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Policy Rules as a Means to a More Effective Monetary Policy*

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This paper reviews recent developments in the design of monetary policy rules and shows that there are several key similarities between interest rate rules and money supply rules. In particular, both types of rule entail a positive response of interest rates to real output. The paper also shows why setting targets and using policy rules to achieve those targets can make monetary policy more effective.

Key words: Monetary policy; Policy rule; Inflation target; Price stability; Output stability; Time inconsistency

The purpose of the Seventh Bank of Japan International Conference is to discuss ways in which monetary policy can be made more effective. There are many routes to a more effective monetary policy—through more accurate measurement of inflation, greater knowledge of the monetary transmission mechanism, better ways to supervise banks and other financial institutions, and so on. But the most basic route of all, in my view, is through the development of a set of monetary policy rules or guidelines to help guide monetary policy decisions.

The use of monetary policy rules is a theme which has repeatedly come up at previous Bank of Japan conferences—Milton Friedman (1985) and James Tobin (1985) discussed policy rules in their keynote addresses at the First Bank of Japan International Conference in 1983 and such rules are discussed in most of the papers for this conference. Continuing in that tradition, my aims are (1) to briefly review historical developments in the empirical design of policy rules—with an emphasis on what has happened since the rational expectations revolution began to transform econometric policy evaluation methods in the early 1970s, (2) to give the reasons why

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setting explicit targets and using policy rules to achieve those targets can make monetary policy more effective, and (3) to discuss some of the differences and similarities between some recent policy rules which have been proposed for practical application in the United States and other economies.

I. Models, Trade-Offs, and Targets

A basic principle of economic policy analysis is that recommendations for policy actions—including proposals for policy rules—be based on a coherent explanation, or theory, of how policy actions affect the economy, backed up by empirical facts in support of the theory. The most formal way to provide an empirically supported theory is through a well-specified and tested econometric model, but less formal descriptions of theories and facts have their use as well. The introduction of rational expectations to macroeconomics by Robert Lucas in the 1970s (see Lucas, 1972, for example) had major impacts on our models—both theoretical and empirical—of how monetary policy actions affect the economy.

A. No Long-Run Trade-Off

The rational expectations revolution laid to rest the notion of a long-run trade-off between the rate of inflation and the rate of unemployment, as first put forth by Milton Friedman and Edmund Phelps. That is, when averaged over long periods of time, such as decades, higher rates of inflation are not associated with lower levels of unemployment, and lower levels of inflation are not associated with higher levels of unemployment. Whether average inflation is high or low in a given decade, unemployment hovers around a natural rate of unemployment during that decade. Experience with inflation and unemployment during the decades of the 1970s and 1980s in the United States and other countries has confirmed this view.

The natural rate of unemployment is not a constant, however. For example, the rise in unemployment in Europe compared to the United States since the 1980s is due to a rise in the natural unemployment rate in Europe relative to the United States.

Moreover, the nonexistence of a long-run trade-off between inflation and unemployment does not mean that inflation does not have long-run effects on economic growth and productivity. Cross-country evidence suggests that countries with higher rates of inflation tend to have lower long-term economic growth rates.

B. A Short-Run Trade-Off?

The introduction of rational expectations into macroeconomics was less definitive, however, about the short-run trade-off between inflation and unemployment. Today, many remain tentative about the existence of such a trade-off, or at least about how to describe it and take account of it in policymaking. Some early econometric models with rational expectations (Sargent, 1976, for example), implied there was no short-term trade-off in the sense that short-run anticipated *changes* in inflation or money growth would not affect the level of the unemployment rate. Models without a short-run trade-off—which today includes most real business cycle models—usually assume perfectly flexible prices.

But other econometric models, for example, the one which I built about the same time as Sargent's (Taylor, 1979), do imply a kind of short-run trade-off, and this trade-off has implications for monetary policy decisions. Such models are usually based on some degree of temporary price or wage rigidities. I have found the short-run trade-off best described and estimated in terms of a trade-off between the *variability* of inflation and the *variability* of unemployment: that is, in terms of the short-run fluctuations in these variables rather than their levels over time. In particular, I find that there is a trade-off between the size of the fluctuations in inflation and the size of the fluctuations in real GDP (or the fluctuations in unemployment because deviations of real GDP from potential GDP are highly correlated with deviations of the unemployment rate from the natural rate).

The best way to understand this short-run variability trade-off is to consider some scenarios which bring it about. Consider a situation where the unemployment rate equals the natural rate of unemployment (or real GDP equals potential GDP) and where inflation is equal to the target rate of inflation, perhaps zero inflation. Now suppose that there is a upward shock to velocity. Assuming that monetary policy cannot react to offset the velocity shock immediately, the shock will cause real GDP to rise above potential GDP, probably with a lag of several quarters. Most likely this boom in the economy will cause the inflation rate to rise above its target, again with a lag. In such a situation the central bankers have a policy decision (if they were following a policy rule their decision would be stipulated by the rule): How much should we "tighten" policy? If the central bank tightens policy sharply letting short-term interest rates rise by a large amount in response to the rise in inflation, the inflation rate will return to target quickly, but the economy will slow down and perhaps go into recession. Alternatively, if the central bank is more cautious in

tightening policy, the inflation rate will return to target more gradually, but there will be a smaller slowdown in real GDP. One monetary reaction results in more inflation stability and less real GDP stability, while the other monetary reaction results in less inflation stability and more real GDP stability. Hence, the trade-off.

Many other shocks would give rise to the same set of choices. For example, the monetary response to an unanticipated change in potential GDP growth, a run-up in oil prices, or simply a past error in setting or measuring the money supply, would affect the size of the fluctuations of inflation versus real GDP.

C. The Rationale for Inflation Targets

Whether or not there is an inflation-output variability trade-off, the finding that there is no long-run trade-off has unambiguous normative policy implications in my view. It implies that central banks should choose a target for inflation and then consistently stay with the target. Because higher inflation has higher costs and no benefits in terms of lower unemployment, a low target for the inflation rate is better than a high target for the inflation rate. Due to biases in the measure of inflation, a target of slightly greater than zero would be reasonable, and may be near an actual inflation rate of zero.

Even with such an inflation target for monetary policy, the actual inflation rate would tend to fluctuate around the target. Or if the target is stipulated as a range then the inflation rate would fluctuate within that range. If all the major central banks adopted inflation targets and stuck with them then a major source of uncertainty about exchange rates would be removed and we would likely see a much greater stability of exchange rates.

It should be noted that an inflation target is not a maximum for inflation; if inflation falls below the target (deflation if the target is zero) then that is as poor an outcome as inflation being above the target. For example, an explicit target of one percent inflation would imply easing of monetary policy if inflation were below one percent.

In my view this same theory also implies that the central bank should *not* set a long-run target for the unemployment rate or for the gap between potential GDP and real GDP. According to the theory neither the unemployment rate nor the GDP gap can be affected by monetary policy in the long-run. Of course, a higher inflation rate can affect the growth rate of potential GDP and since the inflation rate is affected by money growth the central bank can implicitly affect the growth rate of potential GDP;

but setting a low target of inflation is apparently the best monetary policy for potential GDP growth.

D. Targets versus Rules

This conclusion that the central bank should set a long-run target, or a target range, for inflation, but not for real variables like real GDP or unemployment, does not imply any particular policy rule to achieve that target. In fact, as I will show, there is a whole range of policy rules which will give the same average target rate of inflation. The long-run average rate of inflation is determined by the long-run average rate of money growth, but there are many different monetary policy rules which generate the same long-run money growth. An important question, in my view, is which of those policy rules works best in keeping the fluctuations of inflation around the stated target small. That depends on the nature of the short-run trade-off.

II. Rules for Setting the Instrments of Monetary Policy

I have already begun to use the term "policy rule" without defining what I mean by policy rule. In my work I have focused on policy rules that describe explicitly what the central bank should do with its instruments of policy. Currently we can think of two broad classes of monetary instruments—monetary aggregates, such as the monetary base, and short-term interest rates, such as the federal funds rate. I recognize that this is a somewhat more narrow focus than in recent research. In my view, if a policy rule is to be useful in making monetary policy more effective to policymakers it should stipulate exactly how the instruments of policy should be set in response to events in the economy.

A broader focus on policy rules might include nominal GDP targeting, which simply states that the central bank should keep the growth rate of nominal GDP at a certain target or target range. However, a nominal GDP target does not specify the actions that must be taken regarding interest rates or the monetary aggregate to achieve that target. Similarly, simply setting a target for the inflation rate or the price level does not tell the central bank what to do. Setting targets without policy rules is like telling a sailing ship's crew to "head zero degrees north" without stipulating how to turn the rudder, tack, or trim the sails when the wind or current changes. One could simply say that sailing is a "technical problem" the crew can figure out on its own, but it would be constructive for those giving policy advice to

endeavor to at least comment on this important (and as interesting as sailing) technical problem.

A. Money Rules

By far the most widely cited monetary policy rule is the constant growth rate rule for the money supply put forth by Milton Friedman. Friedman's justification for this rule—summarized nicely in Friedman's (1985) address to the First Bank of Japan Conference was based on monetary theory and extensive empirical research which documented the dynamic effects of changes in the money stock on inflation and output. Friedman explicitly rejected price level or inflation targeting as a substitute for a monetary policy rule. "I think this is the wrong kind of rule" (Friedman, 1962) because of a lack of a close short-term connection between the money stock and the price level. Friedman also rejected proposals that money growth be adjusted to events in the economy though he had earlier advocated using money to finance the budget deficit and thereby have money growth vary counter-cyclically.

However, armed with a new class of rational expectations econometric models, extensions of Friedman's constant growth rate rule to allow for contingencies began to be examined in the late 1970s. For example, I designed and proposed an alternative money rule using a rational expectations econometric model; this rule called for money growth to respond to real GDP, but not to accommodate inflation. In particular, money growth would average the Friedman *k*-percent rate, but would be increased when real GDP dropped below potential GDP and decreased when real GDP rose above potential GDP. The optimal rule (derived from the model) had the feature that (as an approximation) the money supply should not respond to inflation at all. In other words, if inflation picked up the money growth would stay constant, reducing real money balances, slowing down the economy, and thereby bringing inflation back under control. As a matter of econometric estimation I found that it was not optimal to decrease the money supply when inflation rose or increase it when inflation rose (even if there were a supply shock).

Simulation of the model showed that such a policy rule would outperform a constant growth rate rule for the money supply, though the constant growth rate rule was better than the actual policy at the time. This calculation was based on the inflation-output variability trade-off previously discussed.

B. Velocity Shocks and the Rise of Interest Rate Rules

In the mid-1980s research on monetary policy rules aimed at guiding the instruments of policy experienced two significant developments. I believe both developments were related to a decrease in the observed stability of several velocity measures.

First, there was an increased emphasis of interest rate rules rather than money supply rules. For example, during this period I was working on a multi-country econometric model with rational expectations with the aim of experimenting with alternative money supply rules. My first working paper reporting the results—which argued in favor of flexible exchange rates—was based entirely on simulating money supply rules in which the money supply in each of the developed economies responded to various indicators. However, because of the large estimated money demand shocks in my estimated money demand equations, it quickly became apparent that interest rate rules would result in less instability than money rules; at least that was what was implied by the model simulations, as could be expected from the analysis of different instruments by Poole (1970). For this reason I began to focus on interest rate rules, examining which variables should be in the policy rule and what the size of the response coefficients should be. Also during this period, the Fed and other central banks began moving toward interest rate setting in their policy deliberations—a move which is now complete and transparent at the Federal Reserve. In any case virtually all the policy rule analysis in my final multi-country model (Taylor, 1993) was conducted in terms of interest rate rules.

The other development in research on policy rules consisted of the proposals by McCallum (1988) and Meltzer (1987) for money rules which automatically adjust to shifts in velocity. McCallum has since done extensive experimentation with such money rules by simulating their performance in different models and for different countries, including Japan (McCallum, 1993).

This research on policy rules—both money and interest rate rules together—has now become quite substantial. The book edited by Bryant, Hooper and Mann (1993) has assembled much of this research in one place. Rational expectations model simulations by Fuhrer and Moore (1995) has been in a similar vein though focused on a single economy framework. Work by Judd and Trehan (1995) at the San Francisco Fed and by Lipsky and others (1995) at Salomon Brothers has investigated the use of policy rules for both historical analysis and forecasting. In fact, virtually all academic policy evaluation research on monetary policy in recent years has focused

on policy rules.

In my view this research is providing information which can be quite useful in making monetary policy more effective. But the results of the different researchers do not always agree and are hard to reconcile. For example, while it is possible to glean a slight consensus about policy rules from the Bryant, Hooper, and Mann study, in many cases the experiments were not conducted in the same way by different researchers.

C. Advantages of Policy Rules

There are several reasons to recommend policy instrument changes through policy rules rather than as one-time changes in the instruments of policy. The most commonly cited reason is the time-inconsistency problem which states that, without commitment to a rule, policymakers will end up choosing a suboptimal monetary policy—with a higher average inflation rate and the same unemployment that could be achieved with a lower average inflation rate (see Kydland and Prescott, 1977). But the time-inconsistency problem is only one of many reasons for using policy rules, and, as I first argued in comments on the Kydland and Prescott (1977) and Barro and Gordon (1983) papers (see Taylor, 1983), it is difficult to see why the time inconsistency problem should be that tough for a political system to solve in the case of the unemployment-inflation trade-off.

There are several other good reasons to make use of policy rules. First, if people are forward-looking one needs to stipulate future as well as current policy actions in order to evaluate the effects of policy. Second, policy rules can reduce uncertainty about policy actions and thereby can reduce risk premia in financial markets. Without a policy rule to describe monetary policy actions, market participants find it difficult to forecast future actions or even interpret current actions of policymakers. Third, policy rules can be useful as a way to instruct policymakers about actions to take to achieve their goals. If there were a school for central bankers the early lessons might indeed be conducted in terms of policy rules describing what they ought to do in certain circumstances. Fourth, policy rules can make it easier to teach students and educate the public about the actions of one of the most powerful agencies of government. Fifth, policy rules provide a way to increase the accountability of policymakers: if the policy rule is reliable then policymakers would find themselves having to account for differences between their actions and the recommendations of a policy rule. Of course, I recognize that, at least with our

current knowledge, events like the 1987 stock market crash may require that the central bank depart from the rule, and that some discretion is still necessary in working with a rule. But with a policy rule the analysis of policy—including justifying whether a deviation from the rule is warranted—will tend to focus less on discretion and more on the rule.

III. The Similarity between Money Rules and Interest Rate Rules

Although interest rate rules and money supply rules are frequently viewed as quite different there is an important similarity between them. First, consider a money supply rule which calls for constant growth rate of the money supply. Recall that the demand for money is a demand for real money balances—the money supply divided by the price level (P)—which is a function of some scale variable such as real income or real GDP (Y), an opportunity cost variable such as the short-term interest rate (R), and some other taste variables which may change from time to time. If money growth is fixed then the money demand function can be viewed as a relationship between three variables: (1) the price level (P) or its percentage change the inflation rate, (2) real GDP (Y), and (3) the short-term interest rate (R). If we isolate the interest rate as one variable then this relationship says that the interest rate depends on the inflation rate and on real GDP. This relationship may be quite complex, but over long periods of time the signs are remarkably stable: along this relationship a higher level of real GDP raises the interest rate and a higher level of inflation also raises the interest rate (assuming a constant rate of money growth).

The similarity between money supply rules and interest rate rules is that many interest rate rules that have been proposed—including the ones that I have proposed (Taylor, 1993)—have exactly the same properties: a rise of real GDP calls for the central bank to increase the interest rate and an increase in the inflation rate calls on the central bank to increase the interest rate. In fact, when I simulate the effects of interest rate rules in econometric models I replace the money demand function with the policy rule as a determinant of the short-term interest rate. (The money demand function then becomes a way to project money growth, though not with much accuracy because of the volatility of the shocks to money demand.)

I think this close connection between money rules and interest rate rules is important. First, it helps us in the design of rules: the good properties of one type of rule can be copied in the other. In the case of the interest rate rules I have proposed

the effect of real GDP and inflation on interest rates are carried over from money supply rules but the volatility of velocity is left behind. Second, the connection reminds us that if interest rate rules become unreliable—perhaps because inflation gets very high or very low (deflation) and short-term nominal interest rate movements become dominated by expectations of inflation or deflation then money rules can be emphasized. For example, in Japan in recent years the deflation has, in my view, made an interest rate rule unreliable, calling for greater emphasis on money supply rules and the need to keep money growth from falling. Another example was the Great Depression in the United States in the 1930s. I would argue that interest rate rules need to be supplemented by money supply rules in cases of either extended deflation or hyperinflation.

The similarity between money supply rules and interest rate rules suggests that both have a role as a consistency check on monetary decisions. For example, in recent work Wall Street economists interested in projecting Fed behavior have consulted both types of rules (see Lipsky and *et al.*, 1995).

A. The Role of Real GDP in Interest Rate Rules

The connection between money rules and interest rate rules helps resolve a puzzle that many have raised about interest rate rules. As I stated earlier, modern macroeconomic theory implies that it is not wise for a central bank to have a long-run target for real output or unemployment as it should for an inflation rate. But then why is real output a variable in the interest rate policy rule I have suggested? The answer is that non-target variables have an important role in policy rules; effectively real GDP plays a role in moving interest rates when the central bank keeps money growth fixed: this is one of the attractive features of money supply rules, because the interest rate increase helps moderate the boom in real GDP and thereby helps stabilize both inflation and real GDP. Real GDP appears in interest rate policy rules for exactly the same reason: the increase in the interest rate helps moderate the boom and stabilize inflation.

B. Future Developments Relating to Monetary Policy Rules

I am getting old enough to see the development of monetary policy rules from a long-term perspective. My first experience with research on monetary policy rules was when I was in college nearly 30 years ago. In my senior thesis (Taylor, 1968) I built a dynamic simulation model to evaluate different types of policy rules for

monetary policy. In fact the rule which I found worked best was a money rule in which the money supply growth rate increased when real GDP fell below potential GDP and decreased when real GDP rose above potential GDP—an adaptation of the Friedman *k*-percent rule. Needless to say that model was before rational expectations entered macroeconomics, and involved no formal policy optimization. It is nice to see the progress we have made since then. In my view, future progress will occur not only in improving policy rules, but in finding ways for them to be more useful to practitioners of monetary policy.

Are policy rules of the type I have described here applied in practice? Some have characterized the Federal Reserve policy of the late 1970s and early 1980s as monetarist, but Friedman (1985) argued in no uncertain terms that that was far from what the Fed was doing during that period. Similarly many have commented on the similarity of the interest rate policy rule I developed and the actual action of the Federal Reserve since 1987, but Federal Reserve officials say that at most they look at such a rule as a reality or consistency check, and I think this is true.

A challenge for future research is to find ways for policy rules to be used more directly by policymakers. The 1990 *Economic Report of the President* devoted a chapter to describing policy rules, showing how they can be useful, and describing in words an interest rate policy rule for the Fed. One of the advantages of explicit policy rules is that they can be used in real time at least in parallel with other means of formulating policy decisions. The experience can then prove useful in modifying the policy rule for the future.

In assessing future work on policy rules I think it is useful to close with a quote from Milton Friedman written after proposing the *k*-percent rule:

> I should like to emphasize that I do not regard my particular proposal as a be-all and end-all of monetary management, as a rule which is somehow to be written in tablets of stone and enshrined for all future time. It seems to me to be the rule that offers the greatest promise of achieving a reasonable degree of monetary stability in light of our present knowledge. I would hope that as we operated with it, as we learned more about monetary matters, we might be able to devise still better rules, which would achieve still better results (Friedman, 1962, pp. 54-55).

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