the evidence that supports the estimation results in the previous sections from this table.


In 1979 when Haruo Maekawa was appointed Governor of the Bank of Japan, the second oil crisis occurred and it brought about the rapid depreciation of the yen and the sharp hike of the domestic prices. As Table 3-A shows, in April 1979, the Bank of Japan started a preemptive attack on the inflationary pressures driven by the drastic depreciation of the yen (“On the raise of the discount rate”, *Monthly Bulletin*, April 1979). When the Bank raised the discount rate again in November 1979, the Bank emphasized that it was anxious all the more about the future inflation since wholesale prices had been firmly rising and the yen had been further declining (“On the raise of the discount rate”, *Monthly Bulletin*, November 1979).

Under the situation where the Bank of Japan was concerned about the domestic price inflation and the trend of the weak yen, the Bank decided a series of the raise of the discount rate in February and March 1980 to show its clear and strong stance against inflation.
Table 3-A: Monetary Policy Stance in the Maekawa period, 1979–84

<table>
<thead>
<tr>
<th>Month/Year</th>
<th>Quotations as for the official policy stance of the Bank of Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 1979</td>
<td>“We judged that inflationary pressure had risen above the warning line. Recently, the yen exchange rate is excessively depreciating. We decided to raise the discount rate by 0.75 percent to preemptively check inflation... and this device will also contribute to stabilizing exchange rates.” (“On the raise of the discount rate”, <em>Monthly Bulletin</em>, April 1979, p. 1). “Since excessive depreciation of the yen will have bad effects on price stability and trade balance, we need to fully care about the future movements of exchange rates.” (statement by Governor of the BOJ at the 33rd National Bankers Conference, <em>Monthly Bulletin</em>, June 1979).</td>
</tr>
<tr>
<td>November 1979</td>
<td>“Wholesale prices have been firmly rising and the yen has further depreciated recently, and therefore we are anxious all the more about future inflation. Considering the situation, the BOJ decided to raise the discount rate by 1 percent and expects that this raise will also contribute to stabilizing exchange rates.” (“On the raise of the discount rate”, <em>Monthly Bulletin</em>, November 1979, pp. 2–3).</td>
</tr>
<tr>
<td>February &amp; March 1980</td>
<td>“Under the situations where the BOJ concerned about domestic price inflation and basic trend of the weak yen, the BOJ decided a series of the raise of the discount rate on February and March 1980 to show its strong and clear policy stance against inflation... These consecutive monetary contractions aimed to preemptively check the spread of the inflationary pressure and minimize the evil effects of external factors on the domestic price movements.” (“Financial and economic conditions in 1979”, <em>Monthly Bulletin</em>, August 1980, p. 10).</td>
</tr>
<tr>
<td>August 1980</td>
<td>“Future inflation highly depends on how the yen exchange rate and oil price will move and also the future conditions of a demand-supply gap... We think that the price stability is the foundation of all economic policies.” (“On the reduction of the discount rate”, <em>Monthly Bulletin</em>, August 1980, pp. 3–4).</td>
</tr>
</tbody>
</table>

*Note:* These tables are based on the official announcements and statements by the policy board and Governors, reported in the BOJ’s *Monthly Bulletin* and the Nikkei newspaper.
Table 3-B: Accommodative Policy Stance in the 1990s

<table>
<thead>
<tr>
<th>Month Year</th>
<th>Quotations as for the official policy stance of the Bank of Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>July 1992</td>
<td>&quot;The series of easy-money policies which were carried out since the last summer aimed to attain balanced economic growth based on a judgment that general prices are in such a favorable circumstance.&quot; (On the recent financial and economic conditions, a lecture meeting by Governor Mieno, <em>Monthly Bulletin</em>, Jul. 1992, pp. 1–8). &quot;The economic situations of this time have some different features from those in the past... An autonomous adjustment mechanism that intrinsically exists in our economy came out to a great extent... The Japanese economy is in the autonomous adjustment process to correct the imbalance that was produced in the late 1980s&quot; (<em>Monthly Bulletin</em>, June 1992, p. 2).</td>
</tr>
<tr>
<td>February 1993</td>
<td>On the morning of 4 Feb., the BOJ held an extra policy board meeting and decided to reduce the discount rate by 0.75%. &quot;Aggregate demand remains stagnant since business firms and consumers have cautious attitudes, while the stability of general prices has become remarkably clear.&quot; (On the reduction of the discount rate, 4 Feb.).</td>
</tr>
<tr>
<td>July 1994</td>
<td>On 20 Jul., the BOJ announced its judgment on the economic situation, which signaled to markets that the economy was in recovery. A senior official in the Operations Department said on 21 Jul., &quot;We will not cool down the upward pressure on market interest rates since the BOJ's judgment on the economic conditions has changed&quot; (<em>The Nikkei newspaper</em>, 22 Jul.).</td>
</tr>
<tr>
<td>May 1995</td>
<td>A senior official of the BOJ said, &quot;The declines of market rates are just reflecting the slowdown of the economic recovery, and hence we do not regard them as excessive movements&quot; (<em>The Nikkei newspaper</em>, 31 May). &quot;Needless to say, a primary goal of the recent monetary policy is to recover from economic stagnation... Our economy is not in a deflationary spiral while both the CPI and the WPI continue to decline&quot; (On the recent monetary policy, a lecture meeting by Deputy Governor Fukui on 13 Nov., <em>Monthly Bulletin</em>, Dec. 1995, pp. 4–5 and 10–11).</td>
</tr>
<tr>
<td>April 1996</td>
<td>On 3 Apr., BOJ Governor Matsushita released an official statement, &quot;A gradual rise of long-term interest rates since late 1995 clearly shows a steady upturn of our economy... It is quite natural for market rates to rise as the economy recovers... Market interest rates are smoothly settling down to the consistent levels with the economic movements&quot; (<em>Monthly Bulletin</em>, May 1996, pp. 3–4). &quot;The risk of the ‘deflation cycle’ has been decreasing to a considerable extent. Price falls, based on the productivity growth through market competition and utilization of new technology, could rather make the national welfare be better off and enhance an opportunity to bring about a new economic development&quot; (On the issues of the recent financial and economic conditions and the Japanese financial system, by Governor Matsushita on 3 April, <em>Monthly Bulletin</em>, May 1996, p. 2).</td>
</tr>
<tr>
<td>July 1996</td>
<td>&quot;The GDP deflator has had fallen for six consecutive quarters... But, it seems to become evident that falls of general price levels will gradually stop... Our economy has prospects of being in a gradual and an autonomous recovery process&quot; (Judgment report for the economic conditions—Spring 1996—<em>, Monthly Bulletin</em>, May 1996, pp. 13–14).</td>
</tr>
</tbody>
</table>
Again, these consecutive contractions aimed to preemptively check the spread of the inflationary pressure and minimize the evil effects of external factors on the domestic price movements ("Financial and economic conditions in 1979", Monthly Bulletin, August 1980).

Later in 1980, the Bank of Japan moved to gradually cancel the severe contraction policy, but it still gave a first priority on inflation stabilization during the first half of the 1980s. The Bank of Japan’s official statements said, “Price stability is the foundation of all economic policies” ("On the reduction of the discount rate", Monthly Bulletin, August 1980), and “The Bank of Japan will manage to assist continuous economic growth based on the future price stability” ("On the reduction of the discount rate", Monthly Bulletin, December 1981 and October 1983).

Thus, these narrative findings clearly support the estimated statistical significance of the strong commitment to inflation stabilization during the Maekawa period.

4.2. After the Maekawa period: 1985–97

Table 3–B shows the Bank of Japan’s accommodative policy stance in the 1990s. The table seems to indicate that the Bank consistently overestimated the self-correcting mechanism of the Japanese economy and accommodated those price conditions, in particular, where the estimated output shocks revealed close movements with the real call rate.

15) As for the accommodative policy stance during the bubble period (1987–90), please see Jinushi et al. (2000).
Facing successive negative output shocks in 1992–93, the Bank said, “An autonomous adjustment mechanism that intrinsically exists in our economy came out to a great extent... The Japanese economy is in the autonomous adjustment process to correct the imbalance that was produced in the late 1980s.” (Monthly Bulletin, June 1992), and “It is desirable that general prices have come to show stable movements... The series of easy money policies... are based on a judgment that general prices are in such a favorable circumstance.” (Monthly Bulletin, July 1992).

From the beginning of 1994, there were faint but favorable output shocks to show that the economy would improve. Some economic indicators such as the real GDP growth, consumption indices, business prospects and machinery orders revealed relatively good sign. Under the situation, the Bank of Japan put a strong weight on output stabilization and often accommodated the deflationary movements of general prices. It is noteworthy that this period coincides with the period when the real call rate moved very closely with the estimated output shocks.

The following statements evidently show the passive treatment of price deflations:16)

“Needless to say, a primary goal of the recent monetary policy is to recover from economic stagnation... Our economy is not in a deflationary spiral while both the Consumer Price Index and the Wholesale Price Index continue to decline.” (“On the recent monetary policy”,

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16) The following statements by the BOJ indicate that the problem is not just due to prediction errors about the future course of the economy, but a problem of the change in the policy stance.
“A gradual rise of long-term interest rates since late 1995 clearly shows a steady upturn of our economy.... It is quite natural for market rates to rise as the economy recovers.... Market interest rates are smoothly settling down to the consistent levels with economic movements.”¹⁷ “The risk of the ‘deflation cycle’ has been decreasing to a considerable extent.... Price falls, based on the productivity growth through market competition and utilization of new technology, could rather make the national welfare be better off and enhance an opportunity to bring about a new economic development.”¹⁸ “The GDP deflator has fallen for six consecutive quarters.... but, it seems to become evident that falls of general price levels will gradually stop.... Our economy has prospects of being in a gradual and autonomous recovery process.”¹⁹

In summary, the estimated poor commitment to inflation stabilization and strong emphasis on output control after the Maekawa period can be verified by the facts based on a narrative analysis. Moreover, the co-movement of the estimated output shocks and the real call rate is not a pure coincidence, but indeed it reflects the actual accommodative policy stance by the Bank of Japan.

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¹⁸) “On the issues of the recent financial and economic conditions and the Japanese financial system,” a lecture meeting by Governor Matsushita on 3 April (Monthly Bulletin, May 1996, p. 2)
5. **Monetary policy effects on price movements**

We now move on to our third aim of this paper. That is, in this section, we verify that the inflation accommodating policy after 1985 actually allowed a self-fulfilling deterioration in the Japanese economy. The theoretical findings by Bernanke and Woodford (1997) and the simulation results by Bernanke and Gertler (1999) suggest that such a policy can give rise to a devastated economic situation. Clarida et al. (2000) also show that supply shocks alone cannot account for the persistent inflation (deflation) without an accommodative monetary policy. These findings imply that monetary policy could have been an important sustainable force of the boom-bust cycle in the late 1980s and the successive deflation over the recent decade.

These previous works, however, lack empirical evidence that a poor commitment to stabilizing inflation indeed led to the self-deterioration in economies, because they did not have an experience to test. Fortunately (or unfortunately), the Japanese economy has had such an experience. Based on the recursive VAR system in the previous section, we show that such a passive or accommodative policy actually destabilized both inflation and output.

5.1. **Impulse response functions**

The consistent estimators of the impulse responses for the recursive VAR, with the Choleski ordering of the exchange rate gap, the real GDP gap, the CPI inflation rate and the call rate, are plotted in Figures 5 and 6. We also plotted ±2 standard error bands, which yield an approximate 95 percent confidence interval for each of the

28 ©
Figure 5: Impulse responses of monetary policy shocks (full sample period)

Response to Cholesky One S.D. Innovations ± 2 S.E.

A. Response of EGAP to CALL

B. Response of IGAP to CALL

C. Response of GGAP to CALL

D. Response of CALL to CALL

(Note)
The Cholesky ordering is Egap (the yen-dollar exchange rate gap), Ggap (the real GDP gap), Igap (the CPI Inflation rate) and Call (the nominal call rate).

impulse responses.20)

Panel A through D of Figure 5 show the results for the entire estimation period. Those reveal the effect of one standard deviation shock in the nominal overnight call rate on the exchange rate gap, the output gap, the CPI inflation rate and the call rate itself. We should interpret the results carefully, since our full sample includes both the

20) Again, setting the call rate in first place does not alter the results below, although we put the call rate in last place assuming an accommodative policy.
“Maekawa period” when the Bank of Japan was preemptively and strongly committed to inflation stabilization and the “after the Maekawa period” when the Bank inclined to implement an inflation accommodating policy.

However, the estimated impulse response functions seem to imply that Japan’s monetary policy made inflation and other policy goals reasonably stable for the entire period (probably owing to the strong commitment to inflation stabilization during the Maekawa period). An unexpected raise of the nominal call rate brings about a sharp appreciation of the yen. The yen begins to appreciate in response to an unexpected monetary contraction and reaches a peak in the fifth quarter. While the policy impact gradually decreases after the peak, it leaves a dominant effect on the exchange rate after four years.

More importantly, preemptive and active monetary policy before 1985 seems to succeed in stabilizing both inflation rate and output. Panel B shows that an unexpected increase in the call rate is associated with a considerable contractionary effect on the CPI inflation rate after three quarters. Its negative impact statistically significantly produces a 0.35 percentage point decrease in the inflation rate within two years. This implies that the raising of the nominal call rate by one percentage point brings about an approximately 0.6 percentage point decrease in the inflation rate in two years.

As for the monetary policy impact on the real GDP (Panel C), it is not as clear as those for the exchange rate and the inflation rate. However, the real GDP gap drops sharply right after a tightening policy. It is reduced by approximately 0.5 percentage points within six quarters almost with the significance level of 5 percent, although this nega-
Figure 6: Impulse responses of monetary policy shocks (1985–97)

Response to Cholesky One S.D. Innovations ± 2 S.E.

A. Response of EGAP to CALL

B. Response of IGAP to CALL

C. Response of GGAP to CALL

D. Response of CALL to CALL

(Note)
The Cholesky ordering is Egap (the yen-dollar exchange rate gap), Ggap (the real GDP gap), Igap (the CPI Inflation rate) and Call (the nominal call rate).

tive impact gradually fades out after the seventh quarter.

As such, we can infer that the preemptive and active policy during the Maekawa period contributed to reducing the fluctuations of the yen-dollar exchange rate and succeeded in stabilizing both the inflation rate and output.

When we extract the monetary policy effects after 1985, the results are quite different. As Figure 6 shows, the monetary policy shock of one standard deviation produces procyclical effects on both inflation and output. The output gap statistically significantly rises by approxi-
mately 0.6 percentage points within the year after the rate hike and it eventually increases by approximately 0.2 percentage points (Panel C). This implies that an accommodative reduction of the rate by one percentage point corresponds to an approximately 1.2 percentage point decrease in the output gap within a year.

Although inflation oscillates over one year and a half, it rises by 0.15 percentage points eventually. Again, this implies that an accommodative reduction of the nominal call rate by one percentage point corresponds to an approximately 0.3 percentage point deflation after two years.

Consequently, we might be able to conclude that there is a high possibility that the inflation accommodating policy after 1985 indeed accommodated a self-fulfilling deterioration in the Japanese economy although it might not be a leading force to bring about the deterioration.

5.2. Forecast error variance decompositions

Some features to support the above results can be found in the forecast error variance decomposition shown in Tables 4 and 5.

For the entire estimation period, around forty percent of the error in the forecast of the exchange rate gap is attributed to the call rate shock and seventeen percent of the error in the forecast of inflation rate is attributed to the rate shock at the four year horizon. Further, the attributions of the nominal call rate are the likeliest explanation of the forecast errors of the exchange rate gap and inflation rate other than their own attributions of the dependent variables.

During the period after 1985, the case for the call rate becomes
Table 4: Variance decompositions from the recursive VAR (full sample)

A: Variance decomposition of the exchange rate gap

<table>
<thead>
<tr>
<th>Forecast horizon</th>
<th>Exchange rate</th>
<th>Output</th>
<th>Inflation</th>
<th>Call rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>4</td>
<td>73.107</td>
<td>4.479</td>
<td>0.334</td>
<td>22.081</td>
</tr>
<tr>
<td>8</td>
<td>54.620</td>
<td>6.831</td>
<td>3.160</td>
<td>35.389</td>
</tr>
<tr>
<td>12</td>
<td>46.068</td>
<td>7.397</td>
<td>6.903</td>
<td>39.631</td>
</tr>
<tr>
<td>15</td>
<td>42.400</td>
<td>7.561</td>
<td>8.733</td>
<td>41.306</td>
</tr>
</tbody>
</table>

B: Variance decomposition of the output gap

<table>
<thead>
<tr>
<th>Forecast horizon</th>
<th>Exchange rate</th>
<th>Output</th>
<th>Inflation</th>
<th>Call rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.589</td>
<td>98.411</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>4</td>
<td>6.847</td>
<td>91.126</td>
<td>0.054</td>
<td>1.973</td>
</tr>
<tr>
<td>8</td>
<td>4.909</td>
<td>84.353</td>
<td>2.970</td>
<td>7.768</td>
</tr>
<tr>
<td>12</td>
<td>4.032</td>
<td>80.696</td>
<td>7.188</td>
<td>8.083</td>
</tr>
<tr>
<td>15</td>
<td>3.735</td>
<td>78.217</td>
<td>10.401</td>
<td>7.647</td>
</tr>
</tbody>
</table>

C: Variance decomposition of inflation rate

<table>
<thead>
<tr>
<th>Forecast horizon</th>
<th>Exchange rate</th>
<th>Output</th>
<th>Inflation</th>
<th>Call rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.007</td>
<td>0.114</td>
<td>99.879</td>
<td>0.000</td>
</tr>
<tr>
<td>4</td>
<td>7.117</td>
<td>2.351</td>
<td>89.003</td>
<td>1.529</td>
</tr>
<tr>
<td>8</td>
<td>8.117</td>
<td>9.516</td>
<td>69.949</td>
<td>12.418</td>
</tr>
<tr>
<td>12</td>
<td>7.031</td>
<td>13.349</td>
<td>62.751</td>
<td>16.869</td>
</tr>
<tr>
<td>15</td>
<td>7.415</td>
<td>14.131</td>
<td>61.409</td>
<td>17.045</td>
</tr>
</tbody>
</table>

much weaker than that for the entire period and this fact may derive from the inflation accommodating policy after 1985. Only nine percent of the error in the forecast of the exchange rate gap is attributed to the call rate shock and eight percent of the error in the forecast of in-
Table 5: Variance decompositions from the recursive VAR (1985–97)

A: Variance decomposition of the exchange rate gap

<table>
<thead>
<tr>
<th>Forecast horizon</th>
<th>Exchange rate</th>
<th>Output</th>
<th>Inflation</th>
<th>Call rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100.000</td>
<td>0.000</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>4</td>
<td>84.767</td>
<td>1.627</td>
<td>2.038</td>
<td>11.568</td>
</tr>
<tr>
<td>8</td>
<td>73.650</td>
<td>6.426</td>
<td>4.353</td>
<td>15.572</td>
</tr>
<tr>
<td>12</td>
<td>53.063</td>
<td>17.214</td>
<td>18.510</td>
<td>11.213</td>
</tr>
<tr>
<td>15</td>
<td>44.317</td>
<td>20.281</td>
<td>25.922</td>
<td>9.480</td>
</tr>
</tbody>
</table>

B: Variance decomposition of the output gap

<table>
<thead>
<tr>
<th>Forecast horizon</th>
<th>Exchange rate</th>
<th>Output</th>
<th>Inflation</th>
<th>Call rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.494</td>
<td>99.506</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>4</td>
<td>5.529</td>
<td>76.966</td>
<td>3.272</td>
<td>14.233</td>
</tr>
<tr>
<td>8</td>
<td>4.479</td>
<td>64.225</td>
<td>20.739</td>
<td>10.557</td>
</tr>
<tr>
<td>12</td>
<td>3.537</td>
<td>57.193</td>
<td>30.569</td>
<td>8.702</td>
</tr>
<tr>
<td>15</td>
<td>3.592</td>
<td>54.499</td>
<td>33.869</td>
<td>8.040</td>
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</tbody>
</table>

C: Variance decomposition of inflation rate

<table>
<thead>
<tr>
<th>Forecast horizon</th>
<th>Exchange rate</th>
<th>Output</th>
<th>Inflation</th>
<th>Call rate</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2.343</td>
<td>3.009</td>
<td>94.648</td>
<td>0.000</td>
</tr>
<tr>
<td>4</td>
<td>3.259</td>
<td>8.240</td>
<td>85.648</td>
<td>2.853</td>
</tr>
<tr>
<td>8</td>
<td>4.495</td>
<td>14.604</td>
<td>75.888</td>
<td>5.014</td>
</tr>
<tr>
<td>12</td>
<td>2.788</td>
<td>31.104</td>
<td>58.655</td>
<td>7.454</td>
</tr>
<tr>
<td>15</td>
<td>2.133</td>
<td>34.126</td>
<td>55.395</td>
<td>8.346</td>
</tr>
</tbody>
</table>

Inflation rate is ascribed to the rate shock at the four-year horizon. Moreover, the attribution of the nominal call rate is the least likely explanation of the forecast errors of the exchange rate gap and is second unlikeliest to capture those for the inflation rate.
6. Concluding remarks

The Bank of Japan was not always aggressively committed to inflation stabilization throughout the period since 1979. Although it had preemptively attacked high inflation during the Maekawa period, it began to inadequately address future inflation and put much more emphasis on output control after 1985. The outcome was that such an inflation accommodating monetary policy gave rise to the sustainable force of the boom-bust cycle in the late 1980s and the successive deflation over the decade.

The policy implication of this paper is quite straightforward. Monetary policy should actively and preemptively offset early inflationary or deflationary pressures. Judging from Japan’s experience, particularly the relatively good performance during the Maekawa period, we might be able to conclude that contemporary central banks would obtain better macroeconomic outcomes by committing preemptively and aggressively to inflation stabilization.

References

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On Self-fulfilling Deterioration in an Economy in the Accommodative Monetary Policy Regime


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The *Nikkei* newspaper. each issue.

**Data appendix I: Forecast data**

Forecasts of inflation rate \( \mathbb{E}[\pi_{t+j} | \Omega_t] \) and output level \( \mathbb{E}[y_{t+m} | \Omega_t] \):


Forecasts of the yen-dollar exchange rate \( \mathbb{E}[z_{t+n} | \Omega_t] \):

*Market Data Survey* published by *The Japan Center for International Finance*.

The *Survey* provides only one-month, one-quarter and two-quarter forecasts of the yen-dollar rate and longer term forecasts than two quarters are not available. Hence, we used the two-quarter forecast when we estimated the reaction function including longer term forecasts of inflation rate and the output gap than two quarters (that is, \( n = 1 \) when \( j = m = 1 \), and \( n = 2 \) when \( j = m \geq 2 \)).

The Real GDP:

*The Economic and Social Research Institute, Cabinet Office.*
The Consumer price indexes of Japan and the U.S:  
*International Financial Statistics* published by the IMF.

The Nominal yen-dollar exchange rate:  
*The Bank of Japan.*

**Data appendix II: The Construction of the Potential real GDP**

The potential real GDP

In this paper, we employ the production function approach to calculate the potential GDP in Japan. Previous works such as The Economic Planning Agency (2000), Kamata and Masuda (2001) and Miyao (2004), utilized the Solow residual derived from the Cobb-Douglas type production function to calculate the potential GDP. Here, we adopt the same method, in particular, shown in Kamata and Masuda, ibid.

Then, the production function can be expressed:

\[ \ln Y_t = \ln A_t + (1 - \alpha) \ln \lambda K_t + \alpha \ln L_t \]

where, \( Y_t \) is the level of the real GDP, \( K_t \) is the capital stock level, \( L_t \) is the total labor hours (defined as ‘working population’ multiplied by ‘working hours’), and \( A_t \) is the Solow residual. All of the variables are defined in period \( t \). The operating ratio of capital and the coefficient labor input are expressed as \( \lambda \) and \( \alpha \), respectively. The parameter \( \alpha \) is defined as ‘Compensation of employees’ divided by ‘total income’, assuming the perfect competition.

We construct the operating ratio \( \lambda \) as the next step. Since the economy consists of manufacturing and non-manufacturing sectors, \( \ln \lambda K_t \) can be written as:

\[ \ln \lambda K_t = \ln (\lambda_{m} K_{m,t} + \lambda_{nm} K_{nm,t}) \]
where, \( m \) indicates the manufacturing industry and \( nm \) indicates the non-manufacturing industry. Unfortunately, the operating ratio of capital in the non-manufacturing industry \( \lambda_{nm} \) is not available.

Previous works usually assumed that the operating ratio of the non-manufacturing industry was always 100\%, and the measurement error was included in the Solow residual (\( \ln A_t \)). On the other hand, Kamata et al., ibid. and Miyao, ibid. argued that we should have calculated the TFP (Total Factor Productivity) correctly and hence they recommended utilizing the BSI (Business Survey Index) of the non-manufacturing industry. In addition, Miyao, ibid. defined the peak of the BSI as the full operation level of capital.

We basically follow Miyao’s method, but there is another problem: obtaining a reliable measure of the potential GDP level. While our sample period is from the first quarter of 1979 to the third quarter of 1997, the BSI is only available from the second quarter of 1983. Hence, we constructed an appropriate proxy for the operating ratio of the non-manufacturing industry from the first quarter of 1979 to that of 1983, which was the ‘average of the operating ratio and the Index of Industrial Production of the manufacturing industry’. This series can be most smoothly connected to the series based on the BSI at the second quarter of 1983.

As a result, the potential real GDP (\( \bar{Y}_t \)) can be calculated as follows:

\[
\ln \bar{Y}_t = \ln \bar{A}_t + (1 - \alpha) \ln \lambda K_{\text{max}} + \alpha \ln L_{\text{max}},
\]

where, \( K_{\text{max}} \) is the full capital stock level and \( L_{\text{max}} \) is defined as the ‘maximum working population’ multiplied by the ‘maximum labor hours’, which is analogous to Kamata et al., ibid.
Data source

· The long run elasticity of the exchange rate pass-through
  Campa and Goldberg (2002), p. 11, Table 1.

· Consumer Price Index
  Main Economic Indicators, OECD

· Real GDP level, Compensation of Employees and Total Income
  68SNA (Seasonal Adjusted) in Annual Report on National Account, Cabinet Office

· Capital Stock
  Capital Stock on Private Sector (68SNA) with adjustment of privatization, Cabinet Office

· Working Population
  Labor Force Survey (for All Industries), Ministry of internal Affair and Communication

· Working hours
  Monthly Labour Survey (All Industries, company with more than 30 employees), Ministry of Health, Labour and Welfare

· Business Survey Index
  Business Survey Index for Capital Investment (Large Company, Non-manufacturing), Ministry of Finance

· Operating Ratio of Capital
  Indices of Operating Ratio of Manufacturing (1995 = 100), Ministry of Economics, Trade and Industry

· Maximum Working Population
  We separate two categories: (1) from 15 to 64 years old and (2) more than 65 years old. Then, we adjust the linear trend of working population to the peak of original data for each category, and we
add up these two adjusted linear trends.

· *Maximum Working hours*

  *In designed hours:* As for each sample of (1) 1978: 1–1987: 4, (2) 1988: 1–1993: 4 and (3) 1994: 1–1997: 3, we calculate the linear trend and adjust them to the peak of original data.

  *Out of designed hours:* We adjust the linear trend of working hours to the peak of original data. Then, we add up these two adjusted linear trends.

(Received: March 2, 2015)
Summary

On Self-fulfilling Deterioration in an Economy in the Accommodative Monetary Policy Regime

Yoshihiro KUROKI

Unfortunately, Japan has had first-hand experience to confirm that an inflation accommodating policy assists self-deterioration in an economy.

Unlike previous contributions, we find that the Bank of Japan was poorly committed to inflation stabilization for our full sample period of 1979–97. Although the Bank had aggressively stabilized inflation during the period of Governor Maekawa (1979–84), it accommodated inflation in a short-sighted manner and emphasized output control after 1985. In particular, we identify that the Bank strengthened its accommodative policy stance during the bubble period (1987–89) and the deflation period (1993–97). We present empirical evidence that such an accommodative policy regime could be a sustainable force of the boom-bust cycle in the late 1980s and the successive persistent deflation.

We believe that the experience of the Bank of Japan has important implications for other contemporary central banks.