

THE CREDIBILITY OF MONETARY POLICY: A COMPARISON BETWEEN THE BANK OF JAPAN AND THE FEDERAL RESERVE

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I. INTRODUCTION

There has been an increasing interest in the Japanese economic policy in recent years among the policy-makers and academic economists as well since Japan has been able to maintain strong output growth, while avoiding the continual inflationary pressures that followed the second oil-shock in 1979. This is clearly contrasting to the experience of the U.S. Although the U.S. has eventually succeeded in bringing down the double-digit inflation of the late 1970s to a low single-digit level, it came only after undergoing a severe reduction in real output growth during 1981-82.

It has been frequently argued that Japan's successful macroeconomic performance is attributable to the Bank of Japan's successful monetary policy. The Bank of Japan (BOJ hereafter) undertook a major shift in its conduct of monetary policy in the mid-1970s into emphasizing the monetary aggregate of $M2 + CD$. Friedman (1985) argues that "The Bank of Japan has been the least monetarist central bank in its rhetoric, the most monetarist in its policy", citing the stable pattern of money growth in Japan as opposed to that of the U.S. Meltzer (1986 b), on the other hand, characterizes the BOJ's monetary policy as a "credible" policy in the sense that it is very predictable, and attributes the Japanese macroeconomic success to the BOJ's credible monetary policy.

Whether the BOJ's monetary policy is "monetarist" or not is not an easy question to answer because monetarism has many different facets. Dotsey (1986), for example, argues that "Japan achieves results that are monetarist in nature without using the procedures frequently advocated by monetarists." He argues that, contrary to some allegations, the environment in which monetary policy is implemented in Japan is quite similar to that of the U.S. with the exception of the discount window. The so-called 'window guidance' in Japan, he argues, works as a signalling device that affects the forecastability and variance of interest

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rates.

In this paper, I investigate the BOJ's conduct of monetary policy from the perspective of credibility hypothesis. This is an extension of the Meltzer's study. He investigates the predictability of the Japanese monetary policy as Japan switches from the Bretton Woods pegged exchange rate system to a managed floating exchange rate system. While change of the foreign exchange rate system has an important bearing on the conduct of the monetary policy in Japan, this approach does not capture the exact nature of the Japanese monetary policy regimes because there are other important features in the Japanese institutions such as the window guidance, and in the changes made by the BOJ since the mid-1970s such as increased emphasis on the M2+CD monetary aggregate and announcement of BOJ's projection of M2+CD growth. I will also compare the effect of the different credibility of the monetary policies of Japan and the U.S. during the recent decade and this will provide a valuable lesson for the Federal Reserve in its conduct of monetary policy.

This paper is organized as follows: section II describes important developments in Japanese monetary policy environment during the postwar period along with macroeconomic changes. Section III explains the credibility hypothesis in the context of the effect of monetary policy. Section IV presents empirical results of Japan and the U.S. on the predictability of the monetary policy. Section V ends the paper with conclusion and policy implications.

II. CHANGES IN THE MONETARY POLICY ENVIRONMENT OF JAPAN

The Japanese economic history during the postwar period can be divided into two periods: the rapid growth period(1956-1973) and the slow growth period(1974-). The monetary policy conducted by the BOJ differs sharply in each period in its long-term goal and intermediate targets used.

1. The Rapid Growth Period

During the rapid growth period, the real GNP grew at an average 10%, while inflation continued at an average 6%. The money supply growth fluctuated widely between about 15% decline when a tight money policy is pursued and about 25% rise when a loose money policy is pursued. This fluctuation in the money supply growth was in large part due to the balance of payments fluctuations under the Bretton Woods pegged exchange rate system. This fluctuation in the money supply growth was followed by fluctuation in the nominal GNP with a few quarter lags.

The flow of funds in this period was characterized by the large personal sector surpluses, large corporate sector deficits and relatively small government sector deficits. The first oil shock came at a time when the Japanese government greatly expanded its expenditure in 1972-73 and when the BOJ adopted an excessively

easy money policy and hence inflation accelerated. Although the money supply growth was slowed down in early 1973, it remained well over 20% until the oil price hike started.

2. The Slow Growth Period

During the slow growth period which started with the first oil shock in 1973, the average real output growth fell to about 5%, approximately half the pre-oil shock level. The BOJ had an extremely tight monetary policy in response to accelerating inflation in 1973 and to the sharp oil price hike. This, coupled with a low 1976 "shunto rate"(i.e., the wage rate set in a series of the labor-management negotiations in the spring offensive in Japan), the slowed productivity growth in the 1970s since the oil shock, and the existence of excess capacity and stagnant aggregate demand, has helped to ease the inflationary expectations. This has led the inflation rate to stay at a relatively low level throughout the 1970s.

3. Macroeconomic Performance Since the Second Oil Shock

The second oil shock in 1979 which raised the import price of crude oil 2.8 times in Japan did not have as significant effect on inflation as the first oil shock. While prices of import oil and other oil related products rose sharply, the prices of the domestic products did not go up much. This was partly due to the existence of excess production capacities and the BOJ's timely tight money policy in response to the oil price hike. Another factor would be the flexible real wages in the Japanese labor market. Real wages in Japan are very responsive to the market forces, namely the past and expected inflation rate, labor market conditions and corporate profits. Bonuses and overtime payments account for one quarter to one third of workers' annual income and these two components are very flexible, thereby making the overall wage even more responsive to market forces. Therefore, in times of slack demand, wages do not go up fast, alleviating the pressure of the inflation.¹

4. Bank of Japan's Conduct of Monetary Policy

As the Japan's macroeconomic picture changed significantly between the rapid growth and the slow growth period, so did the conduct of monetary policy by the BOJ. During the rapid growth period, the BOJ had focused its monetary policy

¹Many Japanese economists argue that the real wage in Japan is very flexible in its response to market forces. See, for example, Suzuki (1986), and Komiya and Yasui (1984). Especially, the latter authors explain the structure of the Japanese labor market including the employment pattern, and the determination of nominal wages in great detail. Also, despite the prevalence of the lifetime employment, the lack of long-term contracts (i.e., majority of labor contracts are renegotiated annually in the spring offensive) has led Parkin (1984) to argue that the New Classical, not the New Keynesian, model explains the Japanese economy better.

on directly providing low-cost credit to the corporate sector which had perennial shortage of liquidity due to rapid expansion. As the Table 1 shows below, the money growth rate was much higher in this period than in the slow growth period. However, the importance of money in determining the aggregate demand and the price level was largely overlooked by policy-makers and academic econ-

Table 1. Sample Means and Variance of the Log Levels and Growth Rates of Actual Data

	Japan		United States	
	Mean	Variance	Mean	Variance
1959:I-1975:II				
Deflator (P)	3.7603	0.0813	4.4178	0.0312
Real GNP (y)	11.5147	0.2024	6.8790	0.0339
M1	9.3498	0.6741	5.2301	0.0523
M2+CD	10.3916	0.5784		
MB			4.0762	0.0658
RCALL	0.0807	0.0004		
RTB		0.0003	0.0461	0.0003
G _P	0.0163	0.0010	0.0095	0.00004
G _y	0.0220	0.0004	0.0083	0.0001
G _{M1}	0.0424	0.0001	0.0111	0.0007
G _{M2+CD}	0.0422			
G _{MB}			0.0126	0.00004
1975:III-1985:IV				
Deflator (P)	4.5900	0.0074	5.1786	0.0420
Real GNP (y)	12.3679	0.0186	7.2995	0.0073
M1	11.0869	0.0300	6.0287	0.0525
M2+CD	12.2091	0.0805		
MB			4.9867	0.0541
RCALL	0.0689	0.0003		
RTB			0.0879	0.0009
G _P	0.0074	0.0000	0.0151	0.0000
G _y	0.0116	0.0000	0.0081	0.0001
G _{M1}	0.0150	0.0002	0.0195	0.0007
G _{M2+CD}	0.0242	0.0003		
G _{MB}			0.0191	0.0000

Notes: ^aMB is monetary base, RCALL is the Japanese call money rate, RTB is the 3-month Treasury bill rate of the U.S. and G_x is the growth rate of variable x.

^bAll level variables are logarithmic values, except the interest rates.

^cMonetary aggregates and real GNP of Japan are expressed in yen.

omists as well until 1972–73 when Japan had significant inflation. This was due to the predominant influence of the Keynesian economics in Japan at the time.

The main means of controlling the overall liquidity was the BOJ's direct lending to the large city banks through the discount window. Through this lending, they could affect the short-term interbank rate, called call rate. The Bank's day-to-day conduct of monetary policy has focused on this interbank market which consists of call loans and commercial bills. Financial sector was heavily regulated and interest rates were controlled at a rate below the market-clearing level.

The most significant development in the BOJ's conduct of monetary policy is that they began to watch the money supply as an intermediate target for monetary policy from 1975 and that they began in July 1978 to announce the forecasts of money growth. This meant that the BOJ deemphasized the credit control and encouraged the interest rate flexibility. Since they adopted the broad money as the intermediate target, the money supply growth became much more stable, 2.5% deviation from the trend growth. The monetary aggregate targeting used by the BOJ was, however, very different in many ways from that used by the Federal Reserve in recent years: first, broad money, $M2+CD$, instead of $M1$, was used as an intermediate target, because the aggregate shows a high correlation with nominal expenditure with 4–6 quarter lag.² Second, the period of targeting is a year. That is, the forecast of the percentage of change over the one-year period ending in the next month is announced by the BOJ. Third, it is not the target, but the "forecast" of money growth that is announced quarterly. At the beginning of each quarter, the Bank announces its projection for the four quarters ending one quarter ahead. This forecast, however, contains information about the BOJ's stance on the monetary policy for the future and has fared very closely to the actual path of the money growth since its inception and this made the BOJ's policy very credible.^{3,4} This is explained in more detail below.

²While there are arguments that a broad measure of money such as $M2+CD$ shows a more stable relation to GNP in Japan, Ishida (1984) argues that in the midst of financial innovation in Japan, the Divisia monetary aggregates are superior to ordinary monetary aggregates in the sense that they have more stable relationship with GNP than the simple-sum aggregate and that the money demand functions using Divisia monetary aggregates are more stable than when ordinary aggregates are used.

³Another aspect that makes the BOJ's policy credible is the so-called window guidance, which is a direct quantitative control at the discount window. While the extent and effectiveness of this process is open to debate, it certainly has the element of signalling process in which the BOJ communicates some of the information to the city banks, thereby making the Bank's policy more predictable (see, Dotsey (1986)).

⁴This is in sharp contrast to the case of the Federal Reserve in the U.S.. The Fed's announced target has often been outpaced significantly by the actual money growth. This, coupled with a highly volatile change of money supply growth, has made the Fed's policy highly incredible.

The BOJ's switch of policy to a monetary targeting was influenced by the experience of a significant inflation in 1972-73 and the difficulty of using interest rate as an indicator of monetary policy stance (The latter is well explained in the Milton Friedman's theory of interest rate). Suzuki (1986) argues that the correlation between loan increase and nominal GNP disappeared in early 1970s, whereas that between money and GNP remained strong and this was one of the influences, too.

Another phenomenon to note in Japanese economy since the first oil shock is a sharp increase in the government deficits.⁵ This has helped the bond market in Japan grow rapidly and the BOJ has used the open market operation more frequently as a tool of controlling the money supply. Also, the yield on central government bond began to be more importantly used as an operating variable for the BOJ's monetary policy.

An interesting question to ask about the BOJ's monetary policy is whether it has been Keynesian fine-tuning or Monetarist x percent rule or any combination of the two. Suzuki (1986) argues that it is neither of the two. It is discretionary in that it allows for a gradual tuning and it conforms to a rule in the sense that it stabilizes money growth as much as possible and gives information to the public about policy in the form of announcement of forecasts. He calls it an eclectic gradualism.

III. THE CREDIBILITY OF MONETARY POLICY

Traditional economic analysis treats policymakers' behavior as determined exogenously. However, the recent literature has explicitly focused on the motives, constraints, and information of the policy-makers and their game-theoretic approach toward the public in determining the outcome of their policies. One of the important aspects of this line of research is the emphasis paid to the credibility of the policies in determining the outcome of the policies.⁶

Credibility can be defined in different ways depending on the models used. One general way to define it is the extent to which the public believes that a change in policy has taken place when such a change has actually occurred.⁷

Another aspect of the Fed's policy-making is its excessive degree of secrecy. For the defense of secrecy by the Fed and critique on the Fed's argument, see Goodfriend (1986).

⁵This was caused by a sharp increase in government spending due to inflationary hike of salaries of government workers and social security payments and by a substantial decline in tax revenue due to a tax cut in 1974 and a decline of firms' profits.

⁶Fellner (1976, 1979) was the first one to introduce the idea of credibility into macroeconomics.

⁷Cukierman and Meltzer (1986), for example, define credibility as the speed with which the public recognizes that a change in the policymakers' objective has actually occurred. Under this formulation, credibility is a parameter. In models with two types of policymakers like in Barro (1985), credibility (or reputation) is a state variable, namely a subjective probability assigned by

Credibility is important in determining the outcome of the monetary policies because the ability of the policy-makers to achieve their future goals depends on the inflationary expectations of the public. The inflationary expectations of the public depend, in turn, on the public's perception of the credibility of the policy-makers. For example, the less credible a disinflationary policy is, the more severe the adverse effects of the policy will be. This can be seen clearly from the Lucas-type supply curve:

$$y_t - \bar{y}_t = a_0(y_{t-1} - \bar{y}_{t-1}) + a_1(\pi_t - E_{t-1}\pi_t) + v_t \quad (1)$$

where y_t (\bar{y}_t) is the logarithm of actual (natural) output, π_t is actual inflation rate, $E_{t-1}\pi_t$ is the (subjective) expected inflation, and v_t is a random disturbance term.⁸ It holds that $0 \leq a_0 < 1$ and $a_1 > 0$. This states that inflation can be lowered with little adverse effect on real output provided that the reduction is correctly anticipated. Of course, the anticipation of inflation change can be significantly affected by the credibility of the policies adopted by the authorities.

Credibility of the monetary policy can be enhanced when announcements are made by the authorities as to the future movement of the monetary targets, or when central bank regularly communicates with commercial banks. Announcement, even if noisy, enhances the credibility by reducing the public's uncertainty about the future growth of money supply.⁹

The Fellner's hypothesis that the cost of a disinflationary policy will be smaller when the public believes that the disinflation will be in fact carried out has been challenged by B. Friedman (1984) and Gordon (1983). They argue that conventional Phillips curve relationships are consistent with the disinflationary episode when pre-1980 data are used, thus refuting the relevance of the credibility hypothesis and the Lucas critique. On the other hand, some models have been developed in the line of the credibility hypothesis (see, Barro and Gordon (1983a, 1983b), Cukierman and Meltzer (1986)). Barro and Gordon argue that the reputational equilibrium in the Central bank's monetary policy is a weighted

the public to the event that the policymaker is strong.

⁸McCallum (1984) points out that rational expectations hypothesis, which implies that $E_{t-1}\pi_t = E(\pi_t | I_{t-1})$ where E is mathematical expectations operator and I_{t-1} is the information set available at $t-1$ in neither necessary nor sufficient for the credibility hypothesis.

⁹Announcements by the central banks have been the trend in recent years. In the United States, the Humphrey-Hawkins Act required the Federal Reserve to announce planned rate of growth of key monetary aggregates. This is intended to provide more information to the public and Congress about the policy actions taken by the Fed. Similar announcements have been practiced in U.K., Germany, Japan, Canada, France, Switzerland and Australia. However, they differed in the aggregates which they announce and period of targeting. Germany, Japan, U.K., and France focus on broad money, whereas U.S. and Canada focus on the narrow money. The U.S. announces quarterly growth (in annual rates), the European central banks announce only annual targets of money supply growth, and Japan announces the forecast of M2+CD growth rate in the first month of each quarter.

average of that under discretion and that under an ideal rule and is superior to the former and inferior to the latter. Of course, the more credible the central bank's policy is, the closer the effect of the policy is to that under an ideal rule.

The key conclusions of these studies are that discretionary policies tend to lead to excessive inflation and that operation of "rules" does not preclude activist stabilization responses. However, as we shall see below, the BOJ has achieved many of the desirable results without necessarily adopting any money growth rules of the sort discussed in these papers and this makes the case of the BOJ policy more interesting.

In this paper, I investigate the macroeconomic performance of the Japanese economy and monetary policy of the BOJ during much of the postwar period. I pay a particular attention to the high level of credibility of the Japanese monetary policy by investigating the variability of the forecast errors of the key monetary and macroeconomic variables. I will also investigate the effects of some of the BOJ's practices (e.g., window guidance, monetary aggregate targeting) in conducting the policy on the credibility of the policy. This will be compared to the experience of the Federal Reserve of the U.S. for the same period.

IV. EMPIRICAL ESTIMATION

In this section, I investigate the behavior of the key macroeconomic variables of the Japanese economy. Results of the U.S. economy will be presented for comparison. Emphasis will be placed on the magnitude of the shocks (or unanticipated changes) as deviations from forecasts made using the rolling ARIMA model.

I concentrate on the forecasting of the logarithm of the level of each variable such as the price level rather than inflation rate because it is the price level that determines the real value of nominal obligations entered into over the relevant horizon.

In generating the forecast value of the variables, I use the rolling ARIMA process.¹⁰ It works as follows: a "forecasting equation" is formed using the actual data of an early period and forecast is generated each period by running a separate regression as additional observations are made available. This way, forecasts are formed using only the information available at the time forecasts are made. The specification of the ARIMA model is based on search for the best fit for each variable.

¹⁰Meltzer (1985, 1986) uses the Multi-State Kalman Filter (MSKF) to forecast each variable, which is a Bayesian way of using past observations to estimate the one-period-ahead forecast of the variable. However, Christ (1986) reports that the MSKF forecasts are about as accurate as ARIMA forecasts and less accurate than those of the ASA-NBER survey or the Wharton model III. Therefore, I choose the rolling ARIMA model which is much simpler to use.

Another point to note is that the variability or uncertainty of variables is obtained from the variance of the forecast errors of those variables, not the variance of the logarithm of actual level. I do it because it is the agents' inability to forecast what will happen that creates risk and uncertainty, not the economic variability per se.

A clear trend of money supply growth, both M1 and M2+CD, in Japan can be seen in Table 1. Since 1975, there is a definite downward trend in the money supply growth rate, and variability is lower, too for both measures. On the other hand, the U.S. money supply growth (M1) has become more volatile on a slightly upward trend in recent years.

Table 1 presents sample means and variances of the log level and the growth rate of the GNP deflator (P), real GNP (y), M1, M2+CD and the level of call money rate for Japan, and of the GNP deflator (P), real GNP (y), M1, monetary base (MB) and the level of the 3-month Treasury bill rate for the United States for the period of 1959:I-1975:II and of 1975:III-1985:IV. The real GNP and monetary aggregates of Japan are in units of yen. Surprisingly, the variance of all variables is higher for the level and growth rate for Japan than the United States in the former period except for the money supply variables.¹¹ The Japanese M2+CD is significantly more variable in level and significantly less variable in growth rate than the U.S. M1.

For the latter period, in which the BOJ shifted the policy emphasis to the broad monetary aggregate, M2+CD, from the short-term interest rate, the results are sharply contrasting. That is, the variances of all variables except the level real GNP are much smaller for Japan than for the U.S. The variance of the Japanese level M2+CD is higher than the U.S. level M1. It is also the case that variances of all variables except the growth rate M2+CD have significantly reduced in the latter compared to the former period. While this significant reduction of the variation of macro variables since 1975 cannot be totally attributable to the BOJ's sound monetary policy, it is clear that the Japanese economy has in general experienced stable prices and steady real output growth. During this period, the inflation rate measured in terms of the GNP deflator in Japan has been half of that of the U.S. and the real output growth is 50% higher on average. The growth rate of M2+CD shows more variation in the latter period because CD which was not directly controllable by the BOJ was first introduced in 1979:III. The interest rate is on average lower and less variable in Japan in the latter than in the former period, but in the U.S., it rose sharply and became much more variable in the latter period. The Japanese call money rate was not only higher and more variable than the U.S. 3-month Treasury bill rate in the earlier period but in the latter period, it is completely reversed. That is, it is not

¹¹The Japanese M2+CD behavior should be compared to the U.S. M1 behavior in the sense that they are the monetary aggregates which are used as the primary policy target variables. The data for Japanese M1 and the U.S. monetary base are reported only for reference.

only lower but less variable than the U. S. Treasury bill rate.

Table 2 presents the accuracy of forecasts obtained from the ARIMA model for GNP deflator (P), real GNP (y), M1, and M2+CD for Japan and the same variables except M2+CD replaced by monetary base (MB) for the U.S. for two periods, 1959:I-1975:II, and 1975:III-1985:IV. The dividing point of time is

Table 2. Accuracy of the Forecasts Obtained from ARIMA model
(Standard Error of Estimate)

	1959:I-1975:II	1975:III-1985:IV
Japan		
Deflator (P)	0.03408	0.00490
Real GNP (y)	0.04167	0.00697
M1	0.02016	0.01357
M2+CD	0.01034	0.01766
United States		
Deflator (P)	0.00368	0.00441
Real GNP (y)	0.00976	0.01145
M1	0.02253	0.02177
MB	0.00472	0.00341

Notes: ^aSee the note of Table 1.

1975:III when the BOJ first introduced growth rate target of M2+CD aggregate in their monetary policy. The measures of the accuracy of forecasts are the standard error of estimate. For Japan, the standard error of estimate indicates that the accuracy of forecasts has significantly increased since mid-1970s for all variables except M2+CD. These results of Japan are consistent with those of Table 1. For the U.S., the standard error of estimate indicates that the forecast accuracy of the price level and the real output has deteriorated, whereas that of both monetary aggregates has improved in the latter period. The forecast accuracy of real output and M2+CD for Japan is higher than the U.S. counterparts, whereas that of the price level is lower.

Table 3 presents the forecast error statistics of the monetary policy variables for the two countries for several different periods. The statistics reported are mean squared errors and the mean absolute percentage errors. For Japan, 1975:III is when the BOJ began to look to M2+CD as an intermediate target and 1978:III is when the BOJ began to announce the forecast of the growth rate of M2+CD. Statistics are reported for the rapid growth and slow growth periods for comparison. As was pointed out earlier, the money supply growth had been much more fluctuating (at a higher level) during the earlier period than the latter. Surprisingly, the forecast error of the money supply has slightly increased since

Table 3. Forecast Errors of Money Supply Change under Different Monetary Policy Procedures

	MSE ^b	MA%E ^c
Japan: (M2 + CD)		
1975:III–1985:IV	0.00050	0.00142
1978:III–1985:IV	0.00064	0.00164
1960:I–1985:IV ^a	0.06963	0.02036
1960:I–1973:IV ^a	0.00189	0.00335
(Rapid Growth Period)		
1974:I–1985:IV	0.00046	0.00140
(Slow Growth Period)		
United States: (M1)		
1975:III–1979:III	0.00079	0.00424
1979:IV–1982:III	0.00061	0.00345
1982:IV–1985:IV	0.00076	0.00394
1975:III–1985:IV	0.00073	0.02364
1959:I–1985:IV ^a	0.02457	0.02653

Notes: ^aThe statistic is based on the forecast errors obtained from an ordinary ARIMA model.

^bMSE is mean squared error.

^cMA%E is mean absolute percentage error, defined as the mean absolute error divided by the actual value.

1978:III compared to the 1975:III–1985:IV period. I suspect this is due to the new introduction of CD's and financial deregulation which began to take place in Japan from the late 1970s. Of course, the forecast accuracy has markedly increased since 1975:III compared to the whole period and this has made the BOJ's policy much more credible.¹²

For the U.S., the forecast accuracy of M1 for the 1975:III–1984:IV period is much lower than that for Japan. It also varies depending on the operating proce-

¹²This is in sharp contrast to the arguments made by Hutchison (1987). Criticizing the Meltzer's argument, he argues, "...the variance of money (M1) forecast errors for Japan... did not decline after 1971 when forecast errors for GNP and price did decline." First, the monetary aggregate that should be of concern is not M1, but M2+CD. Secondly, since 1975:III, the forecast errors of money supply have clearly declined. Hutchison's Chart 2 itself clearly shows a downward trend in broad money growth with declining variability. He then concludes, "The Bank of Japan achieves results that are more credible in nature without having used more predictable policies." This is clearly contrasting to the result reported here.

dures adopted by the Fed. The period 1975:III–1979:III represents the period when the Fed had an interest rate targeting and 1979:IV–1982:III period is when they had a monetary aggregate targeting. The last period, 1982:IV–1985:IV, is when they had a borrowed reserve targeting. The forecast error measures do not significantly differ for different sub-periods, except that the error has clearly decreased since the mid-1970s. The rather poor forecast for the whole period for both countries is due to the poor performance of the ARIMA with larger sample size.

The BOJ's forecast values of money growth and the actual money growth are reported in Table 4. One finds a strikingly close similarity between the two values

Table 4. Actual and "Forecast" Levels of Money Supply Growth of Japan (1978:III–1983:III)

	Announced "Forecasts" (%)	Actual (%)
1978:III	about 12	12.1
IV	12–13	12.2
1979:I	12–13	12.3
II	12–13	12.3
III	about 12	11.7
IV	about 11	11.2
1980:I	about 10	10.6
II	10–11	10.1
III	below 10	8.4
IV	about 8	7.8
1981:I	about 7	7.6
II	6–7	7.9
III	9–10	9.6
IV	10–11	10.6
1982:I	about 11	10.6
II	about 10	9.2
III	about 9	9.0
IV	about 8	8.1
1983:I	7–8	7.6
II	7–8	7.6
III	about 7	7.1

Notes: ^aAnnounced forecasts are the BOJ's announcement of average percentage growth of M2+CD for a quarter versus the same quarter previous year.

^bActual money growth rate is average growth of M2+CD versus that of same period previous year.

^cThe data in this table is obtained from Suzuki (1986).

and it is supported by the error statistics. That is, the mean squared error is 0.0000315 and the mean absolute percentage error is 0.04165. This strongly indicates how credible the monetary policy of the BOJ has been since the late 1970s. This practice of the Bank should be an important factor for the high degree of credibility along with the information dissemination through the window guidance.

Another factor that may be responsible for Japan's high and stable real output growth is the lower level and volatility of interest rates in Japan than in the U.S. As Table 1 indicates, the call rate of Japan has an average of 6.89% with variance of 0.0003 for 1975:III–1985:IV period, whereas the 3-month Treasury bill rate of the U.S. has an average of 8.79% with variance of 0.0009. The real output cost of the increased volatility of interest rate is well documented in Evans (1984) for the U.S.

The hypothesis that the high credibility of the BOJ's monetary policy is responsible for stable inflation rate and real output in Japan has been explained using descriptive statistics. I now present a simple test of the credibility hypothesis. A variant of equation (1) is written as the expectations-augmented Phillips curve equation as follows:

$$\pi_t = b_0 + b_1 E \pi_t - b_2 u_t + w_t \quad (3)$$

where u_t is the unemployment rate, and w_t is a random disturbance term. In estimating the equation (3) for Japan, I substitute the employment growth rate for the unemployment rate:¹³

$$\pi_t = c_0 + c_1 \pi_{t-1} + c_2 EMP_t + \xi_t \quad (3')$$

where EMP_t is the employment growth rate. π_{t-1} is used as a proxy for expected inflation rate. The credibility hypothesis implies that b_2 and c_2 become larger. That is, the more credible the monetary policy is, the more employment bang the anti-inflationary policy buck would have. The estimated results for 1960:I–1975:II and 1975:III–1985:IV are reported as follows:

$$\pi_t = 0.0105 + 0.4283 \pi_{t-1} + 0.0107 EMP_t \quad 1960:I-1975:II$$

(3.653) (3.546) (0.161)

¹³The Japanese unemployment rate statistic is known for its low level and low variability. Beside reflecting a good employment situation, it reflects the rigorous definition of unemployment in Japan. The completely unemployed workers are defined to be those over 15 years of age who are not employed, able to work, and those who want and search for job. They are the ones who did not work during the last week of the month more than one hour. Those who did not seek jobs during the last week and are waiting for the results of past job seeking activity are not included in the unemployment statistic (see, Taria (1983)). For this reason, the unemployment rate statistics of Japan do not accurately represent the labor market situation and therefore, I used instead the employment rate in equation (3').

$R^2 = 0.1833$ D.W. = 2.110 t-values in the parentheses.

$$\pi_t = 0.0086 + 0.4265 \pi_{t-1} + 0.0701 \text{EMP}_t \quad 1975:\text{III}-1985:\text{IV}$$

(4.572) (4.684) (1.307)

$R^2 = 0.1897$ D.W. = 2.153

The coefficient of EMP has increased significantly in the latter period as was expected in the credibility hypothesis. The statistical significance of the coefficient shift is tested by the dummy variable approach as follows: the dummy takes a value of 0 for the former and 1 for the latter period. An equation is estimated with a new variable, EMPD, added, where EMPD is the product of EMP and the dummy variable.

$$\pi_t = 0.0083 + 0.4566 \pi_{t-1} + 0.0249 \text{EMP}_t + 0.3701 \text{EMPD}_t$$

(4.502) (5.071) (0.445) (2.313)

$R^2 = 0.2320$ D.W. = 2.085 1960:I-1985:IV

The coefficient on the dummy variable is significant at 5% level and the $\chi^2(99)$ value is 5.4603, which exceeds 3.84, the critical value at 5% significance level. This indicates a statistically significant change in the relationship between inflation and employment since the mid-1970s in Japan.

The above analysis, although not definitive, sheds some light on the improved relationship between the inflation policy of the BOJ and the real output. Along with the rich evidence from the descriptive statistics presented above, this provides good support for the hypotheses that the BOJ's monetary policy has become significantly credible since the mid-1970s and that this credible monetary policy has been largely responsible for the remarkable macroeconomic performance of the Japanese economy during the period.

V. CONCLUSION

In this paper, I have investigated the macroeconomic performance of the Japanese economy and the role of the Bank of Japan's monetary policy during much of the postwar period in comparison to the United States. While the real output growth in the slow growth period has fallen to approximately half the level of the earlier rapid growth period, the overall macroeconomic performance of the Japanese economy is still remarkable compared to that of the U.S. economy particularly since the mid-1970s. The real output growth is much higher than that of the U. S., whereas average inflation rate has been much lower. Interest rates have been lower and much more stable in Japan than in the U.S.

I have extended the Meltzer's line of suggestion by explicitly investigating the

degree of credibility (in the sense of predictability) of the monetary policy measures taken by Japan and the U.S. The various measures of the forecast error of monetary aggregate indicate that Japanese monetary policy has become significantly more predictable and credible since the BOJ adopted the M2+CD aggregate as an intermediate target in 1975. This has led to the increased predictability and actual stability of key macro variables during the same period. The conventional Phillips curve relationship appears to have become more favorable during this period and a simple test lends support to the credibility hypothesis. The BOJ's monetary policy has been much more predictable and hence more credible than the Federal Reserve's during the period.

Uncertainty surrounding the monetary policy is costly in terms of real output as private sector tries to obtain more accurate information about the policy changes. An enhanced credibility of the monetary policy through reduction of uncertainty about the policy itself and dissemination of information to the private sector through various channels would therefore increase the effectiveness of the policy. This has been the case for the BOJ since the mid-1970s. Stable money growth, fairly strict adherence of actual money growth to the Bank's announced projections, and quick dissemination of information through frequent contact with the banking sector have all contributed to the credibility of the BOJ's monetary policy and hence, the oft-quoted remarkable performance of the Japanese economy.

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