Commentary

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This paper is a logical extension of some of Ben Friedman's valuable work in monetary economics. That work has several strands. First, it has clarified the nature of intermediate targeting and demonstrated that the informational assumptions implicit in a two-stage targeting procedure can be extreme. Friedman has shown this theoretically and, using an early version of the Pirandello model appearing in the present paper, has quantitatively evaluated the inefficiency in two-stage targeting.

Given the importance of informational assumptions in this work, it is not surprising that a second related strand of Friedman's research has been to evaluate the informational content of a broad range of financial variables. A basic approach in this regard has been to ask whether surprises or innovations in a particular financial variable or set of variables can contribute to an explanation of current or subsequent movements in variables like GNP and prices. It is based on this research that Friedman has become one of the leading advocates of the informational value of a credit variable. As Friedman has previously emphasized, finding an informational role for a financial variable does not mean that intermediate targeting on that variable is an optimal, or even a good, policy, since there may be many variables that provide information. Furthermore, as a third strand of Friedman's research has sought to demonstrate, the relationships among financial and nonfinancial variables may not exhibit the requisite temporal stability needed to justify the religious targeting on some financial variable.

Taken as a whole, then, the various strands of Friedman's past research have cast considerable doubt on the merits of intermediate targeting. His present paper attempts to add another nail to the coffin. Not surprisingly, it bears a strong resemblance to some of Friedman's earlier research. There is, of course, a novel element in the paper, and this lies in the nature of the econometric technique used to provide the latest nail. However, despite its novelty, I have serious reservations about the usefulness of the procedure. Indeed, to put it simply, I think it is unnecessary to use the procedure and dangerous to do so. Moreover, Friedman does not carry out the procedure in a way that it is consistent with the econometric model he presents. I will try to make the basis for these claims clear as we proceed.

Friedman starts with the informal idea that intermediate targeting makes sense only if aberrant movements in the target variable tell you something that you don't know about the future course of the economy. He further takes the view that one tests this by looking at "surprises" in some likely target variable and seeing if these explain future surprises in GNP or real GNP or whatever. A key element in this is how one goes about defining surprises and how one carries out the relevant tests of significance. As Friedman points out, these questions have been traditionally examined by nonstructural methods. The earliest incarnation of this is the approach embodied in the so-called St. Louis equation. More recently, the technique of vector autoregression has been applied to these issues.

In the present paper, Friedman adopts something of a mixed strategy, relying on a small structural econometric model but then using the model in a way that has some spiritual similarities to the vector autoregression approach. Quite obviously, the conclusions one is entitled to draw from this exercise depend on the reasonableness both of the model and of the procedure that uses the model to answer questions of interest. I will say a bit about the model later, but for the moment I want to concentrate on the novel Friedman procedure. Unfortunately, this involves a bit of notation.

To begin with, let us focus on a case where there is one target variable denoted without much imagination by the symbol M and one goal variable, y. The basic idea is first to decompose y and M into systematic and surprise components. This is done in equations (1) and (2) where e_{yt} is the income surprise and e_{Mt} is the money surprise, and where the t-subscript denotes time.

(1) $y_t = \hat{y}_t + e_{yt}$

(2) $M_t = \hat{M}_t + e_{Mt}$

If one had values for the income and money surprises, one could then regress the income surprise on both lagged values of the money surprise and lagged values of itself. Friedman would then judge the informational value of the money variable by the contribution the lagged money surprises make to such a regression.

The problem, of course, is to get values for the surprises. Friedman suggests estimating a structural econometric model and then solving this model for the so-called final form that expresses the endogenous variables of the model as a function of all current and past values of the exogenous variables. The final form is then used to calculate the predicted values, $\hat{y}_t$ and **M,.** The surprises can then be calculated from equations (1) and (2), and these then can be used to evaluate the informational value of the money variable.

While this two-step procedure sounds superficially plausible, upon closer examination it is not that appealing. It is easiest to see this if we consider the logic of the Friedman approach in a simplified setting. More specifically, let us consider a one-equation model in which we assume that y, is related to its past value and one exogenous variable x, as in

$$(3) \quad y_t = ay_{t-1} + hx_t + u_t$$

For the moment, we also assume the parameters in equation (3) are known. By lagging equation (3) repeatedly and substituting for lagged y's on the right hand side, we can derive the final form of this model given by

$$(4) \quad y_t = h\sum_{i=0}^{\infty} a^i x_{t-i} + \sum_{i=0}^{\infty} a^i u_{t-i}$$

We see that the first term on the right hand side of (4)is a prediction of y, based on current and past values of the exogenous variable, so this is the needed $\hat{y}_t$. By (1), the second term is the surprise denoted by e,. We then have

$$(5) \quad y_t = \hat{y}_t + e_t$$

as required. Furthermore, given the definition of e,, it is easy to verify that

$$(6) \quad e, = ae_{t-1} + u,.$$

We are now in a position to make some preliminary observations about the Friedman procedure in this simple setting.

First we note that equation (6)is what Friedman would propose to estimate. But what we see is that (6)involves only one parameter of interest, a, and this parameter also appears in the underlying model, equation (3).Put another way, if we have (3), there is no need to do any second-step regression to get (6);we can simply write it down. What this also suggests is that there is a one-to-one correspondence between the underlying model and the form of equation (6). As we shall see momentarily, this is true in general.

Now, of course, even with a simplified model like (3), we will in general not know the parameters a priori, so one would have to estimate (3) to determine them. However, once having estimated (3) there is no reason to estimate (6), since we already have an estimate of the parameter, a. Moreover, if one did choose to estimate (6) by least squares after estimating (3), one would not obtain an estimate of a with good statistical properties. Furthermore, the conventional tests of significances would not be applicable to this regression. In short, estimation of equation (6) is both redundant and fraught with statistical difficulties.

Before turning to a more general model, it is worth making one additional observation for this simple case. In particular, despite my disparaging remarks about estimating equation (6), in some cases it may be possible to learn something from its estimation. Consider, for example, the case when the true model is given by (3), but the investigator mistakenly assumes a is zero. If one goes through the Friedman procedure, one might well conclude that e_{t-1} matters in explaining e_t. One would then have a clue that one should reexamine the initial specification. In this case, the Friedman procedure would function like a crude version of the Durbin-Watson test. The same sort of thing would be true if the misspecification involved omitting a second order lag from (3) that was then included in (6). More generally, misspecifying the dynamics of the initial model will have implications for what looks important in (6). The message here, however, is that estimating the surprise equations is subject to yet another frailty—namely that it will be sensitive to the proper specification of the underlying model.

Armed with this background, we can quickly move through the general case where we deal with a multi-equation structural econometric model. As we know, such a model implies a reduced-form model. This is, in fact, what equation (3) is and, by analogy with (3), we can write the reduced-form model as

$$(7)\quad Y_t = AY_{t-1} + HX_t + V_t$$

where Y_t now represents a vector of endogenous variables and A is a matrix of parameters rather then a single parameter as in (3). Some algebra also yields the generalizations of equations (4) to (6) which are implied by (7).

In particular, we have

$$(8)\quad Y_t = (HX_t + AHX_{t-1} + A^2HX_{t-2} \ldots) + (V_t + AV_{t-1} + A^2V_{t-2} + \ldots)$$

which can be rewritten as

$$(9)\quad Y_t = \hat{Y}_t + E_t.$$

Here E_t represents a vector of surprises, one for each of the endogenous variables in the model. Finally, we can manipulate the definition of E_t to obtain the generalization of (6) given by

$$(10)\quad E_t = AE_{t-1} + V_t.$$

A comparison of equations (7) and (10) reveals, as before, that there is a one-to-one correspondence between the model and the surprise equations, and that the latter involve the same parameters as does the original model.

To illustrate the nature of (10), it may help if we consider a specific example. The following two-equation model, which is hardly meant to be anything other than an algebraic example, will suffice.

$$y_t = ay_{t-1} + bM_t + gM_{t-1} + \text{exogenous variables} + u_{yt}$$

$$M_t = cy_t + dM_{t-1} + fy_{t-1} + \text{exogenous variables} + u_{Mt}.$$

While we have written this model in structural form (both endogenous variables, y_t and M_t, appear in each equation) and have not spelled out the exogenous variables, this information is sufficient to derive the equations for the income surprise:

$$(11)\quad e_{yt} + \frac{(a+bf)}{1-bc} e_{y,t-1} + \frac{(g+bd)e_{M,t-1}}{1-bc} + \frac{u_{yt} + bu_{Mt}}{1-bc}$$

Equation (11) is the equation of interest in the Friedman procedure that is consistent with the initial model. Straightforwardly enough, it says that the lagged money surprise will help explain the income surprise whenever g is nonzero (M_{t-1} affects y_t directly) or b and d are nonzero (M_{t-1} affects M_t which, in turn, affects y_t).

What this brings out is the important point that all the substantive questions of interest about the informational content of a potential target variable are contained in the original model. In order to answer the kinds of questions that interest Friedman, one needs only to estimate the original model and then carry out the appropriate tests of significance based on the estimates. One could, for example, test hypotheses about the coefficients in equation (11) from the estimates of the basic model. Moreover, because of the statistical difficulties alluded to earlier, estimation of (10) or (11), after one has first estimated the model, is a statistically invalid way of drawing the sorts of inferences that are at issue. In short, there is no need to use the Friedman procedure and many reasons not to.

Equations (10) and (11) also bring out another troublesome aspect of the Friedman procedure. As already emphasized, the form of these equations is implied by the underlying model. In general, this means that the income surprise equations should include the lagged surprises for all the endogenous variables in the model. Moreover, whether one includes first- or second- or third-order lags of these variables is determined solely by the lag structure of the original model. In estimating his surprise equations, Friedman violates both of these principles. More particularly, he includes lags of only two variables, whereas he has a six-equation model. Furthermore, he carries out his procedure with varying lag lengths, ignoring the fact that this sort of arbitrariness is ruled out by his own model.

Although my main concern is with the logic of the basic Friedman approach, as noted earlier, the reliability of the underlying model is also a potential issue. One feature of the model that deserves note is the apparently rather slow response of the money supply to an injection of reserves. Indeed, the actual magnitudes involved seem quite implausible, suggesting there may be some difficulty in using the model to evaluate monetary policy. A related issue concerns the choice of the exogenous policy variable. The model is estimated with either the short-term interest rate or nonborrowed reserves as an exogenous variable. The appropriate choice may not be either one or the other and should depend on what policies were pursued in the sample history.

Model details aside, there are also some issues of timing implicit in the Friedman paper that are worthy of note. The time unit of the basic analysis is quarterly, but data on reserves and money are available almost continuously. Since the Fed probably finds it hard to sit on its hands in the face of what appears to be new information, some realistic aspects of targeting may be lost with a quarterly focus. By using the latest revised data, another practical element in targeting is brushed aside. In particular, since there are often substantial revisions in money and GNP data, to evaluate targeting in a realistic way may require use of initial estimates of these variables. To paraphrase the words of Senator Howard Baker at the time of Watergate, we may need to ask, "What did you know and when did you know it?" Finally, there is a somewhat extreme timing aspect to the way Friedman chose to define his surprises. In particular, by use of the final form of his model, the surprise is defined relative to a prediction based only on current and past values of exogenous variables. That is, no past values of the endogenous variables are used in making the predictions. While it is possible for someone to forecast in this way, it seems an unlikely description of any realistic forecast. As a consequence, the surprises implied by this procedure may be of limited interest.

Overall, then, while I have considerable sympathy with Friedman's punch line on the shortcomings of intermediate targeting, I am not persuaded that the evidence provided by his two-step procedure is of much value. Rather, it seems to me that Friedman needs to state precisely the hypotheses that he is interested in. These hypotheses could then be tested by estimates obtained from his structural model. While it might be possible to argue that Friedman's two-step procedure provides an approximation to the correct procedure, in view of the potentially serious statistical difficulties with his estimated surprise equations, it is his burden to make this case with some evidence.