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DISCUSSION

CHRISTOPHER A. SIMS*: Pierce *et. al.* have provided us with a valuable overview of the quantitative importance of month-to-month uncertainty in the current status of monetary aggregates and of the main sources of that uncertainty. Their conclusion that error due to problems with seasonal adjustment is of prime quantitative importance is both encouraging and discouraging—encouraging because it is understood how this situation could be improved; discouraging because it has been understood for a number of years now and yet the appropriate changes have still not been introduced.

The dramatic number of "misleading signals" from preliminary data displayed in figure 1 may in itself be somewhat misleading, however, precisely because some of these misleading signals arise from sources we know could be corrected for. In the case of seasonal data, the paper points out that re-estimation of seasonals contemporaneously, based on standard techniques, could greatly reduce the amount of *ex post* revision of preliminary figures. But sensible policy-makers, after observing the pattern of revisions over a few years (and sooner if they have time series analysts on their staffs) will recognize this source of discrepancy between preliminary and final figures and discount it. Thus a question arises which the paper does not directly address: what is the information gap between preliminary and final figures? It would be interesting to see a figure like 1 in which the preliminary figures were replaced by a least squares projection of final figures on preliminary figures for the preceding several months. This would give some idea of the extent to which there might be real lack of information about current developments in the aggregates.

The paper's discussion of the "policy seasonal" is interesting, and it raises issues which go beyond the question of measurement error. A policy of "control-

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ling the seasonally adjusted money stock" is not a completely specified policy. The paper assumes that seasonal factors will remain fixed under this policy. But if seasonal patterns are estimated as before, variation over time in the Fed's objectives for the path of the money stock and random deviations from those objectives will cause the seasonal factors to change. A policy of controlling the seasonally adjusted stock implies no criterion for evaluating the seasonal movements in the stock, and if taken literally implies that the seasonal pattern will be allowed to expand and wander.

In fact, the exclusion of seasonal movements from the policy of fixing a path for the stock in advance reflects, I think, a view that at least for this type of variation, firm fixing of targets for the stock is not reasonable, that it is reasonable to let reserves and money stock fluctuate to meet seasonal variations in the needs of trade. The Fed would not in fact stick to the naive characterization of its policy in the face of explosive movements in the quantity seasonal or a growing interest rate seasonal. It would instead damp movements in the quantity seasonal by responding to the appearance of interest seasonals. In principle, of course, kinds of institutions other than banks and kinds of instruments other than currency and demand deposits might evolve to absorb the seasonal fluctuations in needs for liquidity and media of exchange. But it does not seem reasonable to insist that such institutional developments take place.

There would be nothing remarkable about this discussion, except that it points to a more fundamental issue. For seasonal variations, it seems reasonable to take account of demand factors. At least after the first year or two, the Fed will have to take account of observations on interest rates and to distinguish demand-induced from supply-induced seasonal movements in the money stock in order to pursue a reasonable policy. Is there a good argument as to why this mundanely reasonable approach to policy relative to seasonal variations becomes abruptly unreasonable for non-seasonal variations? Since, as this paper shows, distinguishing seasonal from non-seasonal components of money stock variation is difficult, there may in fact be no way to isolate the consideration of interest rate variation and demand shifts under the "seasonal" heading.

In the latter part of this paper it is argued that relations among macroeconomic variables are weak and uncertain. Some such relations are indeed weak, but the paper builds its case on a measure, put forward by Pierce, of the "weakness" of relations which is quite misleading. I will not repeat here the objections which are laid out in my published comments on Pierce [1977]. Suffice it to say that Geweke in unpublished work has recently shown how to disaggregate feedback relations by frequency, and that this provides a much more useful way of examining the strength of relations among series than Pierce's incremental forecast error reduction approach. Also, a recent paper of mine [1980] provides an example of a type of dependent variable (durable good or asset prices) for which economic theory predicts that, regardless of the strength of the variable's relation to a determining variable, Pierce's measure of association approaches zero as the time interval at which data is sampled shrinks to zero.

The paper by Tinsley et. al. raises an important broad issue. If one accepts an econometric model as a description of reality, no simulation or other elaborate analysis is required to justify the conclusion that "direct targeting" as defined in

this paper is a better policy than "intermediate targeting". The latter policy is optimal subject to a constraint not present in choosing the former policy—so intermediate targeting is bound to be worse. Of course it is of some interest to see how much worse intermediate targeting is expected to be if the model is treated as accurate, but only because intermediate targeting does have some appeal. What could its appeal be?

The answer is that there is uncertainty about the accuracy of the model's specification. It may be felt that intermediate targeting depends less for its results on the most rickety parts of the model structure and hence has less risk due to uncertainty about model specification.

The group whose work is presented in this paper seems to be approaching model uncertainty by generalizing the stochastic structure of the model, in particular by taking account of possible random variation over time in "parameters". This is a legitimate and interesting approach, but it may face fundamental limitations. Increasingly sophisticated stochastic structures require increasingly complicated and high-dimensional models. As soon as we make all coefficients random, for example, the question arises as to whether they should have an arbitrary or a somehow restricted covariance matrix. The n original "parameters", in being made random generate $n(n + 1)/2$ new nonrandom covariance parameters. It may be that before we reach a realistically complicated model, we reach a model so complicated as to be of no practical use.

There is an alternative approach to model uncertainty which perhaps deserves exploration. We can attempt to specify both the model and the way it is to be estimated and implemented as a policy tool. Then this set of procedures can be applied to historical data to generate policy analysis based on data available at particular historical dates. In particular, the accuracy of the predictions of the model for target variables conditional on actual historical values of policy variables at date t and on estimation of the model based on data through $t - 1$ can be assessed over many dates t in the past. This can give a picture of the total uncertainty in a policy projection. Published and unpublished work by Ray Fair (of Yale) and Robert Litterman (of MIT) points in this direction, though it is mainly oriented toward forecasting rather than policy analysis.

Of course this line of approach requires that informal rules for "throwing out insignificant variables" and the like be made explicit and that the model used be lean and simple enough to be estimable with, say, half the data used to estimate the current version. But these prices may be worth paying.

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