Some Lessons of Monetary Management

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The 1970s and 1980s have provided an unusually large number of experiments in monetary management. We have had fixed and fluctuating exchange rates, interest rate and exchange rate targets and pre-announced targets for monetary growth. Some countries have continued to adjust policies based on short-term forecasts while others have adopted medium-term strategies. What can be learned from this experience?

This paper takes an empirical approach to see whether we can characterize recent policies as better or worse than others used elsewhere under (hopefully) similar circumstances. To evaluate outcomes, we need to specify a criterion or objective. I propose to use measures of variability – unanticipated variability – to compare alternative policy arrangements. I take as the proper objective of economic policy reduction of risk and uncertainty to the minimum level inherent in nature and trading arrangements. Risk and uncertainty are assumed to increase with unanticipated variability.

Critics of fluctuating exchange rates implicitly use variability as a criterion when they decry the variability of exchange rates. Unfortunately, the critics typically err in their use of the criterion by emphasizing the variability of real or nominal exchange rates. Variability of either nominal or real exchange rates is not evidence that an economy experiences excessive risk or bears an excess burden. The benefits of relative price changes are known to often exceed the costs. Despite greater variability of real exchange rates, or even as a result of such variability, fluctuating exchange rates may permit a country to reach an optimum.

To measure variability, I use the variance of unanticipated changes in output and the general price level. These measures are relevant for decisions to hold domestic or foreign assets or to hold money or real capital, so they

* I am indebted to *Eduard Bomhoff, Herbert Buscher, Manfred J. M. Neumann* and *Saranna Robinson* for supplying some of the data used here. An earlier version of this paper was presented as a keynote address at the Third International Conference of the Institute of Monetary and Economic Studies, Bank of Japan and published as "On Monetary Stability and Monetary Reform," Bank of Japan Monetary and Economic Studies, 5 (September 1987).

affect the rate of interest, the intertemporal allocation of resources and the size of the capital stock. Excessive variability of output and prices contributes to the variability of returns, thereby raising the required rate of return on private investment above the minimum rate of return that society could reach.

In the following section, I restate some of the main arguments for fixed and fluctuating exchange rates and discuss the importance of variability. Both exchange rate systems can be operated under an inflexible rule, a flexible rule or with different degrees of discretion. Variability and uncertainty are affected by the choice between a rule and discretionary action. I present some evidence suggesting that discretionary action is likely to increase variability and uncertainty.

The empirical findings suggest that uncertainty can be reduced by developing rules for monetary policy. I propose a rule to increase domestic price stability while reducing exchange rate variability. A conclusion summarizes principal findings.

I. Fixed Versus Fluctuating Exchange Rates

Fixed exchange rates require the government to relinquish control of money and fix a relative price. Fluctuating exchange rates typically require a government monopoly to control the stock of money. Generally, economic theory supports neither price fixing nor monopoly. For these reasons alone conclusions from theoretical work about the proper exchange regime can at most be qualified and conditional. Small, open economies are said to benefit more from fixing than from floating, but not much has been done to establish a dividing line. The small open economy model helps to explain why Holland, Belgium and Luxembourg choose to peg their exchange rate to the Deutsche mark or why many countries in Central American peg to the dollar. The model has much less to say about the optimal choice of regime in the United Kingdom, the European Monetary System, Japan and the United States. It does not explain why Britain, the United States and Japan have fluctuating rates while Germany, France and Italy have adjustable, pegged rates within the bloc of countries known as the European Monetary System (EMS) and fluctuating rates outside the bloc. The model has little to say about the risk of relative price changes, or about the comparative cost of changing exchange rates instead of changing income and price levels or about the risk of sudden policy changes.

In a comprehensive system of fixed exchange rates, some means of determining the growth of world reserves must be agreed upon. This is the n-

country problem, a standard problem of price determination involving the choice of a numeraire to set, in this case, the world price level. In practice, this is a difficult problem involving comparison of the costs of holding commodities, the gains from seigniorage, the cost to the public of foregoing domestic concerns to maintain international price stability and some thorny political issues. Formal analysis of several of these issues has not produced firm conclusions. We must rely on less than fully formal analyses.

A useful, starting point for discussion of exchange rate systems is *Milton Friedman's* "The Case for Flexible Exchange Rates" (Friedman, 1953). Friedman considers a world in which changes in trade and payments occur continuously in response to unanticipated real and nominal changes. Adjustment to these shocks requires changes in relative prices and changes in the relative demands for assets denominated in different currencies. Friedman, and much subsequent analysis, considers four ways of adjusting, of which two are most relevant here. Countries can allow exchange rates to clear the market, or they can hold exchange rates fixed and wait until prices and money wages adjust. Where the adjustment of some relative prices and real wages is sluggish, as in most modern economies, fixed exchange rates necessarily introduce changes in the demand for labor and unemployment as part of the process of adjustment.

Flexible exchange rates do not avoid all changes in domestic unemployment when major trading partners experience changes in technology or change policy. But, flexible exchange rates avoid some changes in internal prices and incomes. The clearest, but not the only example, is the adjustment to an anticipated foreign inflation. The perceived costs of an inflation, anticipated as to occurrence but uncertain in magnitude and timing, became so large in the 1970s that many central bankers and governments changed their views about the relative costs of fixed and fluctuating rate systems. Flexible exchange rates can also increase stability if prices or money wages adjust slowly and there are frequent changes in relative rates of productivity growth at home and abroad.

To a considerable extent, the case in favor of fluctuating exchange rates rests on the greater stability of prices and output that can be achieved at times by allowing exchange rates to adjust prices relative to production costs and foreign prices. An added advantage, claimed for fluctuating rates, is that fewer resources are invested in holding commodity reserves or foreign exchange, so more saving is available for investment in physical capital. As far as I know, the latter argument has not been challenged; the greater resource cost of fixed rate systems is generally accepted.[1]

Against the benefits claimed for fluctuating exchange rates, proponents of fixed, or fixed but adjustable rates, offer three main arguments. First is the claim that fluctuating exchange rates increase the instability of output. The main evidence of increased instability is usually the greater variability of real exchange rates. Second, fluctuating rates are said to reduce trade. The reason given is that exporters and importers face increased uncertainty about prices of traded goods, or they must pay the cost of hedging against uncertainty. Third, fluctuating exchange rates are said to cause greater variability of prices and inflation. The argument is that fluctuating exchange rates work by changing prices of foreign goods relative to prices of domestic goods and by changing product prices relative to costs of production. These changes in relative prices affect the price level and, particularly in countries with money wages indexed to the price level, they trigger price adjustment and inflation.

The claims and counterclaims are well-known by now. Advocates of fluctuating rates point out that price and output variability is caused by shocks and policies. Advocates of fixed rates respond that fluctuating exchange rates amplify the responses in two ways. First, they claim that there is destabilizing speculation under fluctuating exchange rates. Second, they argue that fluctuating rates free countries from the discipline of a fixed rate system, so they pursue more expansive monetary policies and experience more inflation.

Support for these last conjectures is, at best, weak. There is not much evidence of a relation between the exchange rate regime and the rate of inflation. Inflation was a principal reason for ending the fixed exchange rate regime, and disinflation has been carried out in many countries under fluctuating exchange rates. Countries have learned to use crawling pegs and adjustable pegs to reconcile differences in inflation with fixed real exchange rates. If alternating periods of inflation and disinflation are a greater problem under one type of regime than under the other, much of the cost arises from variability and uncertainty. The issue is, again, one of relative uncertainty.

Mussa's (1986) comprehensive study of the variability of ex post real exchange rates shows that the short-time variability of bilateral exchange rates is higher under fluctuating rates, often substantially higher. His finding is that the more rapid adjustment of nominal exchange rates, under a

[1] Some possible exceptions are papers that claim that price stability can be achieved using commodity money systems without holding commodities. *McCallum* (1985) finds these arguments invalid.

fluctuating rate regime, is not matched by a corresponding increase in the speed of price adjustment. Mussa notes, however, that his findings have no clear welfare implications. Nominal exchange rate changes have real effects, but these effects are the result of the slow, gradual adjustment of prices. He notes that his work does not show that fluctuating exchange rates increase the social cost of the monetary system relative to a system in which exchange rates are fixed permanently or relative to a system with discrete changes in currency parities. Exchange rate data cannot resolve the issue. We want to know whether uncertainty about variables such as output and the price level is increased or reduced, whether there are efficiency losses such as might occur if trade was more restricted under one system than another, or whether there is some evidence of an excess burden.

Studies of the effects of exchange rate variability on trade and capital movements have not produced evidence of a reliable effect. Surveys by *Farrell* (1983) and by the IMF (1984) report that the evidence is weak or inconclusive. If there is an effect of variability on trade, it has been hard to detect reliably. Farrell notes that many of the studies that have been done fail to distinguish between anticipated and unanticipated changes or between persistent and transitory changes, thereby increasing the difficulty of interpreting the empirical work.

One reason for the absence of demonstrable effects on trade may be that relevant measures of variability have not increased markedly. There is a tendency in discussions of fluctuating rates to jump from the finding of increased variability of real exchange rates to the conclusion that uncertainty has increased. An alternative interpretation is that the variability of real exchange rates reduces the response of prices and output to changes in the environment. On this interpretation, changes in real exchange rates substitute for changes in real costs of production or changes in relative productivity growth.

II. Rules, Discretion and Forecast Accuracy

Models incorporating rational expectations shows that every policy is a choice of rule; the only purely discretionary policy is haphazard or random action. Complete discretion is dominated by systematic policy that permits people to learn and to anticipate future actions. Proponents of discretion typically do not favor random or haphazard policies; they favor authority to deviate from a rule or to change the rule when, or if, available information suggests to the policymaker that it is desirable to do so. As always, there are type 1 and type 2 errors; discretionary action may increase or decrease var-

iability and uncertainty. *Kydland* and *Prescott* (1977) show that, in general, deviations from a rule reduce welfare.

Empirical comparisons of rules and discretion are difficult to make. There are many different rules to compare to the history of discretionary changes in rules or departures from rules. Further, a change from the discretionary action we have experienced to a rule would affect expectations and structural parameters, so it is difficult to design experiments that sharply discriminate between the history of discretionary action and behavior that would occur under a particular rule.

If the information available to the policymaker is more reliable than the information available to the public, public agencies may have some advantage in forecasting the future and when making discretionary changes based on such forecasts. Some of the information may be obtained from other governments under conditions which prevent release. *Meltzer* (1987) summarizes some quarterly and annual inflation forecasts and real output growth by the Federal Reserve and by private forecasters. There is some evidence from work by *Lombra* and *Moran* (1983) that the Federal Reserve made smaller errors in quarterly forecasts during 1970 - 73, but the advantage is small and is not found for annual forecasts.

A notable finding of the comparison of forecast errors is the low accuracy of the forecasts made by each of the forecasters. Forecast errors for output growth are so large relative to quarterly changes that is not possible for any forecaster, on average, to distinguish reliably between a boom and a recession either in the current quarter or a year in advance. Forecasts included in the study are made using all or most of the techniques commonly in use, including judgment, econometric modelling and time series analysis. The errors from the best forecasts using each method, and from most forecasters, are sufficiently close on average to suggest that the remaining errors are close to the minimum we are likely to achieve with current techniques and models. Remaining errors may be random variation caused by unanticipated real shocks, changes in expectations, and perceived or actual changes in foreign countries.

The information on forecast accuracy and the value of forecasts in *Meltzer* (1987) comes from the United States, so it may not be general. Table 1 shows root mean square forecast errors for forecasts of real or nominal GNP (or GDP) growth by governmental and private forecasters in different countries. The first two rows summarize results reported in Meltzer (1987). For comparison, row 3 shows that quarterly forecasts for the U.S. over a longer period have somewhat lower errors than the forecasts for more recent years.

Table 1

Root Mean Square Errors of Forecast (annual rates in percent)

Real GNP Growth	Current Quarter		Year or Four Quarters Ahead	
	Value or Range	Median	Value or Range	Mean (M) or Median (M)
U.S. 1980/2 - 1985/1[a]	3.1 - 4.4	3.8	2.2 - 3.4	2.7 (Md)
U.S. Federal Reserve 1970 - 73[b]	2.1	n.a.	3.5	n.a.
U.S. 1970/4 - 1983/4[c]	2.8 - 3.6	3.0	–	–
German Council of Economic Experts 1969 - 86[d]			1.9	n.a.
German Council of Economic Experts 1978 - 86[d]			0.7	n.a.
Dutch Central Economic Plan 1953 - 85[d]			3.2	n.a.
Dutch Central Plan 1975 - 85[e]			2.0	n.a.
OECD 1968 - 79[f]			1.4 - 4.4	2.3 (M)
Naive OECD 1968 - 79 (random walk)[f]			2.8 - 4.5	3.8 (M)
Nominal GNP Growth				
U.S. Federal Reserve, 1967 - 82[g]		5.5	5.7	n.a.
U.S. Federal Reserve 1973 - 82[g]		6.1	6.2	n.a.
U.S. 1970/4 - 1983/4[c]	3.5 - 4.3	3.8		

n.a. not applicable, single forecaster
a) 12 econometric and judgmental forecasts from *McNees* (1986)
b) from *Lombra* and *Moran* (1983)
c) from *Zarnowitz* (1986) 4 forecasters
d) supplied by *Herbert Buscher;* see *Neumann* and *Buscher* (1985); forecasts are for one year ahead
e) Central Economic Plan various years for one year ahead
f) *Smyth* (1983); 7 country RMSE
g) Federal Reserve "green" books

The median value of the root mean square error is about equal to the average annual rate of growth, however, so it remains true that, on average, forecasters cannot distinguish between a boom and a recession in the current quarter.

Annual forecast errors for Holland and Germany show a decline in the variability of forecast errors for output under the current system of pre-

announced monetary growth, adjustable pegged rates within the EMS and fluctuating rates against other major currencies.[2] For Germany, forecasts are relatively accurate. The root mean square error is less than one-half the average growth rate for the period 1978 - 86. It remains true, however, that policymakers who rely on forecasts to determine the time for discretionary changes will mistake booms and recessions. For this reason alone discretionary action based on forecasts is likely to increase variability.

Smyth (1983) studied the accuracy of OECD forecasts for seven countries – the United States, Japan, Germany, France, the United Kingdom, Italy and Canada – for the years 1968 - 79. He found no correlation between the errors and the year of the forecast, suggesting that forecast accuracy has not improved significantly but did not worsen after major currencies adopted the fluctuating rate system. *Zarnowitz* (1986) reports a similar result.

Smyth reports the results of several tests. He used *Theil*'s decomposition to show that most of the errors for output growth and inflation are random. He also compared the accuracy of forecasts to a naive model, the latter a random walk using preliminary data for the preceding year to forecast real output. Table 1 shows the comparison. The OECD forecast for each country is more accurate than the random walk but, Smyth notes, all of the improvement is in 1974 - 76, following the first round of oil price increases. Information about the oil shock was available to private individuals as well as to public bodies, so the mechanical procedure probably overstates the error that people would have made. The results for other years suggest that any private information available to the OECD could not be translated into greater forecast accuracy.[3]

Several economists have proposed that central banks adjust monetary policy to correspond to forecasts of nominal GNP growth and, recently, some have urged coordinated adjustments in other countries. Many of the proposals for international policy coordination, target zones or stabilization of world money growth or exchange rates depend on forecasts of nominal GNP growth. Table 1 presents some evidence on the quality of these forecasts.

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[2] Data for seven additional German forecasters are available, but I have not computed the root mean square errors for each forecaster.

[3] Comparison of the root mean square error (RMSE) of forecast to the average growth rate for 1968 - 79 shows that the ratio of RMSE to average growth ranges from 0.35 (France) to 0.95 (U.K.). The mean for the seven countries is 0.78. An alternative measure of the value of forecast is the ratio of RMSE to the standard deviation of real growth. These ratios range from 0.57 (U.S.) to 1.03 (Japan). The results again suggest that. on average, forecasts cannot distinguish reliably between booms and recessions.

The Federal Reserve's record of forecasting nominal GNP growth four quarters ahead has a root mean square error (RMSE) approximately equal to 60% of average nominal growth of GNP under both fixed (1967 - 72) and fluctuating (1973 - 82) exchange rates. The relative size of these errors makes it appear unlikely that discretionary policy action based on forecasts of GNP, or efforts to coordinate policy based on forecasts of GNP growth, are likely to reduce variability and uncertainty.[4] For comparison, I have included forecast errors for the current quarter made by private forecasters and by the Federal Reserve. The Federal Reserve forecasts are less accurate than private forecasts, suggesting that any information available to the staff and not made public did not improve forecast accuracy during the period considered.

An additional problem with Federal Reserve forecasts is that they are biased. Mean absolute errors four quarters ahead and for the current quarter are 5.4% and 5.2% respectively; mean errors are very similar. A plausible reason is that the Federal Reserve consistently underestimated inflation during these years. This systematic error may have occured because of unwillingness to recognize the inflationary consequences of past policies or may be the result of adaptive forecasts that adjust slowly to new information. Whatever the reason for the bias may be, the presence of persistent bias, lower accuracy than private forecasters and large errors relative to the mean rate of change gives little support to proposals for nominal GNP targetting, policy coordination, target zones or other discretionary actions based on forecasts of this kind. If the aim of policy is to reduce, rather than augment, variability and uncertainty, discretionary action based on forecasts or rules that rely on forecasts is unlikely to achieve that goal.

Table 2 shows measures of forecast accuracy for inflation. The root mean square errors are smaller than for real growth, reflecting the lower variability of inflation rates. The errors are broadly similar to those reported in *Meltzer* (1987) for the U.S., and generally between 1% and 2% at annual rates. The OECD root mean square forecast error for each of the seven countries is less than the average rate of price change; the ratio of RMSE to average rate of change is 0.2 to 0.6. Naive forecasts, based on a random walk, are less accurate for six of the seven countries. This suggests that inflation forecasts may be more useful to private and public decision makers than forecasts of real growth. It is less clear that inflation forecasts can be used to reduce the variability of the price level.

[4] The forecasts are made in January for the current quarter and four quarters ahead. Forecasts are revised periodically so other periods may show more or less accuracy.

Table 2

Root Mean Square Errors of Forecast for Inflation (annual rates in percent)

	Current Quarter		Year or Four Quarters Ahead	
	Value or Range	Median	Value or Range	Mean (M) or Median (Md)
U.S. 1980/2 - 1985/2[a]	1.4 - 2.2	1.6	1.1 - 3.3	1.6 (Md)
U.S. Federal Reserve 1970 - 73[b]	1.4	n.a.	3.4	n.a.
U.S. 1970/4 - 1983/4[c]	2.0 - 2.6	2.2		
U.S. 1980/2 - 1985/1[c]	1.4 - 2.0	1.8		
German Council of Economic Experts 1969 - 86[d]			1.4	n.a.
German Council of Economic Experts 1978 - 86[d]			0.7	n.a.
Dutch Central Economic Plan, 1953 - 85[e]			1.1	n.a.
Duteh Central Economic Plan, 1975 - 85[e]			0.5	n.a.
OECD, 1968 - 79[f]			1.2 - 4.6	3.0 (M)
OECD, 1968 - 79 (random walk)[f]			2.2 - 7.3	4.3 (M)

Footnotes are given in Table 1.

The data in Tables 1 and 2 support some preliminary conclusions about fluctuating exchange rates and about discretionary policy action. First, the shift to fluctuating exchange rates has not been followed by lower forecast accuracy. Forecast errors for rates of change of prices and output are a relevant measure of uncertainty faced by decision makers. These data suggest that the change in monetary regime has not increased uncertainty. Second, the size of forecast errors for growth and inflation, particularly the former, are large relative to the average change. Discretionary actions conditioned on forecasts are more likely to increase variability and uncertainty than to reduce uncertainty to the minimum inherent in nature and trading practices.[5]

[5] *Smyth* (1983) also studied the accuracy of trade balance forecasts. These were least accurate, a possible warning to those setting or coordinating policies to reduce the U.S. trade deficit.

III. Variability under Fixed and Fluctuating Exchange Rates

In earlier work, using quarterly data for the years from the 1960s to the 1980s, I compared the variability of unanticipated changes in prices, output, money, velocity and exchange rates under fixed and fluctuating rates for five countries – Canada, Germany, Japan, the United Kingdom and the United States. *Meltzer* (1985, 1986a) reports these findings and the interrelation among current and lagged values of unanticipated changes in these variables. The results suggest that some countries were able to reduce the variability of unanticipated changes in prices or output, or both, during the fluctuating exchange rate period. Further, I found little relation between unanticipated changes in nominal exchange rates and unanticipated changes in prices and output. Exchange rate variability did not appear to be a main source of uncertainty about (or unanticipated changes in) prices and output.

The quarterly data used in previous work may give excessive weight to short-term movements. One reason is that organized futures and forward markets are more active for short- than for long-term maturities. These markets can be used to reduce the cost of variability. It seems useful to extend the analysis to see whether annual data give different results.

To compute measures of variability and uncertainty under fixed and fluctuating exchange rates, I again use the multi-state *Kalman* filter, discussed by *Bomhoff* (1983) and *Kool* (1983), to compute forecast errors for real output (GNP or GDP) and the price level.[6] The forecasts, like those reported in Tables 1 and 2, use only information available at the time of the forecast and are based on annual data for 1950 to 1985. Fluctuating exchange rates begin in 1973.

Countries differ in size and in choice of monetary regime. Two countries, Germany and Denmark, are members of the European Monetary System. They have fixed, but adjustable, exchange rates within the group and fluctuating rates against other major countries. The remaining four countries have fluctuating exchange rates, but they differ in the degree to which they have intervened to affect the exchange rate. The six countries were subject to similar shocks such as the oil shocks of the 1970s and the relatively large devaluation and subsequent revaluation of the dollar from 1978 to 1984. Each country has an independent fiscal policy and differs in product mix, technology and in other ways that may affect variability.

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[6] See, also, *Meltzer* (1985, 1986a) for a discussion of the procedure.

The multi-state *Kalman* filter computes the univariate forecast error for each year from past values and subdivides the error into transitory and permanent changes in level and permanent changes in growth rate. The statistical model used for these computations treats each of the errors as independent. Let ε, γ, and ϱ be respectively the transitory error in level, the permanent error in level and the permanent error in the growth rate. These errors are given by:

$$X_t = \bar{X}_t + \varepsilon_t$$

$$\bar{X}_t = \bar{X}_{t-1} + \hat{X}_t + \gamma_t$$

$$\hat{X}_t = \hat{X}_{t-1} + \varrho_t$$

where X_t, $\bar{X}_t$ and $\hat{X}_t$ are the level, permanent or expected level and permanent or expected growth rate of X.

The statistical model cannot assign causality to the change in exchange rate regime as a reason for the reduction or increase in forecast error. Reduced, or increased, variability can occur for reasons unrelated to the change in monetary arrangements. The forecast errors can be used, however, to reject the hypothesis that the change from fixed to fluctuating exchange rates increased excess burdens as measured by the variability of unanticipated changes in prices and output.

Table 3 shows the root mean square errors of forecasts under fixed and fluctuating exchange rate regimes. The errors are computed for levels of real income and prices and for rates of growth of output and for rates of price change. The errors for the levels are the sum

$$\sqrt{V(\varepsilon) + V(\gamma) + V(\varrho)}$$

where V is the variance of the error. The errors for growth and inflation omit $V(\varepsilon)$, the variance of the transitory error in the levels of output and prices.

Many of the errors lie in the neighborhood of 2%, not very different from the forecast errors reported in Tables 1 and 2 but higher than the best forecasts in some countries. The errors in the earlier tables are for forecasts of growth and inflation, but most shocks are durable, so ε is generally small, and the two sets of errors are often identical at the level of accuracy reported in Table 3.[7]

[7] The errors are from univariate models, so in principle efficiency can be increased. *Meltzer* (1985, 1986a) estimates vector autoregressions (VAR) using unanticipated changes to money, output and prices in part to measure the efficiency loss from the

Table 3

Root Mean Square Errors 1950 - 85
(annual rate in percent)

		Real Income	Growth	Price Level	Inflation
Denmark	1952 - 72	2.5	2.3	2.4	2.3
	1973 - 85	1.9	1.9	1.3	1.5
Germany	1952 - 72	2.3	2.1	1.8	1.7
	1973 - 85	1.8	1.7	0.7	0.4
Japan	1952 - 72	1.9	1.8	1.9	1.8
	1973 - 85	1.8	1.8	2.6	2.6
Sweden	1952 - 72	1.7	1.6	2.5	2.4
	1973 - 85	1.8	1.8	1.5	1.5
U.K.	1952 - 72	1.6	1.5	1.7	1.6
	1973 - 85	2.1	2.1	4.1	4.1
U.S.	1952 - 72	1.3	1.2	2.8	2.6
	1973 - 85	2.3	2.3	1.4	1.4

Comparison of the fixed and fluctuating exchange rate periods provides no support for the claim that fluctuating exchange rates increased variability and uncertainty. Only one of the six countries, U.K., shows increases in uncertainty for both prices and output. Two countries, Denmark and Germany, show reductions in all measures, with relatively large reductions in price level (or inflation) uncertainty during the fluctuating exchange rate period. Despite the oil shocks of the 1970s, price level and inflation uncertainty declined in four of the six countries under fluctuating exchange rates.

The reduction in uncertainty for Germany is highly suggestive. Germany has pre-announced rules for money growth and exchange rates. The exchange rate rule is an adjustable peg against currencies in the European Monetary System and fluctuating rates against other currencies. To provide information about its policy and about expected inflation, the central bank announces targets for central bank money, a measure very similar to the monetary base. While the targets are not always achieved, the record suggests that the government and the central bank are constrained by the targets. The Bundesbank, unlike the Federal Reserve, does not systemati-

univariate model. The reduction in forecast errors is often small. Since the VARs use data for the entire sample period to compute the error in each period, they overstate the reduction in forecast error that would be achieved in practice.

cally exceed its money growth target. Money growth is generally within the target range.

The two rules appear to have increased stability relative to other countries and relative to the fixed exchange rate regime. The Bundesbank raised the credibility of its announced disinflationary policy by holding money growth to a pre-announced disinflationary path through the late 1970s and the 1980s. Deviations from the path, for example to support the dollar in 1978, induce a smaller flight from money if the public believes the deviations are transitory. Further, the government has been willing to revalue the mark rather than import inflation from the countries in the EMS with more inflationary policies.

Denmark, and other countries in the EMS, can pursue independent monetary policies, if they choose to do so. Since they bear most of the cost of such policies under the adjustable exchange rate system, they have an incentive to follow stabilizing policies. Denmark appears to have reduced variability and uncertainty relative to its experience under the Bretton Woods agreement. These data suggest that, despite the oil shocks of the 1970s and the variability of real exchange rates for the dollar, Denmark was able to reduce uncertainty by the choice of policy, in this case, membership in the EMS.

Table 4

Mean Absolute Errors for Output in Japan and the U.S. Annual Rate in Percent

	Japan			United States		
	ε	γ	ϱ	ε	γ	ϱ
1950 - 72	0.5	1.0	1.2	0.3	0.6	0.7
1960 - 72	0.5	1.1	1.4	0.2	0.6	0.7
1973 - 85	0.1	0.6	0.9	0.3	1.0	1.7
1973 - 85*	0.1	0.3	0.2	0.3	0.9	1.7

* omitting year with largest error, 1974 for Japan 1984 for U.S.

The United States is the only country showing a relatively large increase in uncertainty about output and its rate of growth. Inspection of the detail shows that much of the increase is the result of a substantial increase in the forecast error for the permanent growth rate of output. A plausible explanation of the increased uncertainty about output and its rates of growth, relative to the past and relative to other countries in the table, is the frequent change in the thrust of U.S. monetary and fiscal policies in the past decade.

Frequent policy changes make the current and maintained rates of growth difficult to forecast, leading to frequent changes in the expected return to capital invested in the United States. These, in turn, cause changes in the demand for U.S. assets and in real exchange rates.

Japan shows no reduction in output uncertainty and increased price uncertainty following the shift to fluctuating exchange rates. This is misleading. Removing one large error for prices and output changes the results. For output, the forecast error made at the time of the 1974 oil shock is more than five times the mean absolute error. For prices, the forecast error for 1975, when the Bank of Japan changed to a policy of monetary targets and disinflation, is more than four times the mean absolute error.

Table 4 compares the size of errors in forecasts of output for Japan and the United States in different periods by type of error. The table shows that the errors for the fixed exchange rate period are not affected by starting the period in 1950. Mean errors are not much different if 1960 - 72 is used instead.

For Japan, the three computed values of the mean absolute errors for 1973 - 85 decline, but for the United States, all three increase following the adoption of fluctuating exchange rates. Omitting the year with the largest forecast error substantially reduces the mean absolute error for output (and prices) in Japan and the RMSE for Japan. Thus, omitting 1974, reconciles the annual results for Japan with the results reported using quarterly data in *Meltzer* (1985). For the United States, the largest error occurs in 1984. Omitting this year slightly reduces the mean absolute error but does not alter the direction of change or the conclusion that output uncertainty increased in the U.S. under fluctuating rates. Since increases are not observed for other countries, we can reject the hypothesis that the increased output uncertainty is a consequence of the fluctuating exchange rate system.

A plausible, but not fully tested, hypothesis is that the increased variability and uncertainty in the U.S. is the result of more frequent changes in U.S. policy than in the policies of Germany, Japan or Sweden. Under the fixed exchange rate regime, these countries absorbed many of the shocks emanating from the U.S. Under fluctuating rates, they can avoid some of the shocks. During the 1970s and 1980s, several countries adopted and sought to implement medium- or long-term strategies for economic policy. The U.S. repeatedly changed the direction of tax, defense, energy and monetary policies in response to changes in economic activity and popular sentiment.[8] It

[8] Greater certainty (reduced uncertainty) about policies may reduce variability directly, e.g. by lowering monetary variability or by lowering the variability of velocity growth.

should not be surprising, given the inaccuracy of forecasts, that frequent policy changes can create an excess burden, raising social costs and increasing the real rate of interest by imposing a risk premium. *Mascaro* and *Meltzer* (1983) find evidence that this occurred in the 1980s.

Two main conclusions emerge from these comparisons. First, as already noted, there is no evidence that a system of fluctuating exchange rates necessarily increases uncertainty. Second, in the U.K. and the U.S. uncertainty about output or the price level is higher than in earlier periods. To the extent that the variability in the U.S. and U.K. affect other countries, uncertainty in these countries also is not at the minimum inherent in nature and trading arrangements.

IV. A Rule to Reduce Variability

In "A Tract on Monetary Reform", Keynes (1923) considered two types of rules – rules for domestic price or internal stability and rules for exchange rate or external stability. He favored internal price stability but there, and in his later work, he recognized the advantages of reducing both internal and external instability. He recognized also that each country operating alone must sacrifice either internal or external stability unless some country adopts a credible rule for achieving price stability.

Countries operating together can individually achieve internal price stability (or reduce instability) and collectively reduce instability of the exchange rate. *Keynes'* argument recognizes that stability is a public good and that there are costs of providing stability. One of his main arguments against the classical gold standard is that under this standard the social cost of exchange rate stability is higher than can be achieved by alternative arrangements. Throughout his life he proposed alternatives. The Bretton Woods agreement was Keynes' last effort to solve the problem of internal and external stability.

In practice, countries have achieved neither price nor exchange rate stability in the postwar period. Excess burdens, measured by the variability of unanticipated changes in prices and output appear to be lower than during the interwar period or under the classical gold standard[9] but, as noted in the preceding section, variability can be reduced further by an appropriate rule.

Policy rules differ on many dimensions. *McCallum* (1984) makes the useful distinction between activist and discretionary rules.[10] An activist policy rule

[9] *Meltzer* (1986b) compares the different regimes from 1890 to 1980 for the United States. Additional computations for other countries generally support this conclusion.

permits the policymaker to respond to events in the economy, or in other economies. The responses follow a rule; they are predictable by private individuals. Hence the changes do not increase the unanticipated component in output and prices. Since all changes are made in accordance with a rule, they are nondiscretionary.

A second characteristic dinstinguishes activist rules that rely on forecasts of future values from rules that make policy action conditional on observed values. The data summarized in Tables 1 and 2 give no reason to believe that a rule making action conditional on forecasts reduces uncertainty. Policies based on forecasts appear to be a less effective means of reducing variability and uncertainty than (some) rules that constrain policy action to a more predictable path.

A rule to achieve price stability must choose between the stability of the actual or anticipated price level.[11] Permanent productivity changes, and other permanent changes in the level of output, affect the price level. A rule that calls for stability of the actual price level requires the policymaker to reverse all changes in the price level. A rule that maintains stability of the anticipated price level allows the actual price level to adjust as part of the process by which the economy adjusts real values to unanticipated supply shocks. Once adjustment is complete, real values are the same under either rule. Differences arise during the adjustment, however. To maintain stability of actual prices, the policymaker must know the proper amount by which to change money and other nominal values, so he must know structural parameters including the size of the real wealth effect, the magnitude of the productivity shock, and the price elasticity of aggregate supply. The public must have confidence that the policymaker knows these magnitudes. Such confidence would be misplaced. We simply do not know and, after several decades of empirical work in macroeconomics, we should not expect to learn these values with enough precision to improve on market adjustment of the price level to one-time shocks.

Further, there is no reason why current owners of nominally denominated assets should not share in the gains and losses resulting from changes in productivity or supply shocks. One of the main benefits of price stability is that stability of anticipated prices reduces uncertainty faced by transactors, thereby lowering the risk of long-term investment. This is, of course, the argument stressed by proponents of the classical gold standard. Another main benefit is that individuals who save for retirement (or for the distant

[10] *Dornbusch* and *Fischer* (1978, Chapter 10) make a similar distinction.

[11] If the optimal rate of inflation is non-zero, the rule should distinguish between actual and anticipated inflation.

future) have less reason for concern about the form in which assets are held and less reason to fear that the real value of accumulated saving will be altered by unanticipated inflation. Stability of the anticipated price level reduces these risks.

The rule I propose is activist, but nondiscretionary. No use is made of forecasts when setting policy variables. The rule recognizes that, within a period relevant for policy, the trend growth of output is not a fixed value but varies stochastically. The rule has two parts.

The first achieves stability of the anticipated domestic price level by setting the current growth rate of the monetary base (b_t) equal to the difference between a moving average of the growth rate of domestic output ($\bar{y}$) and a moving average of the rate of growth of base velocity ($\bar{v}$). Since forecasts cannot dinstinguish, on average, between booms and recessions, the rule adjusts b_t in response to the most recent past values of $\bar{y}$ and $\bar{v}$ that are known reliably. Formally, the rule sets

$$b_t = \bar{y}_{t-1} - \bar{v}_{t-1}.$$

The second part of the rule reduces variability of exchange rates. This requires major trading countries – the United States, Germany, Japan, and perhaps the U.K. – to adopt the same rule for stability of the anticipated domestic price level. The rate of growth of the monetary base would differ with the experience of each country and would change over time. Anticipated and actual exchange rates would be subject to change with changes in relative productivity growth, rates of growth of intermediation, differences in rates of saving, in expected returns to capital, in labor-leisure choice or other real changes. Prices would continue to fluctuate, but anticipated domestic price levels would be constant in all countries that follow the rule, so the rule eliminates this source of short-term instability in real and nominal exchange rates and of long-term changes in nominal exchange rates. The remaining changes in real exchange rates facilitate the efficient allocation of resources in response to changes in tastes and technology at home and abroad.

To complete the rule, we have to choose the period over which moving averages of output and base velocity are computed. In the past, I have suggested a three year moving average. In practice, a longer or shorter period may provide more stability. Empirical studies can help to determine the length of the period used to compute the moving averages.

Smaller countries could choose to import enhanced price and exchange rate stability by fixing their exchange rate to a basket of the currencies of

major countries or to one of those currencies. They would not be required to do so. There are no international exchange rate agreements under the rule. Each country would choose its own course. If all countries – large and small – choose independent policies, or make frequent discretionary changes, uncertainty will not be at a minimum. Everyone must accept greater variability of exchange rates, if large countries fail to supply stability.

The proposed rule has some additional advantages:

(1) Costs of monitoring are relatively low. The public can observe, and the central bank can control, the monetary base with very little error. Departures from the rule can be observed quickly, so the principal effect of deviations from the rule is on the exchange rate and not on aggregate real demand.

(2) The rule does not adjust to short-term, transitory changes in level, but it adjusts fully to permanent changes in growth rates of output and intermediation (or other changes in the growth rate of velocity) within the term chosen for the moving averages.

(3) The rule is adaptive and modestly counter-cyclical, particularly if recessions lasts for several quarters. If there is an unanticipated decline in real growth, the moving average rate of output growth falls but not as much as the growth rate of current output. Hence growth of the monetary base declines much less than the growth of output in recessions and rises less than the growth of output in expansions.

(4) The rule reflects the difficulties of forecasting and uses certain knowledge about quantitative magnitudes.

V. Conclusions

Through most of the postwar period, the international financial system has been based on the dollar. The dollar served as the principal reserve currency, or store of value, and the principal standard for deferred payments. For a time the dollar standard provided exchange rate stability with relatively low inflation in major trading countries, although formal devaluation or revaluations of the mark, the French franc, the pound and other currencies occurred from time to time.

The period of relative stability ended with the inflation of the 1960s. For the past twenty years, domestic and international monetary policy has provided neither price nor exchange rate stability. As measured by the variability of unanticipated changes in prices and output, however, uncertainty has not increased, and in some cases has decreased. Computations for Germany,

Denmark and Japan suggest that uncertainty can be reduced further if countries adopt monetary rules for internal and external stability.

Neither discursive argumentation nor formal analysis has resolved major issues about the relative costs and benefits of fixed and fluctuating exchange rates for individual countries. Comparisons of policy rules and discretionary action have been advanced by the development of dynamic models with rational expectations, but many countries have not agreed on the type of rule or even accepted the principle that a rule or a medium-term strategy increases welfare.

On the other hand, some countries – notably Germany and Japan – have been reluctant to deviate from their policy rules or to alter their policies. They have remained committed to price stability, or low inflation, in the face of substantial changes in nominal and real exchange rates and exhortations from other countries. Those urging discretionary changes in the monetary policy of these countries often rely on forecasts. Others emphasize the value of stability and the advantage of rules.

To advance the discussion of policy rules and discretionary action and of fixed and fluctuating exchange rates beyond the point the which they are usually left, I introduced two types of data. One shows the forecasting record of private and public bodies. The other uses the variability of annual forecast errors in prices and output as measures of uncertainty under fixed and fluctuating exchange rates for several countries.

The forecasting record gives little reason to believe that variability and uncertainty would be reduced by discretionary action based on forecasts or by policy rules conditioned on forecasts.[12] Forecasts, whether based on econometric models, statistical models, judgment or some combination of these methods, are so wide of the mark that, on average, they cannot distinguish reliably between booms and recessions in the current quarter or a year ahead. Further, comparison of Federal Reserve and OECD forecasts and private forecasts shows that public agencies have not been able to use confidential information to improve forecast accuracy. Federal Reserve forecasts of nominal GNP growth have been less accurate and show substantial bias, while errors by private forecasters appear to be unbiased.

The data suggest that the shift from fixed to fluctuating exchange rates was not followed by a general rise in uncertainty about prices and output, as is often suggested in policy discussions. In some countries both measures of

[12] In a recent paper, *Zarnowitz* (1986) finds that forecast accuracy has not improved since the 1950s and that forecasts are less accurate for recession than for expansions.

uncertainty are lower under fluctuating than under fixed exchange rates. Of the six countries studied, only one shows an increase in both price and output uncertainty under fluctuating exchange rates.

Two lessons can be drawn from this experience. First, fluctuating exchange rates do not of necessity increase uncertainty for private decision makers.[13] Second, the two countries that adopted rules for internal and external stability – Germany and Denmark – reduced uncertainty absolutely and relative to other countries studied.

Based on these findings, I propose a monetary rule to increase price and exchange rate stability that does not require agreements to take coordinated policy action. The rule is simple to follow and easy to monitor. Each major country – Germany, Japan, the United States and perhaps the United Kingdom – achieves price stability on average by setting the rate of growth of the monetary base equal to the difference between the moving average of past real output growth and past growth in base velocity. If each country adopts a compatible rule, the rule reduces variability of exchange rates arising from differences in expected rates of inflation.

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[13] I have not attempted to reconcile the reduced variability of unanticipated changes in prices and output with the increased variability of ex post real exchange rates. Financial markets may effectively buffer the real economy from these shocks. Whether this occurs and whether the result approaches optimality remains open.

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Zusammenfassung

Einige Lehren über geldpolitisches Management

Viele Zentralnotenbanken verlassen sich in ihren diskretionären, geldpolitischen Entscheidungen auf Prognosen. Eine Reihe neuerer Forschungsarbeiten legt nahe, daß eine adaptive Regel, die verfügbare Daten ausnutzt, die Effizienz der Politik vergrößert, indem sie die Prognostizierbarkeit der politischen Maßnahmen verbessert und das wirtschaftliche Wachstum erhöht. Dieser Aufsatz behandelt empirische Fragen. Prognosefehler privater und öffentlicher Prognosen werden vorgeführt. Für alle untersuchten Länder und Zeitperioden lautet das Hauptergebnis: Die Prognosefehler sind im Vergleich zu den normalen Änderungen der Variablen so groß, daß die Prognostiker in der Regel nicht in der Lage sind, zu prognostizieren, ob die Volkswirtschaft sich im nächsten Vierteljahr oder im nächsten Jahr in einem Boom oder in einer Rezession befinden wird. Der Aufsatz vergleicht auch für sechs Länder die Größenordnung nicht antizipierter Änderungsraten bei fixen und bei flexiblen Wechselkursen. Das Hauptergebnis hier ist, daß entgegen allgemeiner Annahme die Variabilität von Preisen und Output in mehreren Ländern während des Regimes flexibler Wechselkurse geringer war. Aufgrund dieser Ergebnisse wird eine adaptive Politikregel vorgeschlagen, um die Variabilität von Preisen, Wechselkursen und wirtschaftlicher Aktivität zu verringern.

Summary

Some Lessons of Monetary Management

Many central banks rely on forecasts to make discretionary changes in monetary and fiscal policies. Much recent research suggests that some type of adaptive rule that exploits available data increases efficiency by increasing the predictability of policy actions and the pace of economic activity. The paper takes an empirical approach. Forecast errors from private and public forecasts are presented. A principal finding, for all countries and time periods considered, is that the forecasts errors are so large relative to mean changes that forecasters are unable to predict, on average, whether the economy will be in a boom or a recession in the next year or quarter. The paper also compares the size of unanticipated changes in six countries under fixed and fluctuating exchange rates. The principal finding is that, contrary to common assertions, several countries have had less variability of prices and output during the fluctuating exchange rate regime. Based on these findings, an adaptive rule is suggested to reduce variability in prices, exchange rates, and economic activity.

Résumé

Quelques leçons de management monétaire

De nombreuses banques centrales se basent sur des prévisions pour entreprendre des changements discrétionnaires dans leurs politiques monétaire et fiscale. Une recherche plus récente suggère qu'un certain type de règle adaptive, qui exploite des données disponibles, augmente l'efficacité, tout en améliorant la prévisibilité des mesures politiques et le résultat d'activités économiques. Cet article fait une approche empirique. L'auteur y présente des erreurs de prévision de prognostics privés et publics. Une des conclusions principales pour tous les pays et toutes les périodes considérées est que les erreurs de prévision sont autant dues aux changements principaux qu'à l'incapacité des conseillers politiques de prédire en moyenne si l'économie connaîtra l'année ou le semestre à venir un boom ou une récession. L'auteur compare aussi dans cet article l'ampleur des changements non-anticipés dans six pays sous des taux de change fixes et flottants. Sa conclusion contredit les affirmations habituelles: selon lui, plusieurs pays ont eu des prix et un output moins variables durant le régime de taux de change flottants. Sur base de ces conclusions, il suggère une règle adaptative afin de réduire la variabilité des prix, des taux de change et de l'activité économique.