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Interest-Rate Rules in an Estimated Sticky Price Model: Comment

by Martin Feldstein

The paper by Julio Rotemberg and Michael Woodford is a complex and rich virtuoso performance. It is worth careful reading not only because of the difficult technical problem that they solve but also because of the extension that they propose to the basic Taylor rule, making the optimal interest rate a function of the past interest rate with a coefficient greater than one. Although I have reservations about specific aspects of the paper, I think it is an important contribution to the analysis of model-based monetary rules that will serve as a base for further useful developments.

Collections of Rules

Before commenting on the Rotemberg-Woodford paper itself, I will discuss the broader issue of the appropriate role of formal monetary policy rules. I think that such rules should not be viewed as substitutes for judgement by the monetary authorities but rather as inputs into that judgmental process. A good rule is therefore one that provides a useful starting point for central bank deliberations.

More specifically, I believe that a central bank can benefit from having a collection of alternative good rules, i.e., rules that have optimal properties in a variety of models. I envision the central bank officials or staff using such a collection of rules each time a federal funds rate decision must be made. Before the decision is taken, the staff would calculate what the optimal federal funds rate would be according to each of the several different rules. If the different rules all point to the same decision, the central bank's choice should be relatively easy. If they do not, the officials and staff have to dig deeper into the reasons for the differences and the authorities have to consider more carefully the decision that seems best in the current circumstances.

I emphasize the idea of using a collection of rules in this way because of the uncertainty inherent in the monetary policy process. There are two types of uncertainty for which this approach can be helpful: Model Uncertainty and Situation Uncertainty.

Ben McCallum has emphasized Model Uncertainty in his important writing on the choice of a monetary policy rule. McCallum's research envisions trying alternative

rules in a variety of models and picking the single rule that does well under a variety of model assumptions. That approach may be too optimistic. There may be no rule that does uniformly better in a broad class of plausible economic models. Moreover, the rule that is optimal for the true structure of the economy may not do very well at all over a wide range of other possible models of the economy. McCallum's procedure may nevertheless help monetary authorities to develop and use a collection of rules by excluding some rules completely and by suggesting that certain rules deserve more weight in the central bank's thinking than others because of their robustness to different plausible models of the economy.

The second type of uncertainty, Situation Uncertainty, is the uncertainty about the current state of the economy and about where the economy would be going with no change in the federal funds rate. The expected values of uncertain estimates and of uncertain forecasts can be used in the decision rules only in very special circumstances. A prudent decision maker would therefore consider the optimal policy under different assumptions about the unobservable state of the economy and about its future path. This would be done with a collection of rules since a single rule may not reflect the sensitivity of the optimal policy to the situation uncertainty.

All of this sounds like a lot of information for the central bank decision makers to absorb. But it basically comes down to a list of the optimal federal funds value implied by each model in the collection, cross-classified by each set of alternative forecast scenarios (where forecasts include the current as well as future values of key economic magnitudes). Realistically, with (say) five alternative models and five alternative forecast scenarios, the decision makers would have 25 "optimal" federal funds rates for each policy rule.

The Lagged Interest Rate and the Weakness of Monetary Policy

This brings me back to the Rotemberg-Woodford paper. An important feature of their work is that it extends the traditional Taylor rule by making the current optimal interest rate depend on the lagged interest rate as well as on inflation and output. In their analysis, the optimal response of the current optimal interest rate to the lagged value of the interest rate may have a coefficient greater than one because doing so significantly reduces the resulting average rate of inflation.

Although I find the analysis that leads Rotemberg and Woodford to this conclusion quite interesting, in the end I am not persuaded. Let me therefore review the logic behind their rule specification and then explain why I am not convinced. The starting point of the Rotemberg-Woodford analysis is the fact that the nominal interest rate that the central bank sets must be greater than or equal to zero. If the inflation rate is

high, the mean value of this nominal interest rate will be high and the standard deviation of the fluctuations in that nominal rate can also be large. But if the inflation rate is low, the mean nominal interest rate will also be relatively low and the standard deviation of the interest rate must be small so that the actual nominal interest rate that the central bank sets is never required to be less than zero.

The R-W analysis shows that a monetary policy rule with a lagged value of the interest rate with a coefficient greater than one permits a low rate of inflation. This occurs because (in their rational expectations analysis) the public understands the rule and knows that when the Fed raises the interest rate it will go on raising the rate until the effect of this autoregressive process is dominated by a decline in actual inflation. This is sufficient to cause the actual inflation rate to decline before the rate is raised very much. They note that this low inflation outcome comes with a high price in terms of increased variance of output.

I believe that the R-W analysis overstates the extent to which low inflation requires volatile output. I think that a richer class of rules would also show that the autoregressive interest rate with the coefficient greater than one is also not necessary for low inflation.

A key limitation of the R-W analysis that they impose in order to carry out the complex rational expectations calculations is that the policy rule is linear. Thus the response of the interest rate must be the same to low and high rates of inflation. This means that if a large interest rate decrease is not possible (because of the non-negativity constraint), there cannot be a large interest rate increase to damp inflation. The substitute for large interest rate increases is the lagged interest rate with the coefficient greater than one because, as I noted above, individuals understand the autoregressive rule and respond to small interest rate increases in a way that damps economic activity.

In actual practice (although not in their model) it would of course be possible to have an asymmetric (i.e., nonlinear) rule. The magnitude of the interest rate increase when inflation is regarded as too high could be much greater than the magnitude of the decrease when inflation is low and output is regarded as too low. That is, the real interest rate would be increased significantly during periods of high inflation. This would make it unnecessary to have the lagged interest rate to signal the expected future tightening of interest rates when inflation is deemed to be too high.

The nonlinear rule means that high interest rates can be used to damp strong demand. But what about situations of weak demand? Rotemberg and Woodford are certainly correct that, when inflation is low, the real interest rate cannot be reduced much

because the nominal interest rate cannot be negative. But that need not mean that monetary policy is ineffective in dealing with weak demand. A central bank that cannot reduce the real interest rate can still increase demand through open market sales of the domestic currency for foreign currencies. Reducing the currency's value through such unsterilized intervention increases exports and reduces imports. The closed-economy character of the R-W model precludes that but it is a feature of the real world that needs to be taken into account.

Similarly, a sustained weakness of demand may be a reason for a fiscal stimulus as in Japan today which can be effective if the monetary authority keeps the real interest rate and the exchange rate from rising in response to the fiscal expansion. This too can prevent output declines even though interest rates cannot move down.

For these reasons, I remain to be convinced of the desirability of the lagged interest rate with the greater than one coefficient that R-W find in their optimal policy rule. I hasten to add that a lagged interest rate in the optimal response function may be a good idea for the others reasons uncertainty about economic conditions, the need to appear consistent, and the potential adverse effects of interest rate volatility on financial institutions but that is a separate matter.

In a richer analysis, it may also be desirable to have asymmetric policy responses and unsterilized foreign exchange intervention. But those are matters that require further analysis.

Sticky Prices

The R-W analysis is both sparse and sophisticated. It is sparse in the sense that it boils down to two equations describing the behavior of households and price setting sellers. It is sophisticated in that it presents dynamic optimizing behavior of those agents with respect to a continuum of commodities in a rational expectations framework. But to make monetary policy effective in this framework and to create the observed stylized fact of a two quarter lag in the impact of monetary policy, Rotemberg and Woodford introduce arbitrary lags into the behavior of both the households and the sellers.

I find this mixture of brilliant rational expectations optimizing behavior on the one hand and arbitrary lags on the other very disconcerting. Moreover, to the extent that the optimal policy rules are sensitive to the resulting lag pattern, as presumably they are since that is where the impact of monetary policy originates, how much weight should be put on rules that reflect arbitrarily imposed lag structures? What would happen if different assumptions were made about the lags in household and firm behavior.

Since the strength of the R-W model is its optimizing rational-expectations framework, it would be interesting to drop the arbitrary lags and derive lags from the assumption that individuals and firms are following some kind of optimal Bayesian learning strategy. The resulting lags might produce a model that is too difficult for policy optimization of the type developed in section 3 of the paper but it would give a more logically consistent basis for simulating alternative rules.

Since the R-W paper already represents an enormous amount of complex work, it seems greedy of me to ask for more. The extension to a Bayesian learning extension of the rational expectations model is certainly work for another paper.

Final thoughts

Another important issue for future work is the optimal transition from the existing policy framework to an optimal policy like that proposed by R-W. Even if one accepted the R-W rule as optimal, it would not be appropriate to implement it immediately, using the existing value of the interest rate as the "past" value in their context. More generally, since the R-W rule gets its power from the rational expectations assumption that the public understands the model and the rule, how should the Fed act if the public is only gradually learning to believe in the Fed's commitment to the rule? And how should the rule be modified to take into account the fact that the assumed model is not the "true" picture of the economy?

Once a transition rule is specified, it would be possible to pick a few historical dates and calculate what the rule would mean for the optimal interest rate at those dates. As a minimum, it would be interesting to see how much the optimal interest rates differ across different rules.

There is a final question that I would like to raise about the role of public confidence. I believe that one of the reasons that monetary policy has been effective in reducing inflation in the United States and in many other countries in recent years is that the Federal Reserve and other monetary authorities have stated the goal of reducing inflation and have, to a greater or lesser extent, specified numerical targets for future inflation.

To what extent would the effectiveness of monetary policy be enhanced in practice by using a rule or a collection of rules that focuses exclusively on price stability? And to what extent is that effectiveness weakened by using an explicit monetary rule that attempts to optimize multiple criteria? Although the R-W rule puts most of its emphasis on price stability and responds very little to changes in the output gap, the

rule communicates a different message from a simpler approach that focuses public attention exclusively on price stability. Shifting from the existing informal emphasis on price stability to anything like a publicly-announced Taylor rule surely requires consideration of that issue.

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