

Discussion

James L. Pierce

It is well known that model parameters are not invariant to shifts in policy regimes. Since Lucas' excellent paper on the subject, economists have paid lip service to the problems raised by regime shifts. Most policy analyses, however, ranging from columns in national magazines and newspapers to more formal work, continue to use models whose parameters are implicitly assumed to be immune to regime shifts.

Carl Walsh departs from standard practice by analyzing how the parameters of a money market model might be affected by the October 1979 change in the Federal Reserve's operating procedures. When the Fed switched from a policy of stabilizing within-month fluctuations in the federal funds rate to a policy of aiming at a path for nonborrowed reserves—while allowing large fluctuations in the funds rate—the probability distributions of asset returns were affected and the parameters of the system changed. Walsh is correct to be distrustful of models whose parameters were estimated from data generated under the old regime to analyze the behavior of the system under the new regime.

There appears to be good reason to be concerned about possible structural changes following the shift in policy regimes. The behavior of financial markets has been difficult to predict and some troublesome puzzles have emerged. While the variance of short-term interest rates rose markedly, as predicted by existing models, the variance of short-term money growth also increased. This was not predicted by existing models and created considerable embarrassment for the Fed since it claimed that the change in operating procedures was needed to achieve closer control over money growth. Finally, long-term interest rates have behaved in a mysterious fashion. Not only has their average level remained higher than seems consistent with reasonable expectations of

inflation, but their variance has also increased. Furthermore, large changes in long-term interest rates accompany unexpected fluctuations in weekly money growth. While there are good reasons for expecting short-term interest rates to move with surprises in weekly money growth, these reasons do not carryover to long-term interest rate.

It is by no means clear that changes in the behavior of interest rates, money growth, and other financial variables are all attributable to the shift in the Fed's operating procedures. Other factors changed at roughly the same time. The unprecedented average level of interest rates, the great uncertainty concerning future fiscal and monetary policies and about future budget deficits have probably played their part. If we are to gain a better understanding of what is going on, however, it is necessary to look at various sources of change in financial markets. Carl Walsh provides us with an interesting start in that direction.

Walsh provides two examples of how parameter changes resulting from the regime shift might have affected the behavior of money and interest rates. He argues that borrowing from the discount window became more responsive to changes in the differential between the funds rate and the discount rate, and the interest elasticity of money demand declined. Walsh shows that these parameter changes tend to increase the variance of both short-term interest rates and of money. Leaving aside for the moment the issue of whether these parameter changes occurred or not, the paper provides a clear and concise analysis of how these parameter changes affect the system. While Walsh's analysis of the stochastic properties of money and interest rates is incomplete because several stochastic factors are not included, the results suggest an answer to the puzzle of why the variance of money increased under the new operating procedures. I shall return to the omitted stochastic factors but first let us turn to some interesting predictions of Walsh's model.

Walsh shows that unexpected movements in the money stock affect interest rates even when market participants do not expect the Fed to change its policy with respect to non-borrowed reserves. This result is important because some observers seem to believe that it is only expectations of changes in policy that produce interest rate movements. With lagged reserve accounting, announcement of the money stock gives information about future required reserves and about future interest rates even if policy is unchanged. Walsh's equation (20) gives a

nice decomposition between the effect on interest rates of money surprises, with expectations, of policy unchanged, and the effect of money surprises on market expectations of changes in Fed policy.

Walsh also uses his model to show that the Fed's proposal to announce a moving average of current and lagged money will not reduce interest rate fluctuations relative to what occurs with reports of weekly money data. His model is a convincing basis for rejecting this bit of hand waving by the Fed.

The paper also contains some telling criticisms of the money multiplier models favored by some economists. He correctly asserts that these are not true reduced forms because their parameters move with endogenous variables in the system. They are not only sensitive to regimes shifts but also to endogenous behavior for a given regime. It is easy to show that shifts in the public's choice between transactions accounts and currency and between transactions accounts and time accounts affect the money multiplier. Thus, money demand affects the money "supply" relation. The money multiplier models do capture some predictable time-series properties in the data. It is dangerous, however, to use them for analyzing the response of the system to changes in exogenous variables. There is no reason to believe that their time-series properties are invariant to the shift in the Fed's operating procedures.

Walsh is careful to treat his borrowing and money demand stories as examples and he concedes that the parameter shifts considered may not be of much practical significance. Despite these caveats, he spends a substantial portion of the paper on rationalizing why the parameter shifts actually did occur. It is here that I have some problems with the analysis.

Walsh's three-period borrowing model is interesting because it clearly illustrates that depository institutions have an incentive to do intertemporal optimization when it comes to their use of the discount window. This involves comparing the current differential between the federal funds rate and the discount rate to the expected future differential. The expected future differential is affected by unexpected movements in money growth. Since the frequency of borrowing is limited by the Fed, institutions have to weigh the benefits of borrowing today against the benefits of borrowing in the future. In Walsh's model, the demand for borrowing from the Fed is affected by the variance of interest rates and under the new regime it is affected by surprises in

reported money growth. He shows that the shift in policy regimes increases the responsiveness of borrowing to a change in the interest rate differential.

It is possible that this change has occurred, but the model is *ad hoc* and it is difficult to put much faith in its predictions. A bothersome feature of the type of model used by Walsh is that the credit rationing behavior of the Fed is left out of the picture. Walsh attributes the lack of infinite demand for borrowing when the funds rate exceeds the discount rate to risk aversion of "banks". This is a weak reed and there is nothing in the model to support this behavior. The actual reason that borrowed reserves are a small proportion of total reserves even when market interest rates exceed the discount rate is that the Fed limits the amount of borrowing. Since the Fed's supply function for credit from the discount window is not specified, Walsh's borrowing function is not a demand function; it is a mixture of supply and demand. This has two important consequences. First, the Fed's supply constraint explains why the amount of borrowing from the discount window only rises to a few billion dollars when the differential of market interest rates over the discount rate rises to hundreds of basis points. We are observing the supply function not the demand function. This suggests a strong nonlinearity in the response of borrowing to a change in the interest rate differential. Second, even if the parameters of the demand function for borrowing by depository institutions did change following the shift in policy regimes, this does not guarantee that actual borrowing changed. It is quite possible that the Fed responded to a change in the true demand function by changing its administration of the discount window. If this occurred there is no reason to expect the change in the "parameters" that Walsh predicts. To address the issue productively it is necessary to have a more careful specification of the true demand and supply relations than one finds in this paper or in the literature generally.

I also do not find Walsh's analyses of why the interest elasticity of money demand changed to be very convincing. He shows that an increase in the variance in the rate of return on nonmoney assets relative to the variance of the return on money increases the demand for money and it decreases the interest elasticity of money demand. It is hard to believe that this portfolio balance story is a very important factor in explaining money demand. There are assets such as overnight RPs, very short-term treasury securities, Eurodollars, and money market

mutual funds that dominate money as an asset for many agents. At the same time that the variance of interest rates increased, the average level of interest rates rose dramatically. There have been massive shifts from noninterest bearing money to these other assets. It is difficult to disentangle the effect of the rise in the level of interest rate from the effects of an increase in their variance. It is my guess, however, that the effects of the level of interest rates has been a much more important factor.

It is likely that the interest elasticity of money demand has fallen. With the increased use of **RPs**, money market mutual fund accounts, Euro accounts, and similar assets, those agents with the highest elasticity of money demand have essentially stopped using money as it is conventionally measured. This leaves agents with low elasticity and agents who must hold compensating balances as the primary money holders. The switch to other assets tends to reduce the interest elasticity of measured money demand. This is not a result of the increase in the variance of interest rates, however, but rather it is a consequence of innovations in cash management that were prompted by the high level of interest rates. These innovations would have occurred in the absence of a shift in policy regimes provided the Fed would have achieved the same high average level of interest rates with its old operating procedures.

Walsh is critical of existing stimulation studies because they use models whose parameters were estimated using data from the earlier policy regime. One should be suspicious of their predictions. It is important to realize, however, that the short-run interest elasticity of money demand in these models is already very low. For example, the monthly money market model used by the Federal Reserve Board's staff predicted that the variance of short-term interest rates would rise a great deal when policy shifted to a reserve path. While this model may have underestimated to some degree the extent of the increase in variance, its qualitative results were correct. Money market models have done a less impressive job of explaining the increase in the variance of money.

I applaud Walsh for addressing the question of why the variance of interest rates and of money have both increased. Perhaps changes in the parameters of the money demand and borrowing functions are the answer. Since Walsh's **analysis** of the stochastic properties of the entire system is incomplete, his results must be viewed with skepticism,

however. Much additional research is needed. The issues should be addressed within the context of a fully stochastic model where all behavior relations — both money demand and supply — are subject to random fluctuations and in which covariances are taken into account. Dynamic factors must also be considered because money demand and other behavioral relations appear to be affected by lagged interest rates as well as by their current values. It is also possible that the probability distributions generating the additive errors change when policy regimes change.

I hope that Walsh continues to work on the issues that he raises. Perhaps he can provide a more iron-clad case for explaining the increase in the variance of both money and short-term interest rates. If successful, we can then expect him to explain why the variance of long-term interest rates has increased and why long-term interest rates are so responsive to weekly surprises in the money numbers.