

**Recent Developments in the  
Use of Monetary Policy Rules**

By

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It is an honor to speak at this Bank Indonesia conference on monetary policy. Thank you for inviting me, and thank you for asking me to talk about monetary policy rules, a subject that has been of great interest to me for nearly thirty years.

Economic research on the use of monetary policy rules has expanded remarkably rapidly in the past two or three years. It is difficult for me to keep track of all that is going on, though the World Wide Web is a real help. In my view, a number of important and useful results have emerged from this research and are worthy of special attention by monetary policy makers in both emerging and more developed economies. In reviewing some of these results in this speech, I will place emphasis on inflation targeting in emerging economies, the main topic of this conference. There is an interesting symbiotic relationship between inflation targeting and monetary policy rules. I will also touch on other policy issues that are important in emerging market economies, including the robustness of policy rules in different economic and financial environments, the role of the exchange rate, the use of forecasts, the problems of uncertainty about potential GDP, and reacting to financial market crises.

### **What Is a Monetary Policy Rule?**

A monetary policy rule is nothing more than a contingency plan that describes as precisely as possible the circumstances in which a central bank changes the *instruments* of monetary policy. In practice most of the recent research on policy rules has focused on the short term interest rate instrument—usually an overnight rate—because that is the decision variable for most central banks, though a policy rule could apply to the monetary base, or some other policy instrument. In my early research on policy rules (for example, Taylor (1979) I focused on

policy rules in which the money supply was the instrument), but since about 1985 I have focused on the interest rate, which in my view appears to work better except in situations of very high inflation or deflation. McCallum (1988) has continued to stress rules based on monetary aggregates. In any case, by this definition of a policy rule, nominal GDP targeting or inflation targeting are not policy rules because they are not statements about the instruments of policy.

But is the classic central bank policy of “leaning against the wind” a monetary policy rule? One of the earliest statements of a monetary policy that leans against the wind defines it as working “against extremes either of inflation or deflation” (the quote is from a 1923 annual report of the Federal Reserve). Thus leaning against the wind is a policy of changing the interest rate or the money supply when inflationary pressures change; this sounds like a contingency plan, and thus may seem like a policy rule. But without specifying what the “wind” is, how one measures it, and how much one leans against it, such a “leaning against the wind” policy has little if any content. Only by being specific about the main variables that the central bank reacts to—such as the inflation rate, real GDP, or the exchange rate, and about the size of the reaction to these variables, does such a policy become a meaningful policy rule.

In reality, the size of the interest rate responses matters greatly. For example, moving the overnight interest rate by more than one for one with the inflation rate is an essential property of a good monetary policy rule. Monetary theory shows that smaller than one-to-one responses can result in very poor performance. Recent historical and international comparisons of policy in different time periods or countries confirm this theoretical result. For example, the reaction coefficient of the interest rate to the inflation rate was less than one during the unstable high inflation period of the late 1960s and 1970s in the United States and greater than one in the more stable period of the 1980s and 1990s.

## **The Importance of Expectations**

Monetary policy rules are crucial for monetary policy analysis because *expectations* of future changes in the policy instruments have huge effects on financial markets and thus on the impact of monetary policy on the rest of the economy. For this reason a monetary policy rule is more important than any single change in the monetary policy instruments. And for this reason monetary policy makers should be as clear as possible about their policy actions and should try to keep the same policy rule in place for the long run, so that financial markets can form clear expectations of future policy actions. Then people can expect that in the same circumstances the policy instruments will change by the same amount, time and time again. Of course, gradual changes in the structure of the economy may entail gradual changes in the policy rule.

A very recent policy event demonstrates the importance of these expectation effects. In February 1999 the Bank of Japan initiated a zero interest rate policy. The Governor of the Bank of Japan made it clear that the monetary policy board would keep the overnight interest rate at zero (actually 2 basis points) until “deflationary concerns are dispelled.” Deflationary concerns were defined as a combination of actual changes in the price level and the gap between real output and potential output—sometimes called the “output gap.” This contingency statement has had the effect of lowering longer term interest rates because people in the financial markets expected that the zero interest rate would last for a while, or at least as long as deflationary conditions persisted. Expectations theory of the term structure of interest rates tells us that longer-term interest rates are expectations of future short-term rates. Thus the zero interest rate policy “rule” has been more effective than simply setting the overnight rate to zero because it

brought expectations of future interest rates to zero. In the view of the Bank of Japan this increased the expansionary effects of the policy.

In some interesting recent research, Reifschneider and Williams (1999) have shown how this kind of policy—if announced as a contingency *before* the interest rate goes to zero—can even reduce the likelihood of getting into deflationary situations. Such expectations effects are present in any monetary policy in which changes in the instruments depend on future events. Of course, the term structure is not the only place in the economy where expectations of the future matter. Even in situations where financial markets are not fully developed and there are few long-term securities, movements in the exchange rate, the price of land, even wages are affected by expectations of the future.

### **Warning: Not For Mechanical Use**

Policy rules are frequently written down in the form of a “mechanical-looking” algebraic formula, table, or graph. For example, a policy rule that I suggested for the Fed in the early 1990s can be written down in such a short form and I have done so on the back of this business card. It is in this explicit form that policy rules are most amenable to policy analysis by economists who use models to evaluate the policies and by econometricians who use statistical methods to compare policies in different periods or countries. But this does not mean that the only way that monetary policy rules can be used is for the central bank to follow them mechanically. On the contrary, most recent proposals for monetary policy rules assume that they would be used as guidelines for policy makers, recognizing the need for some discretion in using the rule. Monetary policy rules are sometimes criticized because central banks cannot—or will

not—use the rules mechanically. Such criticism is misplaced, because no one is saying—at least to my knowledge—that the proposed rules should be used mechanically.

Again an example is useful. The policy rule on the back of my business card suggests a very specific policy rule for the Fed; it calls for the quarterly average U.S. federal funds rate to rise by a specific amount when the quarterly inflation rate or the output gap increases. I proposed this rule in 1992 as a *benchmark or guideline* for assessing interest rate decisions. At a minimum, discretion was needed to assess monthly data on commodity prices, employment, industrial production and other variables, in order to estimate (or predict) the actual quarterly inflation rate and the output gap. Moreover, there will, on occasion, be a need to change the interest rate in the case of liquidity concerns in financial markets. Before the stock market break of 1987 in the United States the Fed was increasing the federal funds rate; inflation and the output gap were increasing. But when liquidity became a concern the Fed lowered the interest rate a bit and thereby provided the liquidity. After the liquidity concerns dissipated, the Fed returned to its tightening mode. By doing so it was able to contain the rise in inflation much earlier than in similar periods in the 1970s. In other words, these discretionary actions were relative to the benchmark policy. Despite these discretionary actions the benchmark policy rule continued to have substantive content for the decisions.

### **Normative Versus Positive Uses of Policy Rules**

Two types of uses of monetary policy rules should be distinguished: *normative* and *positive*. Monetary policy rules can have normative uses—providing a recommendation of a good way to conduct policy, and positive uses—providing a description of how the central bank actually does set policy (in which case the term reaction function is sometimes used.)

I am frequently asked whether the policy rule that I suggested in the early 1990s was meant to be normative or positive. My answer is “normative of course.” I had suggested that policymakers look at plots or tables showing the interest rate settings implied by the rule when they made their policy decisions, and I know that many monetary policy makers now look at such information before policy meetings. But I can understand the reason for the question, because a lot of interest in the rule has come from the fact that it has described the actual decisions of the Fed (and other central banks with good performance) pretty well.

In fact, most of the research on policy rules in the last few years has been normative. The methodology of this research has become so widespread that I like to call in the “new normative macroeconomics.” The methodology is model and computer intensive, and is being done at many different central banks, research institutes, and universities. It involves simulating different policy rules in estimated models of the economy. The policy rule that works best in terms of macroeconomic variables—real output, inflation, the exchange rate—is viewed as the best policy rule. I will come back to some of this research later in this speech.

Financial market analysts frequently use monetary policy rules in the positive way. Whether or not the monetary policy is good or not good, they use policy rules to help predict the short-term interest rate. Such a prediction is of course useful for analyzing exchange rates, bond prices, or stock prices.

An example of this type of use of policy rules is found in a recent analysis of Bank of England policy by PriceWaterhouseCoopers. In a report published late last year they said “If growth was left unchecked it could lead to an acceleration of inflation to over 4% in 2001. Using a simple Taylor rule, we estimate that interest rates would eventually need to be raised to around 7.5% by early 2001. In contrast, if the UK recovery stalls next year then inflation is likely to fall

further below target. Our Taylor rule simulations suggest that interest rates might then need to be cut to only around 4% by early 2001.” Another related example of the positive use of policy rules is in textbook explanations of how monetary policy works. With virtually no central banks in developing countries targeting money growth, a policy rule for the interest rate helps explain what central banks actually do, as has been emphasized by David Romer (2000). But even if the money supply is the instrument of monetary policy it is rarely held constant in all circumstances, so a reactive policy rule is more descriptive. The more people who understand monetary policy in a democracy, the better off monetary policy we will be.

Normative and positive uses frequently occur together for a number of reasons. First, by estimating an actual monetary policy rule and examining economic performance with that rule, one can assess which rules work well and which rules work poorly. There are many such examples of this mixture of positive and normative uses. As I mentioned at the start of this speech, empirical studies show that interest rate decisions in the United States can be described by a different—more reactive—policy rule in the 1980s and 1990s than in the late 1960s and 1970s. And economic performance has been better in the later period than in the earlier period. This empirical work on policy rules thus provides evidence that the more reactive policy rule should be followed in the future. Normative research supports such historical findings, giving us more confidence that it is very important for the coefficient of the interest rate on the inflation rate to be greater than one.

Another example (and an illustration of the case of a smaller, more open, economy) is that of the U.K. in the early 1990s. Before leaving the European Monetary Union in the early 1990s, the policy rule implied by Bank of England decisions was less appropriate for the British economy than the policy that was followed afterwards. Similarly, monetary policy in Japan in



the late 1980s and 1990s seems not reactive enough to the output gap, in comparison to periods with better economic performance.

### **Inflation Targets and Monetary Policy Rules**

There is an interesting symbiotic relationship between inflation targeting and monetary policy rules. And like many symbiotic relationships in nature, it is a beneficial relationship. There are a number of reasons for the symbiosis. One is that inflation targeting, especially as proposed and as adopted by emerging market countries, is an alternative to a fixed or crawling peg exchange rate regime. A floating exchange rate regime means that domestic monetary policy can be aimed at domestic economic conditions and that usually means keeping inflation low and stable, or, in other words, inflation targeting, is the first priority. This means that some procedure for setting the monetary policy instrument must be put in place, which, of course, soon leads to discussion or analysis of a policy rule of some kind. In fact, another way to think about inflation targeting is that it is simply a *flexible exchange rate with a policy rule*. To be sure, a flexible exchange rate system does not mean that the exchange rate does not play an important role in interest rate decisions or in the monetary transmission mechanism. But with a completely fixed exchange rate, there is no need for a monetary policy rule, because the policy instruments cannot be used for domestic purposes.

There is another, perhaps deeper, connection between inflation targeting and monetary policy rules. One cannot design or even evaluate a monetary policy rule without a target inflation rate, about which the actual inflation rate may fluctuate. Ever since the 1970s, research on policy rules has taken the target rate of inflation as given (see Taylor (1979) for example). A general policy implication of modern macroeconomics, in which there is no long run tradeoff

between inflation and unemployment, is that central banks should have a target for the inflation rate. A good policy rule is one in which the fluctuations around the target inflation rate are small. There also can be targets for other variables, as long as they are not inconsistent with the inflation target in the long run. For output, the target must be the natural rate of output. For nominal exchange rate appreciation or depreciation, the target must be the difference between the domestic target inflation rate and the average inflation rate of other countries. Once such consistent long-run targets are set, then there is a tradeoff between keeping small the fluctuations around the inflation target and the fluctuations around the other targets. The policy rule tells one how to pick a point on this tradeoff.

In any case, inflation targeting monetary regimes (including those in Australia, Brazil, Canada, Chile, the Czech Republic, Korea, New Zealand, Thailand, and the United Kingdom which we are hearing about first hand about at this conference) need a procedure for achieving the inflation target, and a monetary policy rule is one such procedure. And though a numerical inflation target is apparently the *sine qua non* of such regimes, even a less specific policy goal of price stability, such as used in the United States, needs a procedure to achieve the goal. Thus, inflation targeting regimes of all kinds need policy rules.

It is useful to quote Donald Brash (1999)—Governor of the Reserve Bank of New Zealand and a pioneer in the use of formal inflation targeting—on the relationship between inflation targeting and procedures for setting the instruments of policy. He states that “Clearly, inflation targeting is no panacea. It is no silver bullet. It is certainly no guarantee against monetary policy error. In many respects, it is a mistake to think of inflation targeting as some kind of new approach to monetary policy.” And he emphasizes that “All the debates about how to formulate monetary policy in order to deliver the best outcomes are still relevant. Should we

use monetary aggregates? Should we use Taylor rules? Should we simply adjust interest rates so that the exchange rate moves in such a way that the direct price effects of the change in the exchange rate produce the desired effect on the domestic price level?”

Thus, inflation targeting is not enough. You need to have a policy procedure—a policy rule—to achieve the target. In fact, as research and practice has shown, there are many different procedures and some work better than others. I like a sailing analogy: Inflation targeting is like the destination for a sailboat. A policy rule is how to sail the boat to get to the destination: for this you need to describe the angle of attack, the sail trim, the contingency for wind change, and so on.

### **The Surprising Robustness of Simple Policy Rules**

One surprising, and potential very useful, finding of recent research on the use of monetary policy rules is that simple rules are quite robust to different monetary transmission mechanisms, as represented by many different models of the economy (Taylor (1999)) and perhaps as might exist in a variety of different countries, including emerging market economies. Take as a benchmark, the policy rule for the interest rate on the back of my business card which I mentioned earlier. The interest rate reacts to inflation and the output gap, with the coefficient on inflation greater than one. That benchmark rule works well, in the sense that the fluctuations in inflation around the target and the fluctuations in real GDP are small, for a wide range of views of the transmission mechanism, including different roles for the exchange rate, different assumptions about expectations, different impacts of long term interest rates, and different models of the slow adjustment of wages and prices. The benchmark rule even holds up under radically different theories of nominal rigidities, including the so-called limited participation

models discussed by Christiano and Gust (1999), and under different views of money and credit (Bernanke, Gertler, and Gilchrist (1999)). As long as the weights are not too high or too low, this simple rule also performs well in keeping the inflation rate and real output stable.

It may seem paradoxical that simple policy rules are robust to such different models. What is the explanation? I think it comes from the fact that although the structure of the transmission mechanism may differ, a change in the interest rate eventually leads to the same type of change in inflation and output. The change in the interest rate and its effect on spending is still the main story of how monetary policy works. If a model is fit to the data it must reflect this effect of interest rates.

To be sure, it is possible that there is a developed country bias to the models that underlie these robustness results. Thus a very high priority is to build and estimate models in emerging countries, and to evaluate policy rules in these models. Today we heard about a small model of Brazilian economy put together during the last year at the Central Bank of Brazil, and tomorrow we will hear about a small model of the Indonesian economy developed at the Bank Indonesia. Policy rules are evaluated in both of these models. It is interesting that the models are of the general form of the models used in the robustness work I have summarized here (Taylor (1999)) and this may be an indication that the robustness results may carry over to emerging country settings.

### **Reacting to the Exchange Rate**

Exchange rate issues are very important in emerging market economies with a great deal of international trade and with less than fully developed financial markets. Of course, open economy issues have not been ignored in the research on policy rule evaluation. The exchange

rate is part of the transmission mechanism in many models. It plays a role in aggregate demand through net exports and directly in inflation as changes in the exchange rate are passed through to domestic prices. Moreover, there is a link between the exchange rate and the interest rate through capital markets. In general, policy rule researchers have used models with a high degree of capital mobility.

For example, my proposal for a policy rule (the one on the business card) was based on simulations of a model that included large exchange rate effects—my own large open economy model with seven industrial countries. I omitted the exchange rate as a variable in the policy rule, not because I had a closed economy view of the world, but because reacting to the exchange rate by more than a negligible amount caused a deterioration of inflation and real output performance. Any reaction of the interest rate to the exchange rate would be indirect, through the effect of the exchange rate on inflation and the output gap.

However, that conclusion does not necessarily hold for small open economies. A country's size and openness should matter. Recent work by Laurence Ball (1999) and Lars Svensson (2000) on small open economy models has examined the role of the exchange rate in policy rules explicitly. Ball and Svensson have proposed policy rules of the form of the simple benchmark rule that I have been discussing, but with the exchange rate included. In these rules an appreciation of the exchange rate calls for a cut in the interest rate, followed in the “next period” by an offsetting, or at least partially offsetting increase in the interest rate. (The favorable effects of the appreciation on inflation are followed by unfavorable effects, which will raise inflation and require an increase in the interest rate.) Similarly, a depreciation of the currency would call for an increase in the interest rate. The recent increase in interest rates by Bank Indonesia in the face of a depreciating currency might be an example of such a reaction.

Ball finds that such a rule improves on the benchmark rule; however, it is a very small improvement. For example, for the same standard deviation of output (1.4 percent) the interest rate rule that reacts to the exchange rate reduces the standard deviation of the inflation rate around its target from 2.0 percent to 1.9 percent. Svensson finds that this rule reduces the standard deviation of CPI inflation from 2.1 to 1.8 percent; however, his results also show that the policy increases the variance of output slightly, from 1.7 to 1.8 percent; thus, it does not dominate the benchmark rule. I have also done simulations and found that reacting to the exchange rate did not have an unambiguous effect on domestic economic stability

Taken literally, the results imply that simple policy rules that focus on inflation and real output and do not try to have an additional reaction to the exchange rate might actually work well in a small open economy. However, in my view, more empirical and theoretical work needs to be done on the costs and benefits of policy rules that deliver less exchange rate variability. The costs of exchange rate fluctuations may be very high for countries where there is a mismatch of assets by currency or duration, or where there may be large swings in the current account.

In fact, one implication of the results thus far is that some explicit reaction of the interest rate to the exchange rate could reduce the size of the exchange rate fluctuations with little deterioration of inflation and output stability. But expectations of the effects of such a policy on exchange rates are likely to be important. If it were possible to incorporate such a reaction into a policy rule that could be explained, at least in rough terms, to the public and especially to those involved in the foreign exchange market, then the same change in the interest rate could have a greater effect on the exchange rate, analogous to the effect on long term interest rate that I mentioned earlier in the case of Japan.

## **The Use of Inflation Forecasts**

Another important recent development in policy rules research concerns the use of inflation forecasts in formulating policy. To be sure providing information about the forecasts for inflation and other variables is a useful element of transparency, regardless of whether they are in an “inflation report” or in a “monetary policy report” and whether staff forecasts of policymakers’ own forecasts are reported.

But there are some important questions about how the forecasts are to be used. For example, should the interest rate react to actual inflation or to a forecast of inflation? And if a forecast is used, how far ahead should the forecast be? What about reacting to a forecast of real output?

It may seem that reacting to a forecast of inflation and output rather than to actual values is more forward-looking. However, that is not necessarily the case. Any forecast depends on observable information and that means current and lagged values of observable economic variables. Thus, in principle reacting to a forecast is no more forward looking than reacting to current and lagged variables. Also, in reality, a policy rule in which the interest rate reacts to the current quarter is actually reacting to a forecast, because the current quarter is not available until after the quarter. So the correct question is what the forecast horizon should be. The answer to that question depends, of course, on the accuracy of the forecasts.

There are some very useful research results to draw on. Batini and Haldane (1999) of the Bank of England show that increasing the horizon for the inflation forecast, at least within some small range, has the effect of reducing output variability and increasing inflation variability. Thus, choosing a longer horizon is like putting more weight on output. Levin, Weiland and

Williams (1999) of the Federal Reserve Board find that the optimal choice of horizon appears to be very small, however, especially if one is concerned about robustness results in different models. They found that policy rules that use forecasts more than two quarters ahead create a great deal of uncertainty and are not as robust as rules without forecasts or with current quarter forecasts. In my own view, it is not a good idea to reacting strongly to forecasts beyond a couple of quarters, at least with our current forecasting abilities.

Another approach to using inflation forecasts is to set the interest rate so that, according to some model, the forecast of inflation is equal to the target, or a at least approaches the target over time. This may be an approximation to what the Reserve Bank of New Zealand or the Bank of England has done. There is less research on this type of procedure, and there may be some problems with it. For example, there is a time inconsistency issue because the interest rate set for the forecast is not the interest rate that will actually be set in the future. In fact, it appears that when this approach is used in practice, a policy rule for the interest rate is used to get the forecast, though this is not usually stated. In any case it is important, if such a policy procedure is used, that the implied reaction of the interest rate to the inflation rate be greater than one. A policy rule is one way to check this.

### **Uncertainty in Measuring Potential GDP**

There is no question that there is a great deal of uncertainty in measuring potential GDP, especially during periods of changing secular growth trends. Even in the United States there are debates about how big the output gap now is with a range of estimates from 1 to 3 percent. The problem is even worse in emerging market economies where secular productivity growth and



population growth is much higher. The output gap is a key variable in most policy rules, but it is important whether or not a central bank follows a policy rule.

Orphanides (1997) has argued that the policy mistakes of the 1970s in the United States could have been caused by gross overestimates of potential GDP, but since there is no evidence about what the Fed actually used, a fair amount of guess work is involved in this assessment. In my view Orphanides choice of a potential GDP series seriously exaggerates the uncertainty problem, but it is a problem none-the-less.

What should be the reaction to this uncertainty? One simple suggestion is to assign more people on the research staff of the central bank to the job of estimating potential GDP. Surveys of capacity utilization can be very helpful.

Another idea, due originally to Frank Smets (1998), now at the European Central Bank, is to put lower weight on the output gap in the policy rule. Actually such down-weighting gets closer to the values in the benchmark rule that I have discussed here than to the optimal rules that come out of formal optimization with estimated models. Another possibility is to use the growth rate of the gap rather than gap itself, but there is evidence that this would hurt economic performance, and I would be concerned that it would cause excess volatility.

What is most clear to me is that, despite the uncertainty about the size of the gap, it is important to react to it. Pre-emptive strikes—such as that taken in the United States in the late 1980s and not taken (at least soon enough or large enough) in Japan in the late 1980s—require that the central bank begin to raise interest rates when the output gap increases (in a positive direction), even though there may not be a noticeable movement in inflation.

## **Dealing with Financial Market Crises**

One of the really exciting areas of policy rule research in the last year is the attempt to assess policy rules that react to financial market crises and in particular to stock market bubbles or crashes. Bernanke and Gertler (1999) placed a stock market term into a simple policy rule, simulated a model, and concluded that using such a rule would reduce both output stability and inflation stability. There is also historical evidence that trying to burst bubbles—as in Japan in the late 1980s and early 1990s and in the United States in the late 1920s can have serious repercussions.

On the other hand some sharp changes in asset prices may require discretionary increases in liquidity. I mentioned the 1987 stock market crash in U.S. already. Another example was the cut in the federal funds rate in the United States during the financial crisis in the late summer and fall of 1998. It is very unlikely that one could state in advance how large such an interest rate reaction should be, because it depends on the size of the increase in liquidity demand. So, for the foreseeable future, such actions will have to be discretionary in my view. But I think it is important that they be undertaken as short-lived temporary deviations from some policy rule and that they be limited to very specific types of crises. Of course, the safer and stronger is the financial system—including the banks, the less likely such crises will be.

## **Conclusion**

There are many other interesting new developments in policy rule research. But enough is enough for one evening. A question for the future is the role of price level targets as distinct from inflation targets. One problem with such targets is that they can entail a reduction in output stability because there may have to be periods of deflation, after the price level goes above the

target path. However, Mervyn King (1999) of the Bank of England has recently shown how a big decrease in inflation variability might be achieved with only a small increase in output variability by modifying the policy rule I have discussed here to include a reaction to the price level with a very small weight.

Another issue for the future is the evolution of the world financial system. Will more developed and emerging countries move toward flexible exchange rates with policy rules (inflation targeting), or will more countries join their currencies together through single currencies, currency boards, or even dollarization? Another way to state this question is “How many different policy rules will there eventually be in the world?” I think the answer to this question will depend on the performance in the countries that are using different approaches now. It seems that three monetary policy rules—perhaps evolving from policy rules used as guidelines at the Federal Reserve, the European Central Bank, and the Bank of Japan—will be the absolute minimum number for many years into the future. If the experience of the 11 countries in the European Monetary Union is good, we could see the number moving toward three rather than away from three in the 21st century.

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