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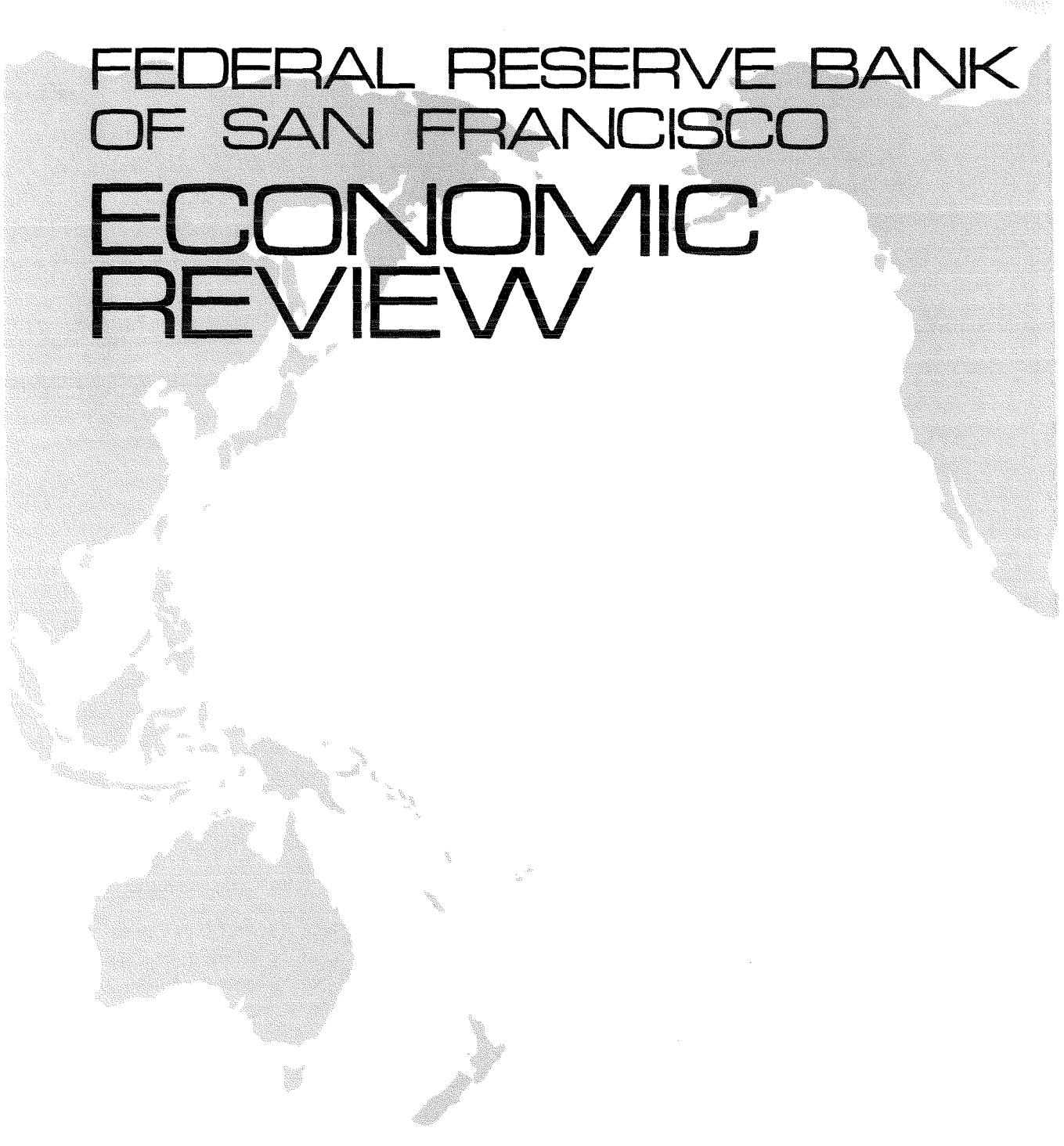

MONEY, INFLATION AND TRADE IN THE PACIFIC BASIN

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Rational Expectations and Counter-Cyclical Monetary Policy: The Japanese Experience

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Scholars of postwar Japanese economic history generally agree that Japanese monetary policy has significantly influenced the cyclical variations in the nation's economy. According to a common view, the authorities reacted to reserve losses during the 1950's and 1960's by slowing the rate of monetary expansion, thereby reducing the growth of investment and real GNP. Monetary policy was the government's primary counter-cyclical policy tool throughout most of this period, since deficit finance was severely constrained both by law and by the relatively underdeveloped state of Japanese capital markets.

This explanation reflects a widely held view of the influence of monetary policy upon economic activity. Until recently, most economists believed that, despite the lack of any permanent relationships, variations in money growth exert a significant and systematic temporary influence on real growth and unemployment. This view, supported by statistical analyses of the various empirical relationships involved, implied that counter-cyclical monetary policy can, in principle, reduce fluctuations in real income. Because of the wide acceptance of this hypothesis, debates about counter-cyclical monetary policy have tended to focus on whether enough is known about the timing and magnitude of the effect of money-stock changes for such a policy to be effectively employed.

Recently, however, several economists have suggested that counter-cyclical monetary policy, as normally implemented, exerts no systematic impact on real economic activity in either the short run or the long run. Their argument rests on two distinct contentions.

First, they claim that private agents intelligently use all available information in forecasting economic events. This hypothesis, known as *rational expectations*, implies that policy rules relating money growth to observable variables, such as past employment or prices, will be used by private agents to forecast future money stocks. Secondly, they assert that anticipated money-stock changes do not influence real output even in the short run. Under this hypothesis, variations in prices, rather than real spending, absorb predictable fluctuations in money growth rates.

These two propositions imply that counter-cyclical monetary policy has no systematic effect on real variables once private agents determine how the authorities conduct their policy. Once the policy is known, the changes in the money supply it produces are predictable, so that they then cease to influence real activity. If this view is correct, a rule prescribing steady money growth becomes more desirable. Such a rule then is no less effective than any other in smoothing business cycles, and may possess the additional virtue of minimizing uncertainty about official policy.

This article attempts to test whether Japanese real growth in the 1957-77 period was systematically influenced by the changes in the Japanese money stock that could have been predicted by an informed economic observer. Evidence that in the U.S. predictable money growth had no influence on real activity has been presented by Barro (3, 1977) and Sargent (8, 1976). More generally, the article examines whether anticipated and unanticipated money growth had different impacts on Japanese real output.

In section I of this paper, we review several theories concerning the impact of counter-cyclical monetary policy, and examine the assumptions underlying the contention that it is ineffective. It is argued that because of "frictions" such as contractual wage and price agreements, counter-cyclical monetary policy may influence output even if expectations are fully rational.

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Section II presents an equation explaining Japanese M_1 growth over the 1957-77 period, and uses this to estimate the anticipated component of money changes. Section III tests the relationship between changes in the money stock and real economic activity. The results, although far from conclusive, suggest that anticipated money growth temporarily influenced the growth of Japanese industrial production and of real GNP. They also suggest that anticipated and unanticipated components of money growth had qualitatively different impacts upon Japanese economic activity.

I. Theories of Counter-Cyclical Monetary Policy

Developments of the last several years have raised doubts about the value of monetary and fiscal policies in combatting cyclical variations in income and employment. Traditional stimulus instruments—tax cuts, public-works expenditures, expansive monetary measures—that seemed effective during the 1960's appear now to have lost their effectiveness in many industrial countries. Public confidence in "fine-tuning" is at a low ebb.

Partly as a result of these events, theoretical views of the impact of counter-cyclical policies have changed substantially. This revision has centered around the theme of expectations: how agents form them and how they influence behavior.

These developments are illustrated by the evolution of theories about the influence of monetary policy on economic activity. During the 1960's, many economists believed that there was a stable—and in practical terms, permanent—trade-off between inflation and unemployment. The implication was that government could reduce the average unemployment level by increasing the long-run inflation rate through expansionary monetary policy. This view greatly influenced macro-economic policy in the U.S. and other industrial countries.[1]

As theoretical attempts to justify this hypothesis failed—and as the trade-off became increasingly unstable beginning in the mid-1960's—most economists came to view significant systematic associations between inflation and unemployment as temporary. The new theories developed to explain the short-run relation between these variables came to be based on the propositions that a) unemployment is influenced by *unanticipated* but not by anticipated variations in the price level; and b) in the long run, actual and anticipated inflation rates are equal. Hence an increase in the inflation rate could have only a transient influence on economic activity.

However, because such theories required only that actual and anticipated price changes coincide eventually, they generally left open the possibility that monetary policy could systematically influence real output over the business cycle. In empirical applications, expected price changes were normally assumed to depend on past inflation and (in some cases) other variables in a manner invariant to changes in government policy. This implied that the authorities could successfully conduct counter-cyclical monetary policy by relating unanticipated price and money changes to past fluctuations in activity, as we will see below.

The theory of "rational expectations," introduced by Muth (6, 1961) and developed further by Barro (2, 1976), Sargent (8, 1976), Lucas (5, 1975) and others, considerably refined the formulation of expectations in such models by making anticipations depend explicitly upon the structure of the economy and government policy. But, when combined with the assumption that predictable money changes have no influence on real activity, this view implies that counter-cyclical monetary policy is ineffective once the private sector determines how the policy is conducted.

The Phillips curve

To illustrate the implications for monetary policy of these different views, consider a simple model of the unemployment rate.

$$u(t) = a_0 + a_1 u(t\text{-}1) + a_2 u(t-2) + Z + e(t) \quad (1)$$

where $u(t)$ is the unemployment rate at time t, $e(t)$ is a random disturbance, and Z is a set of other variables influencing unemployment, including policy instruments. The unemployment rate is affected by its own past values because of delayed responses of consumption and invest-

ment to income and other lagged relations. Because of this dependence, a change in u(t) caused by the disturbance leads to further changes before unemployment returns to its long-run level. In this way, fluctuations in unemployment that resemble business cycles are produced. This process is described in detail by Larry Butler in the spring 1977 issue of this *Review*.[2]

Counter-cyclical policies are designed to reduce the severity and duration of business cycles. This is done by using the government's instruments contained in Z to offset the effects of past fluctuations in u(t). This, in effect, changes the relation between current and past unemployment and reduces business-cycle fluctuations. The controversy raised by rational expectations centers about how the government accomplishes this task.

During the 1960's it was widely believed that one element of Z was the actual change in prices $\Delta p(t)$ ($\equiv p(t) - p(t-1)$. This relation was known as the "Phillips Curve".[3] A simple version of this relation can be written as:

$$u(t) = a_0 + a_1 u(t-1) + a_2 u(t-2) - a_3 \Delta p(t) + e(t) \qquad (2)$$

where a_3 is positive. This implied that the government could, by varying money-supply growth, manipulate price changes, thereby influencing unemployment. In addition to smoothing economic cycles, the appropriate choice of money-stock growth could influence the long-run rate of inflation, and thus permanently alter the average rate of unemployment as well.[4]

Natural-rate hypothesis

This view of the relation between monetary policy and economic activity has now been largely discarded by economists. Current theories generally incorporate the "natural rate" hypothesis that trade-offs between inflation and unemployment are at best temporary, although possibly long-lived.[5]

This hypothesis says that the unemployment rate is equal in the long run to a value, known as the "natural rate of unemployment", which is determined by the cost of searching for jobs, the demographic composition of the labor force and other factors. The natural rate is assumed to be unaffected by changes in the money stock or inflation. This reflects a proposition known as the "neutrality" of money, which asserts that a change in money leads eventually to a proportional change in all prices—leaving unaffected all relative prices and all determinants of the natural rate. The proposition follows intuitively from the observation that a typical individual whose money holdings are doubled while all prices are raised in the same proportion has precisely the same real income and real money balances, and therefore the same opportunities for consumption and leisure, as he did previously; thus his behavior should not be altered.[6]

Most formulations of the natural-rate theory assume that predictable changes in money have the same effects in the short run as in the long run. Anticipated money-stock changes are often assumed to lead immediately to proportional changes in all prices, leaving unemployment and real output unaltered. This implies, in effect, that individual spending decisions depend only upon current and future relative prices and real money balances, and not upon variations in the level of prices.[7]

Natural-rate theories attribute temporary associations between unemployment and inflation to unanticipated changes in money and the price level. According to one account, an unexpected rise in the money stock raises aggregate demand. Because the increase in the total money stock is not immediately perceived (in part because reliable statistics are published with a lag), firms generally confuse the increase in aggregate demand with an improvement in the market for their own products. Firms then move up their supply curves, increasing employment, output and prices. However, once the money-stock increase becomes known, output and employment return to their normal levels. Natural-rate theories thus imply that an unanticipated money-stock increase initially stimulates activity. Furthermore, because a sustained increase in the growth rate of money must eventually become anticipated, its influence on economic activity cannot be permanent.[8]

The natural rate and counter-cyclical policy

A simple version of the unemployment relation implied by natural-rate theories is:

$$u(t) = a_0 + a_1 u(t-1) + a_2 u(t-2) - a_3(\Delta p(t) - \Delta p(t)^e) + e(t) \qquad (3)$$

where now $\Delta p(t)^e$ is the change in the level of

prices anticipated by economic agents. As explained above, a_3 is generally assumed to be positive.[9]

In contrast to the earlier unemployment relation, this implies that a sustained change in the growth of the money stock has no permanent influence on economic activity. This is because money-stock changes, and the inflation they cause, eventually become anticipated; that is $\Delta p(t) = \Delta p(t)^e$ in the long run. Hence, the unemployment rate returns to its "natural" level.

However, until recently formulations of this theory implied that counter-cyclical monetary policy could at least exert a short-run influence on economic activity. The reason is that expectations about prices and money growth were assumed to be formed in a manner that did not directly depend upon government policy. Under "adaptive" expectations, for example, expected prices changes were a function of past inflation:

$$\Delta p(t)^e = \sum_{i=1}^{n} h(i)\Delta p(t-i) \qquad (4)$$

where the h(i) were assumed to be fixed (the h's sum must also equal one if a permanent increase in inflation is eventually anticipated).

Assume, for illustrative purposes only, that prices immediately adjust to current money-stock changes $\Delta m(t)$; that is, that $\Delta m(t) = \Delta p(t)$. Then even in this simple case, a counter-cyclical policy rule of (say) the form:

$$\Delta m(t) = c_0 u(t-1) \qquad (5)$$

will influence cyclical fluctuations in unemployment. To see this, substitute from (5) into (4) to relate expected price changes to past unemployment:

$$\Delta p(t)^e = \sum_{i=1}^{n} h(i)\cdot c_0 u(t-i-1) \qquad (6)$$

Then, since actual price changes equal current money stock changes, unemployment can be written as:

$$u(t) = a_0 + a_1 u(t-1) + a_2 u(t-2) - a_3 c_0 u(t-1) + a_3 c_0 \sum_{i=1}^{n} h(i) u(t-i-1) + e(t) \qquad (7)$$

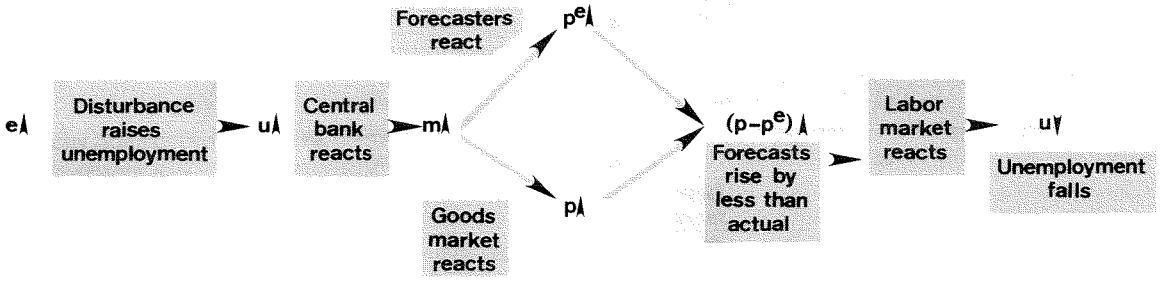
The last two terms in unemployment have been added by the counter-cyclical policy and the expectations mechanism (4). These terms change the size and duration of the fluctuations in unemployment.

More generally, a "reaction" function relating money-stock changes to past unemployment can be designed so that business-cycle fluctuations are reduced. This process is illustrated in Diagram (1). A rise in unemployment caused by the disturbance "e" leads, through the action of the monetary authorities, to an increase in the money stock, "m," and then to an increase in the price level, "p". The price level expected by individuals, "p^e", also rises, but by less than the actual increase in prices. As a result, unemployment is pushed back down toward its natural rate. As this example indicates, stabilization policy is effective because the authorities are able to make the difference between actual and anticipated inflation depend upon past unemployment. They can do this because the relation used to forecast price fluctuations does not change when policy is altered.[10]

Influence of rational expectations

Rational expectations refers to an economic theory explaining how individuals predict economic events. Because the theory has most often been applied to models incorporating the natural-rate hypothesis, the two have sometimes been

Diagram 1



confused. The concepts are actually quite distinct, and indeed rational-expectations theory is just as applicable to models in which the natural-rate hypothesis is invalid as to those in which it is correct.

Rational-expectations theory asserts that private agents forecast economic events in much the same manner as economists. That is, agents use past data and their knowledge of behavior to estimate relations among economic variables—and thus to forecast future developments. In this respect, the rational-expectations model is little different from other forecasting models incorporated in most natural-rate formulations: all imply that agents use past data to predict economic variables.[11] However, rational expectations also implies that individuals continually update their prediction schemes on the basis of new information. This means that when economic behavior changes—in particular, when government policy is altered—individuals' forecasting relations are changed also. According to this aspect of the theory, any counter-cyclical monetary policy based *entirely* on agents' misperceptions about prices and other observable variables must eventually become ineffective.

To see this, consider again the model summarized in relations (4) through (6). Counter-cyclical policy is effective in this case because individuals underpredict actual price level changes when unemployment is above its natural rate, while they do the opposite when unemployment is below the natural rate. Rational-expectations theory asserts that individuals notice these relations. They then improve their predictions by raising their original forecasts when unemployment is high and reducing them when it is low. In this way, agents discover the policy rule used by the government to combat business cycles. But when this happens the policy becomes ineffective, because it produces only predictable variations in prices and money. This is illustrated in Diagram (2). As before, a rise in unemployment leads to an increase in the money stock. However, under rational expectations, anticipated price changes,

$$\Delta p(t)^e = c_0 u(t-1) \qquad (8)$$

are exactly equal to actual price changes. Unemployment and the business cycle are thus unaffected.[12]

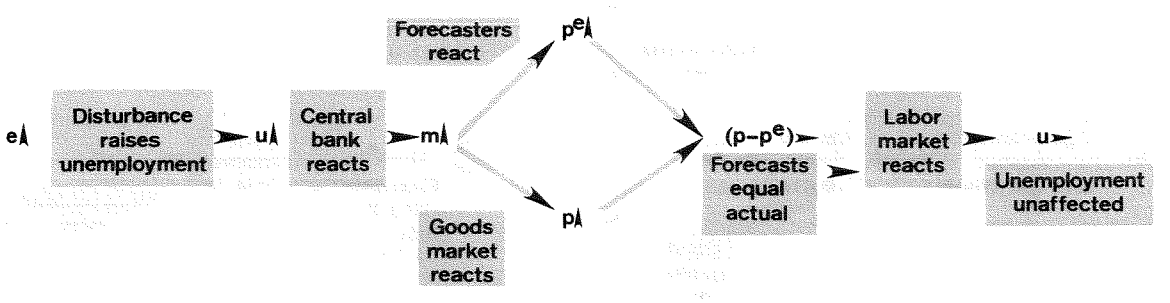
Natural-rate theories reconsidered

This view of counter-cyclical monetary policy is not widely accepted. Most economists believe that counter-cyclical monetary policy can influence unemployment and real output in the short run, but that it has no significant permanent effect. Some economists, skeptical about the policy implications of combined natural rate and rational expectations theories, have questioned the practical validity of the rational expectations hypothesis.

Rational expectations is, however, simply one aspect of the more general assumption that individuals are rational. Economists normally assume that individuals are able to maximize their satisfaction (given their income) and that firms are able to minimize costs (given available resources). But this hypothesis is tenable only if economic agents effectively use all information available to them. Rational-expectations theory merely asserts that agents do just that when predicting economic variables.

On the other hand, less plausible assumptions underlie those theories in which only unanticipated price and money-supply changes influence economic variables. Such theories generally as-

Diagram 2



sume that there are no institutional impediments to free, continuous adjustment of prices and wages. Perceived money-stock changes are often assumed to lead immediately to offsetting price-level movements, leaving unaffected such variables as agents' real money balances, real output, and the relative prices of goods and factors. Predictable attempts by the government to restrict or expand money-supply growth then only produce offsetting price-level fluctuations, with no effect on economic activity.

Prices and wages are not actually adjusted in this manner. Some product and factor prices are contractually set for fixed periods. Others that appear variable in principle are not actually so, but instead tend to respond primarily to long-run rather than cyclical fluctuations in demand. Although the reasons for such behavior are not entirely understood, the implication is that variations in money growth produce temporary fluctuations in private real-money balances.[13]

Theoretically, such transient variations in real balances can influence economic activity: individuals with temporary excess cash may choose to increase their spending, for example.[14] Economists differ, however, about their actual impact. Some believe that fluctuations in real balances have a negligible impact on real aggregate demand, while others assign a more prominent role to such changes. Indeed, in many large econometric models—including several for Japan[15]—temporary variations in liquidity caused by changes in money growth significantly affect at least some spending components.

Predictable changes in money growth thus may exert significant temporary impacts on economic activity, even when expectations are rationally formed. More generally, the impact of both unanticipated and anticipated money growth may vary with institutional factors. For example, the effect of anticipated money growth on activity may depend on the degree to which prices and wages fluctuate with variations in the money stock, as argued above. This impact may also depend upon the extent to which close substitutes for money are available to individuals and firms, as well as other factors. Consequently, the influence of anticipated and unanticipated money growth could vary among countries. Barro (3, 1977) and Sargent (8, 1976), on the basis of U.S. evidence, suggest that anticipated money growth has no influence on economic activity, but the evidence presented here would suggest otherwise for Japan.

II. Testing the Hypothesis: Estimation of Anticipated Money Growth

The hypothesis concerning the relationship between anticipated money-stock changes and Japanese economic activity is particularly significant for Japan because few other industrial countries have relied so heavily on monetary policy as a tool of stabilization policy. Indeed, the Japanese until recently have utilized fiscal policy, by and large, only to accomplish longer-term economic objectives.[16]

Various studies—such as Keran (4, 1970) and the OECD (9, 1972)—suggest that Japanese monetary policy has affected real output in a substantial and systematic way. However, these studies do not distinguish between anticipated and unanticipated components of money growth, and thus do not directly reveal the impact of predictable counter-cyclical changes in the money stock. Indeed, it is possible that such estimates reflect the impact on real activity of unanticipated money growth only. Thus the hypothesis that anticipated money changes influence real output must still be tested.

Testing this proposition is complicated by the fact that expectations are not directly observable. But following the procedure adopted by Barro (3, 1977) in his U.S. study, we can estimate the anticipated components of money growth under the assumption that agents' predictions are rational in the sense defined earlier. More exactly, we can develop a "prediction" equation relating historically observed money-stock changes to other variables; on the assumption that economic agents had at least a rough knowledge of this relation, we may use the fitted values from the equation as estimates of anticipated money growth. The unanticipated components are then defined as the actual changes minus the predicted elements.

If this procedure is to be acceptable, the estimated predicted money-growth components

must be based on commonly available data. Accordingly, the equation developed here related actual money growth during a given quarter to data from earlier quarters. Similarly, the relation should be consistent with the processes actually determining money-stock changes—especially official policies—during the period examined. For this reason, it will be useful to briefly review Japanese monetary policy over the 1957-77 period.

Japanese monetary policy

As many writers have emphasized, Japanese monetary policy is heavily influenced by institutional factors. Large-scale open-market operations have not been feasible, so that central-bank credit has provided the primary source of the banking system's reserve growth. As a result, the major commercial banks are net debtors to the Bank of Japan.[17]

Consequently, the Bank of Japan has exerted a substantial de facto influence on bank lending policies. This influence has been reinforced, particularly during the 1960's, by "window guidance", an informal device whereby the central bank fixes ceilings on individual banks' aggregate lending as well as on their credit to particular sectors. Although there is no legal basis for the ceilings, the Bank's wishes have generally been respected. Thus the Bank generally has been more successful than the central banks of other major industrial countries in implementing its objectives for money growth.[18]

Japan's money stock has grown very rapidly over time, reflecting the nation's exceptionally rapid economic growth. Money stock (M_1) growth averaged 16.5 percent annually from 1957:1 through 1977:3, compared to 4.4 percent for the U.S. over the same period. In contrast to the U.S., Japan's average rate of money growth was the same over the latter half of this period as during the first half (Table 1).

Table 1

Japanese and U.S. M_1 Growth Rates (seasonally adjusted annual rates)

Period	Japan	U.S.
1957:1–1977:3	16.5	4.4
1957:1–1967:4	16.5	3.0
1968.1–1977:3	16.5	6.0

Over shorter time periods, however, Japanese M_1 changes have fluctuated substantially (Chart 1). For example, money growth was below average, and monetary policy was relatively restrictive, from roughly 1961:2 through 1962:2 and again from 1963:3 through 1964:4. Money growth was relatively rapid over the interval 1962:4 to 1963:2, during 1971, and from mid-1972 through mid-1973.[19]

During the 1950's and 1960's, periods of monetary restriction were normally initiated by a deterioration in Japan's balance of payments, while periods of ease normally occurred when economic activity had slowed sufficiently to restore external balance. According to most accounts, a business-cycle expansion typically would lead to a trade deficit, producing a deterioration in the balance of payments and international reserve outflows. The resulting drain in private bank reserves, combined with Bank of Japan credit restrictions, would then lead to a deceleration of money growth and force a reduction in the expansion of private bank credit. The reduction in bank lending (these accounts assert) particularly affected the corporate business sector—which is heavily dependent on commercial banks for external funds—and through it private investment.

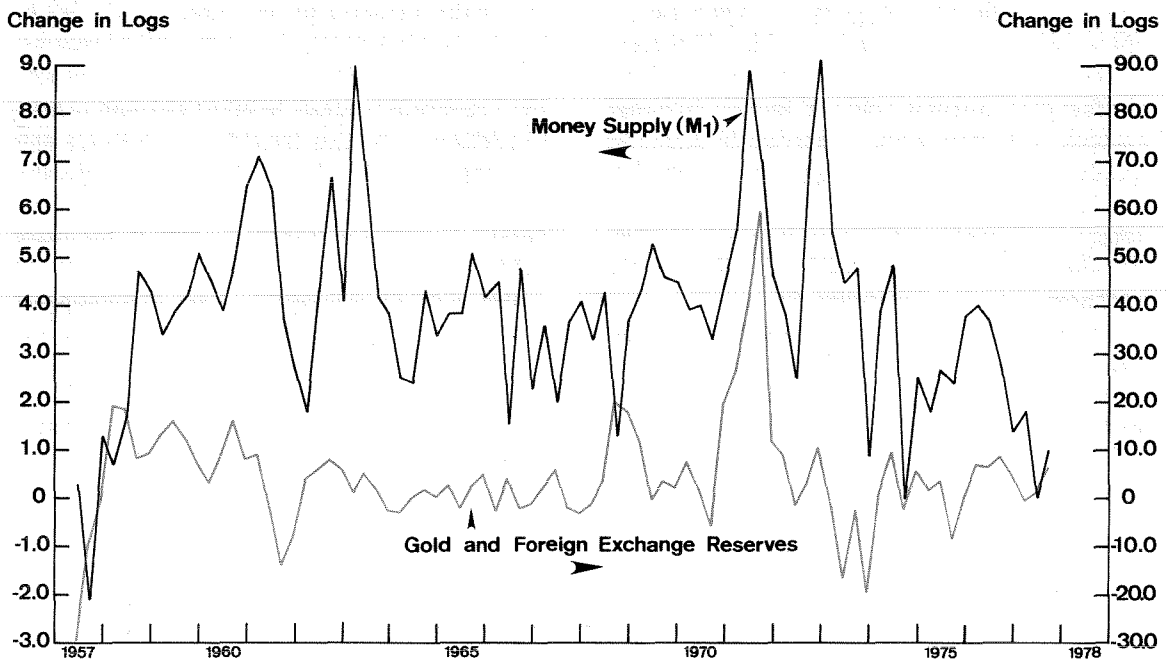
Japanese monetary policy thus was aimed more at offsetting the impact of business-cycle fluctuations on official reserves, than in reducing variations in real income.[20] For example, the decline in the M_1 growth rate from 1961:2 through 1962:2 was accompanied, indeed preceded, by a fall in the growth rate of gold and foreign-exchange reserves. The pattern was similar, although less pronounced, during the subsequent cycle in money growth from 1962:2 through 1964:4 (Chart 1).

Systematic relations between Japanese M_1 growth and reserve fluctuations diminished considerably after 1970. Japanese reserves increased dramatically in 1971 as the government initially resisted revaluation of the yen. As a result of this accumulation of reserves, the Bank of Japan had much less need to use monetary policy to offset temporary balance-of-payments fluctuations.[21]

Japan's economic environment changed even more dramatically beginning in 1973. The advent of generalized floating freed the Bank of the obligation (although not necessarily the desire)

Chart 1

Changes in Japanese Money Supply (M_1) and Gold and Foreign Exchange Reserves



of continuously defending a fixed exchange rate. This development further weakened the direct influence of reserves on domestic money. In addition, inflation accelerated sharply, leading the government eventually to reduce money growth in order to bring price increases back to historical rates. This suggests that fluctuations in Japanese money growth after 1970 may be better explained by variations in foreign and domestic inflation rates than by changes in reserves.

Prediction equation

A statistical analysis of Japanese money-supply changes supports these observations. (In choosing a measure, M_1 data was used to facilitate comparisons with other studies of the determinants of Japanese money growth.)[22] Prior to 1971, variations in M_1 growth appear to be positively and significantly related to changes in Japan's gold and foreign-exchange reserves. Subsequently the two are not significantly associated. Instead variations in M_1 growth appear to be more closely related to the difference between Japanese and U.S. consumer-price inflation. Since maintenance of a stable exchange rate requires that domestic and foreign prices of similar goods grow at the same average rate, this relation may reflect the Japanese authorities' attempt to prevent large changes in the dollar value of the yen, even under floating exchange rates.

A number of equations explaining Japanese M_1 growth fit the 1957-77 sample period about equally well. Generally the more complex the estimated relation, the greater the likelihood that variables will be included that were not actually used by individuals to forecast M_1 growth. The "predicted" M_1 changes estimated from such a relation will then include a portion of money growth that was actually unanticipated; anticipated changes may then appear to affect activity when in fact their influence reflects the impact of unpredicted M_1 changes. For this reason, a relatively simple relation explaining M_1 growth was chosen (Table 2).

To see how Japan's balance of payments af-

fected her money stock in the pre-1971 period, suppose that the growth of reserves rises for a single quarter by one percentage point. The equation implies that M_1 growth will be raised by .04 percent in the next quarter and by .05 percent in the quarter thereafter. This response reflects the fact that Japanese gold and foreign exchange reserves were only about 7 percent of Japanese M_1 during this period; the equation also implies that a decline of one dollar in reserves led to a total fall of roughly 520 yen in Japanese M_1 over the next two quarters, or nearly 1.5 dollars at the exchange rate then prevailing.[23]

The post-1970 equation suggests that the Japanese authorities manipulated money growth to keep the Japanese-U.S. inflation relationship within a range consistent with a stable exchange rate for the yen. Suppose that the ratio of Japanese to U.S. consumer prices rises for one quarter by one percentage point. The equation implies that Japanese M_1 eventually declines by 1.25 percent (Table 2). That is, Japanese money, and eventually Japanese prices, subsequently fall by nearly the same proportion as the initial increase in the relative inflation rates. Thus the authorities apparently attempt to offset changes in relative inflation rates in order to maintain a stable exchange rate. As Chart 2 indicates, the general pattern of variations in actual M_1 growth in both periods is reflected reasonably well in the fitted values.

Measures of anticipated and unanticipated money growth can be extracted from these prediction equations. Anticipated money growth is defined as the values of M_1 growth predicted from the equations in Table 2. Unanticipated money growth is simply the difference between actual and anticipated money changes. These

Table 2

Money Prediction Equations[1]

Period: 1958:1 – 1970:4

$$DMIA(t) = .02 + .044 \times DRSA(t-1) + .052 \times DRSA\ (t-2) + .209 \times DMIA(t-1) + .226 \times DMIA(t-2)$$
$$(4.43)\ (1.21) \qquad (1.35) \qquad (1.41) \qquad (1.75)$$

Period: 1971:1 –1977:3

$$DMIA(t) = .020 - .533 \times (DJCPI(t-2) - DUSCPI(t-3)) + .576 \times DMIA(t-1)$$
$$(4.43)\ (-3.00) \qquad (5.41)$$

Summary Statistics for the Entire Sample

R^2 (adjusted)= .36

Standard Error= .015

1958 : 1–1970 : 4[3] = .012

1971 : 1–1977 : 4[3] = .017

Rho= .009

Durbin-Watson= 1.97

Sample Period= 1958:1–1977:3

Number of Observations= 79

Memorandum: Sum of Coefficients of DRSA= .096

(2.88)

Notes: [1]The estimates were derived from a single equation applied to the entire sample, using multiplicative dummy variables.

[2]DMIA = Difference between the current and previous quarter's logarithm of seasonally adjusted M_1.

DRSA = Difference between the current and previous quarter's logarithm of seasonally adjusted gold and foreign-exchange reserves.

DJCPI = Difference between the current and previous quarter's logarithm of the Japanese CPI.

DUSCPI = Difference between the current and previous quarter's logarithm of the U.S. CPI.

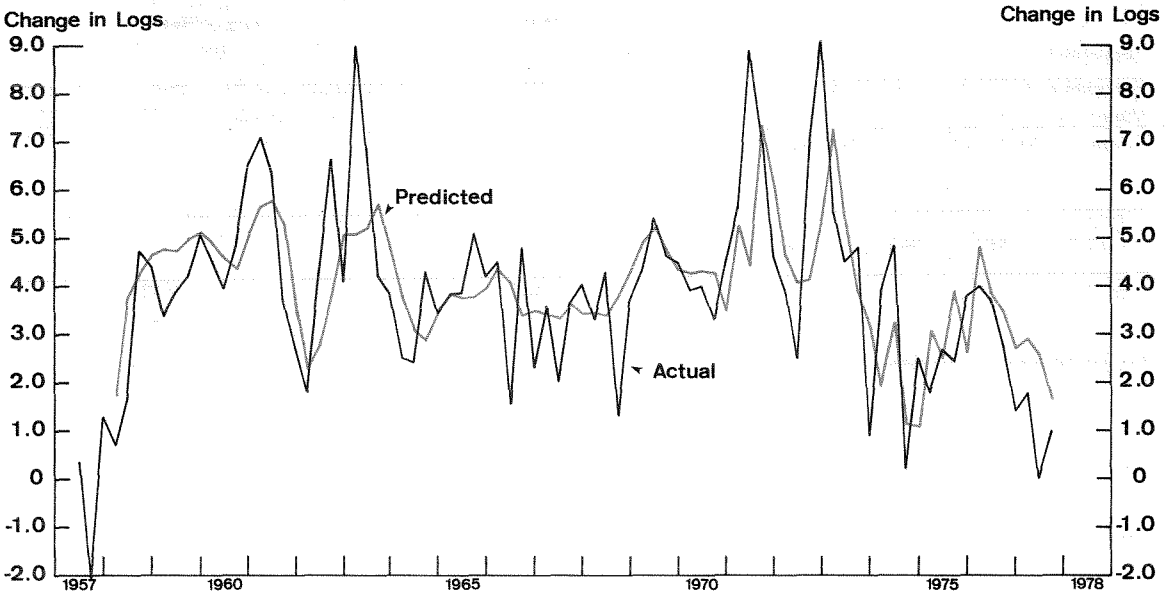
[3]This is the square root of the sum of squared residuals divided by the number of observations; these are not strictly comparable with the standard error of the entire sample.

[4]Figures in parentheses are "T" statistics.

Chart 2

Japanese Money Supply (M_1) Growth Rates

Actual and Predicted Values



components can be used to test the extent to which predicted M_1 growth influenced Japanese economic activity.

As we have seen, however, the relation explaining money growth apparently changed in 1971. The predicted M_1 changes are most likely to reflect expectations held by economic agents if the relation has been fairly stable over a long period of time. Under such circumstances, it is reasonable to suppose that individuals at least had an approximate knowledge of the relation and could have used it to forecast. When (as appears to have been the case) the relation changes significantly, this presumption becomes less plausible.

III. Impact of Anticipated and Unanticipated Money Changes on Japanese Economic Activity

Three separate hypotheses should be tested: 1) that neither anticipated nor unanticipated changes in the money stock influence economic activity in the *long run*; 2) that anticipated money-stock variations have no impact on real activity; and 3) that unanticipated money-growth changes stimulate real activity in the short run.

The first proposition is simply the natural-rate hypothesis; it does not preclude a *short-run* influence of money on real output. The second hypothesis—the focus of this article—suggests that counter-cyclical monetary policy will have no systematic influence on activity once agents determine how the policy is being conducted. The third proposition is frequently used to explain temporary unemployment-inflation-money growth relationships.

These propositions are tested here by regressing alternative measures of real activity on their own past values, and on current and past values of the estimated (predicted and unpredicted) components of money growth. In addition, a time trend is included to allow for secular changes in real growth. The two dependent variables examined are changes in the logarithms of Japanese industrial production and real GNP. Industrial production is included because, according to previous studies, money-growth variations particularly affect the corporate-business sector, and hence industrial activity. The reader interested primarily in the conclusions may wish to skip the unavoidably technical "Analysis of estimates".

Table 3

Summary of Regressions of the Activity Variables on the Money Growth Components

Regressors	Changes In: Log of Industrial Production		Log of Real GNP	
Constant	2.36	(3.06)	2.50	(4.07)
Time	−.02	(−2.33)	−.02	(−2.72)
Anticipated Money Changes - Lag sums:				
0 -2	1.20	(3.91)	.35	(1.27)
3 - 7	−1.20	(−3.91)	−.35	(−1.27)
Unanticipated Money Changes - Lag sums:				
0 - 2	−.23	(−.96)	.06	(.32)
3 - 7	.23	(.96)	−.06	(−.32)
Lagged Dependent Variables (sum)	.56	(4.85)	.30	(2.07)
Rho	−.03		−.58	
R^2(adjusted)	.73		.30	
Standard Error of Regression	1.38		1.34	
Number of Observations	71		71	
Period	1960:I - 1977:III		1960:I - 1977:III	

The basic equation was:

$$\Delta X(t) = a_0 + a_1 \times T + \sum_{i=0}^{7} a_2(i)DMP(t-i) + \sum_{i=0}^{7} a_3(i)DMR(t-i) + \sum_{i=1}^{4} a_4(i)\, X\,(t-i)$$

where $\Delta X(t)$ is the activity variable, T is a time trend, DMP is predicted money growth and DMR is unanticipated money growth. The ΔX, DMP, and DMR were also expressed as percentages (i.e. multiplied by 100). A Cochrane-Orcutt correction for first-order serial correlation of the disburbance was also applied.

Sources: i) Industrial Production: OECD Main Economic Indicators, Historical Statistics.
ii) Real GNP; Investment: OECD Quarterly National Income Accounts.

Notes: 1) Figures in parentheses are "T" statistics.
2) Industrial Production and Real GNP are seasonally adjusted.

Table 4

Summary of Statistics Testing the Hypotheses+

	H0	H1	H2	H3
Change in the Logarithm of Industrial Production	0.48	6.42**	3.14*	3.91**
Change in the Logarithm of Real GNP	0.03	2.35*	0.55	1.36

HO: F test of the hypothesis that the sum of the coefficients of anticipated and unanticipated money growth are zero. The hypothesis is rejected at the 5-percent level (with 50 degrees of freedom) if the statistic exceeds 3.18.

H1: F test of the hypothesis that all the coefficients of anticipated money growth are zero, against the alternative that some of the coefficients of both components may not be zero. The hypothesis is rejected at the 5-percent level (with 50 degrees of freedom and seven restrictions) if the statistic exceeds 2.20.

H2: F test of the hypothesis that the coefficients of unanticipated money growth are all zero, against the same alternative as in H1. The critical 5-percent value is also the same.

H3: F test of the hypothesis that all the coefficients of both money components are zero. The hypothesis is rejected (with 50 degrees of freedom and 14 restrictions) if the statistic exceeds 1.90.

\+ Since a Cochrane-Orcutt procedure was applied, these statistics are only asymptotically distributed as "F".

* Significant at the 5-percent level.

** Significant at the 1-percent level.

Analysis of estimates

The estimates were obtained by allowing lags of seven quarters for the money-growth components and four quarters for the lagged dependent variables.[24] The results are summarized in Tables 3 and 4. To simplify the presentation, only the sums of the coefficients over the indicated lags are listed in Table 3, while the individual coefficients are listed in Appendix A.

The results support the natural-rate hypothesis that money-stock changes exert no permanent influence on economic activity. This hypothesis implies that the sums of the coefficients of anticipated and unanticipated money growth both equal zero. In other words, an acceleration in economic activity following an increase in money must be fully offset by a later deceleration in production if the *level* of activity is to be unaffected in the long run.[25] As shown in the first column of Table IV, the long-run natural-rate hypothesis could not be rejected at the 5 percent confidence level for either of the relations. Variations in M_1 growth thus showed no long-run impact on either Japanese industrial production or real GNP. Consequently, the natural-rate hypothesis is imposed on the estimates presented in Table 3, and this relationship holds for the remainder of this discussion.[26]

Anticipated money growth apparently had a substantial and significant short-run impact on Japanese industrial production and a smaller but still significant effect on real GNP. As shown in the second column of Table 4, the hypothesis that all the predicted money growth coefficients are zero is easily rejected (at well above the 1 percent confidence level) for industrial production, and can also be rejected for real GNP: at least some of these coefficients then differ significantly from zero. Thus, contrary to most formulations of the natural-rate hypothesis, anticipated money growth has had an effect on Japanese economic activity.

Finally, unanticipated money growth apparently shows a much different impact than anticipated money expansion. The hypothesis of zero influence on activity—that is, all zero coefficients—can be rejected for industrial production but not for real GNP, as seen in the third column of Table 4. An unanticipated rise in M_1 initially raises real-output growth; however, this effect is relatively small and statistically insignificant (Appendix A and Table 3). But in the following two quarters, the growth of real output is actually depressed by the unpredicted money increase. Thus the natural-rate hypothesis—that unanticipated money growth stimulates real activity—is not supported by these results. Any stimulus from unanticipated money growth apparently was both small and temporary—at least in Japan, if not the U.S.

Assume that M_1 increases for one quarter by

Table 5
Impact of a One Percent Rise in the Money Growth Rate Sustained Over One Quarter

Quarter	Percentage Rise in Quarterly Money Growth	Percentage Rise in Growth of Industrial Production if:		Percentage Rise in Level of Industrial Production if:	
		Anticipated	Unanticipated	Anticipated	Unanticipated
1	1.0	.52	.03	.52	.03
2	0	.78	−.07	1.30	−.04
3	0	.61	−.20	1.91	−.24
4	0	−.79	−.53	1.12	−.77
5	0	.51	.13	1.63	−.64
6	0	.12	.09	1.75	−.55
7	0	−1.37	−.18	.38	−.73
8	0	−.07	.34	.31	−.39
9	0	−.16	.17	.15	−.22
10	0	−.19	.09.	−.04	−.12
11	0	.00	.09	−.04	−.02
12	0	−.01	.04	−.05	.00

one percentage point. If the increase is anticipated, the growth of industrial production is immediately raised by one-half percent (Table 5). Industrial production continues to rise above its normal level, and by the third quarter it is nearly two percent above the level it would otherwise have reached. But subsequently, production declines back toward its long-run level, and after three years it is virtually unaffected by the anticipated M_1 increase.

If the M_1 increase is unanticipated, the impact on industrial production is both qualitatively different and more modest in size, with an 0.8 percent *decline* below its normal level by the fourth quarter. But again, the impact of the M_1 increase is again largely dissipated after the end of three years.

Implications of results

What do these results imply about Japanese monetary policy over the 1957-77 period? First of all, anticipated increases in money growth stimulated real economic activity—particularly industrial production—while anticipated reductions in money growth depressed activity. Countercylical monetary policy was thus at least potentially effective in reducing Japanese business-cycle fluctuations.[27] The results are consistent in this respect with previous studies of Japanese monetary policy. At the same time, they are incompatible with those rational-expectations formulations of the natural-rate hypothesis that deny any systematic relationship between counter-cyclical monetary policy and real economic activity.

Indeed, the findings for Japan are nearly the opposite of those obtained by Barro for the U.S. Using annual data, he found that anticipated money growth had no impact on the U.S. unemployment rate, whereas unanticipated money growth led to a reduction in unemployment lasting for nearly three years. The results for Japan imply that any stimulus generated by unanticipated money growth is, at best, small and quite short-lived. Thus in Japan, the predictable part of money growth affected real output most heavily, while in the U.S., only unanticipated money growth influenced economic activity.

Institutional features possibly may account for some of these differences in national behavior. In Japan, short-term capital markets are less developed—and close substitutes for money are thus less available—than in the U.S. Moreover, Japanese corporations are strongly dependent upon the private banking sector for external funds, because of the relatively underdeveloped nature of the bond and equity markets. This suggests that Japanese corporations' expenditures may depend more heavily on their real money balances than do the expenditures of their U.S. counterparts, and thus may respond more to anticipated money-growth fluctuations.

It is also conceivable that the contrasting results reflect differences in U.S. and Japanese monetary policies during the period examined. In Japan, M_1 grew (on average) at a stable pace, whereas in the U.S. money growth generally increased from the mid-1960's through the early 1970's.[28] This suggests that an unexpected acceleration of money in the U.S. was often followed by further above-average increases; in Japan, on the other hand, money acceleration was generally followed within several quarters by deceleration. Consequently, an unanticipated money change in Japan, once perceived by individuals, possibly could have had a more temporary impact on real balances than would have been the case in the U.S. If true, this factor may help explain the apparently different impact of unanticipated money growth on real output in the two countries.[29]

The results must, in any case, be regarded as tentative—particularly regarding the findings for unanticipated money growth.[30] Nonetheless, they suggest that, in Japan at least, counter-cyclical monetary policy can be used effectively to reduce fluctuations in real activity.

IV. Summary and Conclusions

The apparent failure in recent years of macroeconomic policy to alleviate conditions of simultaneous inflation and unemployment has disappointed many advocates of counter-cyclical economic policies. During the late 1960's, many economists believed that it would soon be possible to "fine tune" variations in economic activity—that the objectives of price stability and

continuous full employment could be reconciled. Recent proposals for the adoption of incomes policies are, in part, an indicator of the current disillusionment with the traditional macro-economic tools that were supposed to accomplish these policy goals. Some economists have come to question whether counter-cyclical policies have (or indeed ever had) any consistent impact on economic activity, even in the short run.

The results presented in this article suggest that this view of the impotency of policy is not applicable to Japan. If this conclusion is correct, counter-cyclical policies can theoretically be used to reduce business-cycle fluctuations. Officials who design and implement Japanese monetary policy are thus not irrelevant, as some economists have in effect suggested. But the task confronting them today is almost surely more complicated than was generally believed during much of the 1960's.

A decade ago, economists tended to believe in the stability of the relationships among inflation, employment, and real economic activity. In the U.S., for example, the increase in inflation associated with a given reduction in the unemployment rate apparently remained constant for many years. Many economists thus came to believe that economic theory, aided by the sophisticated econometric models then being developed, could exploit such relations to ameliorate the effects of business-cycle fluctuations.

It now seems clear that such relations, which shifted distressingly often as inflation accelerated over the past decade, were actually more complex than had originally been thought. Many economists now believe that changes in prices, money, and other variables that are anticipated by private individuals have different effects than those changes that are unanticipated. This view helps explain why "stable" relations between inflation and unemployment fluctuated as monetary policy changed and as inflation accelerated in the U.S. and other industrial countries. According to this view, the amount of inflation associated with a given level of unemployment in the U.S. is higher now than a decade ago, in large part because actual and expected average money growth has been higher than during the 1960's.

The results for Japan are quite consistent with this approach. Apparently, anticipated money growth substantially, although temporarily, stimulates real economic activity. Unanticipated money growth apparently has a significantly different impact; it may raise activity for one quarter, but then seems to depress activity for some time thereafter.

Thus, it appears that Japanese policy-makers cannot mechanically manipulate private real activity in the manner suggested by the theories of the 1960's. An official interested in determining the impact of a given M_1 increase on real output, for example, must first ask his staff how much of the planned change is expected by the market. And while policy-makers study the market's behavior, they must also know that the market is studying their own reactions. If it were true that predictable policy-generated changes in money do not affect real economic activity, the task facing Japanese officials would be not only difficult, but ultimately futile. Fluctuations in real income could then be offset by monetary policy only to the extent that the authorities were able to confuse the market about actual official intentions. A policy of this type could hardly enhance officials' credibility. But the results derived in this article suggest that Japanese policy-makers may be both predictable and effective in using counter-cyclical monetary policy.

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APPENDIX A

Individual Coefficient Estimates

Regressors	Changes In: Log of Industrial Production		Log of Real GNP	
Constant	2.36	(3.06)	2.50	(4.07)
Time	−0.02	(−2.33)	−0.02	(−2.72)
Anticipated Money Changes:				
Lag – 0	0.52	(1.99)	0.47	(1.73)
1	0.51	(1.52)	−0.23	(−0.50)
2	0.16	(0.46)	0.11	(0.24)
3	−1.20	(−3.52)	−0.39	(−0.87)
4	0.89	(2.40)	0.56	(1.28)
5	−0.08	(−0.21)	−0.29	(−0.65)
6	−1.35	(−3.78)	0.19	(0.45)
7	0.54	(1.87)	−0.42	(−1.72)
Unanticipated Money Changes:				
Lag – 0	0.03	(0.24)	0.12	(1.02)
1	−0.09	(−0.61)	−0.10	(−0.63)
2	−0.16	(−1.10)	0.04	(0.20)
3	−0.42	(−2.82)	−0.03	(−0.19)
4	0.43	(2.67)	0.23	(1.31)
5	0.06	(0.34)	−0.28	(−1.56)
6	−0.22	(−1.27)	0.01	(0.00)
7	0.38	(2.26)	0.02	(0.13)
Lagged Dependent Variable:				
Lag – 1	0.53	(4.15)	0.43	(3.51)
2	0.06	(0.46)	0.06	(0.41)
3	0.07	(0.55)	0.02	(0.18)
4	−0.10	(−0.90)	−0.20	(−1.69)

Notes: 1 Figures in parentheses are "T" statistics

2 Changes expressed as percentages (i.e. multiplied times 100)

FOOTNOTES

1. For a brief description of the influence on U.S. policy, see Robert J. Gordon, "Recent Developments in the Theory of Inflation and Unemployment," **Journal of Monetary Economics,** (2). 1976, p. 190. David Laidler and Michael Parkin, "Inflation, a Survey", **Economic Journal,** December 1975, pp. 741-809 and Rutledge (1975) provide more detailed surveys of the evolution of theories about the Phillips Curve and about monetary policy and economic activity.

2. In the model in the text, a_1 and a_2 must be chosen so that unemployment is stationary. In general the greater the response of current unemployment to its past, the greater the severity and the longer the duration of business cycles.

3. The "Phillips Curve" became a significant influence on economic policy with the publication of A. W. Phillips, "The Relation Between Unemployment and the Rate of Change of Money Wages, 1862-1957," **Economica,** November 1958, pp. 283-299. This describes an apparently stable relation between money wage changes and unemployment in the United Kingdom over the period 1862-1957.

4. Policy prescriptions to exploit the Phillips Curve were generally described in somewhat different terms. Price changes were assumed to be positively related to excess demand, proxied by the unemployment rate. The implication was that by raising aggregate demand, through either fiscal or monetary policy, unemployment could be reduced while inflation would be raised.

5. Strictly speaking, the neutrality proposition refers only to unsustained changes in the level of money, not to changes in the rate of inflation. Variations in the inflation rate alter the real return to money balances and may, as a result, affect the demand for capital; if so, the natural rate of unemployment will **not** be invariant to the long-run rate of money growth. The proposition that the natural rate is unaffected by the rate of inflation is sometimes referred to as "super-neutrality." Natural-rate theorists assert that this is a valid approximation of actual behavior.

6. The first complete description of the elements of the natural-rate hypothesis was given by Milton Friedman ("The Role of Monetary Policy," **American Economic Review,** May 1968). Friedman defined the natural rate as that which would be determined in a general-equilibrium system of excess-demand relations for commodities and factors; these relations were assumed to be functions of relative prices and invariant to movements in the general price level. Variations in unemployment about the natural rate were assumed to result (in part) from unanticipated movements in the price level. Strictly speaking, his account implied only that a permanent rise in inflation would have no long-run impact on unemployment; it did not rule out the possibility that an accelerating rate might have an impact.

7. This was one of the elements of Friedman's original statement of the natural-rate hypothesis. It was also central to attempts by Phelps and others to develop a micro-economic theory of the temporary Phillips Curve based on incomplete information and costly search in the labor market. See E. Phelps (ed.), **The Microeconomic Foundations of Employment and Inflation Theory.** The reader will have noticed that the natural-rate hypothesis and formulations of the natural-rate theory are distinguished in the text. The reason is that many economists who accept the proposition that the Phillips Curve is vertical in the long run do not accept all elements of what are commonly known as natural-rate theories. In this sense Friedman stated both the natural-rate hypothesis and a theory of the natural rate, the latter being more restrictive.

8. This is essentially the account given by Robert Barro in "Rational Expectations and the Role of Monetary Policy", **Journal of Monetary Economics,** (2), 1976, pp. 1-33.

9. Actually the theory implies that the unemployment rate is a function of the difference between the actual and expected price level. Assuming that agents know last period's price level, however, $\Delta p(t) - \Delta p(t)^e = (p(t) - p(t-1)) - (p^e(t)) - p(t-1)) = p(t) - p^e(t)$, so (3) is consistent with the theory.

10. This assumption was often implicit. That is, in simulations of econometric models, the h(i) were assumed invariant to the policy assumptions. This methodology had been forcefully criticized by Thomas Sargent and Neal Wallace ("Rational Expectations and the Theory of Economic Policy", **Journal of Monetary Economics,** (2), 1976, pp. 168-184).

11. Indeed, the theory is really a further development of earlier notions about how expectations were formed. Adaptive-expectations schemes were originally introduced because they seemed to provide a common-sense method for forecasting economic variables. Rational expectations provides a more precise definition of what it means to forecast "sensibly".

12. Several qualifications of this view are worth noting. First, a basis for counter-cyclical policy exists if the government possesses superior information, that is, information not available to the market. For example, suppose that the government could withhold aggregate unemployment statistics from the market. Then it could successfully carry out the counter-cyclical policy summarized in equation (4) because individuals would not possess the data needed to forecast money growth. Proponents of the combined rational-expectations and natural-rate theories generally argue that the government should publish its information and allow individuals to decide how to respond to it. See Robert Barro, **op. cit.,** p. 2. Second, the rational-expectations and natural-rate theories do not imply that government policy has no impact on variations in unemployment, only that it has no systematic impact. If the government policy is prone to error—that is, if the policy produces unanticipated money-stock changes—it will generally raise the variability of unemployment. This is not usually regarded as a desirable objective.

13. Indeed, if commodity markets were efficient in the sense often used in stock-market literature, price-level changes would be random so long as the long-run inflation rate were constant. Under these circumstances, cyclical variations in nominal money would lead to cyclical variations in real balances. For a review of theories of contract pricing and other "rigidities", see Robert J. Gordon, **op. cit.,** pp. 185-219. Richard J. Sweeney, "Efficient Information Processing in Output Markets: Tests & Implications," **Economic Inquiry,** July 1978 provides theoretical and empirical arguments for commodity-market efficiency.

14. The reason is that changes in real balances affect the utility yield of existing holdings. For example, in William Brock's perfect-foresight model, ("Money and Growth: the Case of Long Run Perfect Foresight", **International Economic Review,** October 1974, pp. 750-777), a pre-announced increase in future money growth leads to an immediate increase in prices **and** will generally alter consumption if goods can be stored.

15. For example, in the reconstructed Bank of Japan macromodel, the availability of credit to the corporate sector is an explanatory variable in relations determining inventory and private fixed investment; real liquid deposits of the private household sector are used in the equations for consumption as well. See H. Eguchi and S. Tanigawa, "The Bank of Japan Econometric Model—A Progress Report on its Reconstruction" in **Proceedings of the Second Pacific Basin Central Bank Conference on Econometric Modeling,** June 1976.

16. Deficit finance became legally permitted in 1965. Ackley and Ishi (1976) have argued that even after this date, fiscal policy was primarily directed at objectives other than counter-cycli-

cal policy (p. 231).

17. See, for example, Keran (1970) pp. 174-175. In addition, the OECD (1972), pp. 1-32 and Ackley and Ishi (1970), pp. 196-205, provide detailed descriptions of the institutional setting of Japanese monetary policy.

18. According to the OECD, for example, "The Bank of Japan influenced the banks' lending attitude, buttressed by its ability to control (ration the volume and raise the cost of) its own credit, the predominant source of reserve money in Japan. The restraint on the availability of domestic bank credit was subsequently consolidated by direct quantitative controls on the major banks' lending. . . A deceleration of bank-credit expansion always set in immediately after the first restrictive action of the central bank: In each case, the degree of this slowdown seems to have been generally in line with that aimed at by the authorities" (p. 9). See also Ackley and Ishi, pp. 204-205. Keran (176-177) views "window guidance" as primarily a device designed to share business among banks, rather than as a device to control the aggregate level of credit.

19. The precise periods in the text refer to money-growth rates. The periods of "severe restraint" identified by the OECD (pp. 87-90) are quite similar although, because reserve losses themselves tended to reduce money expansion, they tended to lag the slowdown by about a quarter.

20. The relation between reserve losses and M_1 growth has been extensively documented by Keran, Ackley and Ishi, and the OECD. Keran develops a compact model of the relation between economic activity and reserve changes on the one hand and between activity and monetary policy on the other. The OECD study, pp. 51-58 and Appendix III, discusses the impact of monetary policy on investment; see also Ackley and Ishi, pp. 193-195.

21. Total Japanese reserves more than tripled over 1971, from $4.8 billion at the end of 1970 to $15.4 billion at the end of 1971. Largely as a result, Japanese M_1 rose by nearly 30 percent during 1971. Keran (p. 189) describes the severe reserve constraint faced by Japan during the 1960's.

22. See Keran; the OECD; Robert Gordon, "World Inflation and Monetary Accommodation in Eight Countries", **Brookings Papers on Economic Activity,** 1977:2; and Leroy D. Laney and Thomas Willett, "The Causes of Global Monetary Expansion", unpublished, August 1977. The first three use M_1 data in analyzing the determinants of money growth and the latter analyze both M_1 and M_2. The Bank of Japan ("Role of the Money Supply in the Japanese Economy", Special Paper #60, October 1975) argues that from 1965 on, M_2 changes were somewhat more closely related to variations in prices and real income, but that prior to 1965, M_1 changes were generally slightly more correlated with these variables. For reasons explained later, the effects of money growth on activity are evaluated using seasonally adjusted data. Therefore, the M_1 and reserve series used in the money prediction equation were also seasonally adjusted; the procedure used was the multiplicative version of the Commerce Department's X-11 applied to the level of each series.

23. The calculation in the text was made using 1965 year-end values of gold and foreign-exchange reserves and the 1965 yen value of the dollar (360.8). As Keran (p. 192) has shown, the response of M_1 to reserve changes tended to vary with the composition of the Japanese government.

24. A correction for first-order serial correlation of the disturbance was also applied. Two other features of this procedure should be noted. First, seasonally-adjusted data are used for the activity variables and for money growth. Standard seasonal-adjustment procedures may distort the temporal relations among economic variables. Seasonally adjusted data were used because no unadjusted figures for real GNP were available. Nonetheless, results using such data must be interpreted with caution. However, it was possible to estimate a relation similar to that in Table II using unadjusted money data (with seasonal dummies) and to use this to evaluate the impact of money growth on unadjusted industrial production. The results obtained are, if anything, stronger than those reported in the text. Second, the procedure used is strictly valid only if current changes in activity are assumed to have no impact on current changes in M_1. This does not seem implausible in view of the relatively close control normally maintained by the authorities over domestic money. However, if it is not true, the estimates of the impact of current money growth on activity will be biased. Again, however, the results are not substantially altered if the current money growth terms are omitted.

25. This will also be true if all the coefficients of the money-growth components are zero. The argument in the text indicates why the estimated coefficients must change sign at least once if the natural-rate hypothesis is to hold.

26. When the natural-rate hypothesis is not imposed on the estimates, the hypotheses that anticipated and unanticipated money-growth components do not influence industrial production can each be rejected. The hypothesis that predicted money has no impact on real GNP cannot be rejected; however, the "F" statistic is close to the critical 5-percent value and is significant at the 10-percent level.

27. This does not, of course, mean that policy actually stabilized Japan's real output. To establish this, the changes in output that would have occurred had the policy not been followed would have to be compared with the actual path of output, a task beyond the scope of this paper. Ackley and Ishi argue that the authorities may have increased fluctuations in activity in an attempt to avoid large reserve losses (pp. 170-171).

28. Kurt Dew has pointed out the contrasting structure of U.S. and Japanese monetary policy. His article "Practical Monetarism and the Stock Market" in the Spring 1978 issue of this **Review** describes the shift in U.S. monetary policy beginning, roughly, after 1970. He finds that after 1970, unanticipated money increases in the U.S. tended to depress stock-market prices.

29. However, this argument is admittedly plausible only when (if then) anticipated money growth influences real output. Suppose, for example, that individuals' planned levels of spending depended upon their anticipated present **and future** levels of real money balances. Imagine that money increases unexpectedly and that prices respond to this increase very slowly. Then individuals' real balances may be expected to be above normal for some time. In Japan, however, the impact on real balances may have been more temporary than in the U.S., so that real output was affected for a shorter time. Obviously the validity of this argument depends upon the response of prices to money increases and on other factors. It also does not provide a satisfactory explanation of why the level of real output falls below normal in the quarters following an unanticipated rise in M_1, nor does it explain why anticipated money had a stronger and more persistent impact than in the U.S.

30. Several other relations were estimated which are not reported here. First, similar equations were tried for changes in the ratio of private non-residential fixed investment to GNP, and in the ratio of inventory investment to GNP (both seasonally adjusted). The results were very mixed; in general, when the long-run natural-rate hypothesis is imposed, the hypothesis that anticipated money has no impact cannot be rejected. As noted in a previous footnote, the hypothesis was also tested using seasonally unadjusted M_1, reserve data, and industrial production. These results—which are quite consistent with those reported—and the investment relations will be supplied upon request to the author.