

# REPLY

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**T**HIS REPLY is divided into three parts: first, a review of the empirical work by Patric Hendershott,<sup>1</sup> which Melichar relies upon in the preceding "Comment" to justify his analysis and conclusions; second, a critique of the relevance of this empirical work; and third, an evaluation of the theoretical underpinnings of Melichar's analysis. Following this approach makes it unnecessary to deal point by point with some of the more narrowly conceived issues raised by Melichar.

## *A Summary of Hendershott's Analysis*

The issue raised by Hendershott is how to construct an unbiased measure of Federal Reserve policy actions. The importance of this issue is obvious. Without such a measure it is not possible to evaluate the appropriateness of Federal Reserve behavior.

The criterion Hendershott uses for determining whether a monetary variable is an unbiased measure is that its value be dominated by Federal Reserve actions, and therefore not directly influenced by actions of the private sector of the economy. Hendershott asserts that any monetary variable would be an unbiased measure of monetary policy if it satisfied this "dominance" criterion.

Unfortunately, movements in most monetary variables, such as interest rates, the money stock, or bank credit, are determined by a mixture of both Federal Reserve and private actions. One of the major

criticisms leveled against interest rates as a measure of Federal Reserve actions by those who favor the money stock "measure" is that changes in the observed level of interest rates are dominated by private rather than Federal Reserve actions. However, Hendershott considers that the money stock also suffers from this problem, being simultaneously determined by public and monetary authority behavior. According to Hendershott, if the influence of the public can be removed, any monetary variable will give the same unbiased interpretation of Federal Reserve actions.<sup>2</sup> Because of the complexity of the process of removing public influences, Hendershott performs a "neutralization" procedure on only one variable — the money stock.

To make the money stock an unbiased measure of Federal Reserve actions over the business cycle, he proposes to remove the influence of the public from the cyclical movements in the money stock. To accomplish this he derives a money stock identity which has fourteen terms. Each term is constructed from components of the sources and uses of member bank reserves, and a multiplier based on average reserve requirements on demand deposits. He found that six of these components (float, excess reserves, time deposits, currency held by the public, member bank borrowings from the Federal Reserve, and the gold stock) were substantially influenced by the behavior of the public. That is, their value could be

<sup>1</sup>Patric Hendershott, *The Neutralized Money Stock: An Unbiased Measure of Federal Reserve Policy Actions*, Richard D. Irwin, Inc., Homewood, Illinois, (1968).

<sup>2</sup>*Ibid.*, p. 3. "Which indicator is neutralized is probably un-consequential because after the impact of the business cycle has been removed, the indicators should have similar cyclical patterns; the only systematic cyclical influence remaining in any of them is due to Federal Reserve actions."

satisfactorily predicted on the basis of current and lagged values of GNP, market interest rates, and other indicators of economic activity.

Of the remaining eight components, seven<sup>3</sup> were either small enough so that their influence on the observed money stock was negligible, or they were little influenced by the actions of the public. The remaining component (Federal Reserve holdings of Government securities) was taken to be under the complete control of the monetary authorities and, therefore, for statistical purposes, considered exogenous.<sup>4</sup>

Using standard statistical procedures, Hendershott estimated the degree of public influence on the first six components of member bank reserves discussed above. With these statistical results he was able to remove the effect of the public's actions, and construct a cycle-free value for each component. When the six cycle-free and eight observed components of member bank reserves are inserted into the money identity, they produce Hendershott's "neutralized" money stock. The influence of the public on four of these components (time deposits, excess reserves, float and currency in the hands of the public), although significant, tends to work in offsetting directions on the money stock, that is, it tends to be self-neutralizing. Only member bank borrowings and gold flows were found to be highly procyclical. The adjustment of these two items explains most of the difference between the actual and the neutralized money stock.<sup>5</sup>

### *A Critique of Hendershott's Analysis*

An evaluation of the neutralized money stock can be conducted on both a theoretical and an empirical level. This section considers the relevant empirical issues, and the following section considers some theoretical issues.

Hendershott contends that the way to eliminate the influence of public actions on the money stock is to develop measures of their influence and then subtract them from those components of the money stock which the public has been observed to influence. This

procedure is not easy or straightforward. Hendershott devotes two-thirds of his book to this task and shows considerable ingenuity in measuring the influence of the public on certain components of the money stock identity. He considers that this process is sufficient to neutralize the money stock and make it an unbiased measure of Federal Reserve actions.

This conclusion is valid, however, only if variations in those components which the public influences are *independent* of variations in the values of the other components of the money identity. If it is desirable to eliminate the influence of the public from some components, then it is also desirable to consider whether other components in the money identity behave in a way which offsets or reinforces these public influences. If such behavior exists, then the neutralization process used by Hendershott will no longer lead to an unbiased measure of Federal Reserve actions.

The possibility of a systematic interdependence between the components of member bank reserves, and thus between the terms of the money stock identity, is strong because a large share of changes in Federal Reserve holdings of Government securities (open market operations) are designed to "stabilize money market conditions." Operationally, this means that some Federal Reserve purchases and sales of government securities are designed to offset irregular seasonal and cyclical movements in member bank reserves. Hendershott acknowledges that the Federal Reserve most likely does offset such flows when they are the result of international transactions, and therefore constructs a "modified-neutralized" money stock which implicitly treats gold flows as if they are offset by Federal Reserve actions.<sup>6</sup>

There is no reason why Hendershott should have stopped with allowing only for offsetting actions with respect to gold. There are a wide range of other financial flows which also influence money markets, and which the Federal Reserve could offset if it chose to do so.<sup>7</sup> We tested the possibility that some Federal

<sup>3</sup>Treasury currency, vault cash of nonmember banks, Treasury cash holdings, U.S. Government deposits at member banks, foreign deposits at Federal Reserve Banks, Federal Reserve Accounts not elsewhere classified, and nonmember bank demand deposits.

<sup>4</sup>Hendershott, p. 13. "The money stock is considered as responding to a change in the Federal Reserve's portfolio of government securities and some minor member-bank reserve components rather than to a change in the adjusted monetary base, which is equivalent to the sum of the Federal Reserve's portfolio, Federal Reserve float, the U.S. gold stock, and the same minor reserve components."

<sup>5</sup>*Ibid.*, p. 117.

<sup>6</sup>Hendershott gives two reasons for constructing a "modified-neutralized" money stock: (1) to make it comparable with "policy statements" (which refer to actions net of offsetting gold movements); and (2) "neutralization of gold stock is the most tenuous . . . due to the complexities of the balance of payments and the somewhat heroic assumptions made regarding foreign central bank behavior."

<sup>7</sup>Hendershott argues (page 94) that such offsetting behavior is, for whatever reason, still Federal Reserve actions which should be measured in terms of their independent effect on the money stock. This is not a valid position to hold if (as is pointed out in the text) these actions are *induced* by movements in other components of the money identity.

Reserve actions, measured by changes in its government securities holdings (adjusted for changes in reserve requirements)<sup>8</sup>, were designed to offset movements in other items in the money identity. We were particularly interested to see if the Federal Reserve acted to offset these components which Hendershott found were influenced by actions of the public.<sup>9</sup> To make the test as comparable as possible with Hendershott's, the coefficients were estimated by ordinary least squares regressions using first differences of monthly data (not seasonally adjusted) from January 1952 to December 1964 (the same period used in Hendershott's study).<sup>10</sup>

$$\begin{aligned} \Delta S_A = & .038 - 0.88 \Delta G - 0.35 \Delta F - 1.18 \Delta B \\ & (2.11) (10.69) (4.19) (7.81) \\ & + 1.29 \Delta C_t + 0.69 \Delta O + 1.18 \Delta C_o \quad R^2 = .72 \\ & (1.84) (9.74) (16.92) \quad D-W = 2.03 \end{aligned}$$

- $\Delta$  = month-to-month changes in each series.
- $S_A$  = Federal Reserve holdings of government securities adjusted for changes in reserve requirements.
- $G$  = United States gold stock.
- $F$  = Federal Reserve float.
- $B$  = Borrowings of member banks.
- $C_t$  = Currency and coin issued by United States Treasury.
- $O$  = Other Federal Reserve accounts (mainly Treasury and foreign deposits) and Treasury cash holdings.
- $C_o$  = Currency in the hands of the public.

Numbers in parenthesis are "t" statistics which indicate that all coefficients are estimated to be significant at the one percent level, except Treasury currency and coin ( $\Delta C_t$ ).

These results indicate that adjusted open market operations ( $\Delta S_A$ ) tend to offset the movements in the other components.<sup>11</sup> For example, an increase in the gold stock would, *ceteris paribus*, cause the money stock to increase, but because the Federal Reserve reduces its holdings of government securities by almost the same amount, the actual effect on the money stock is negligible. Conversely, an increase in currency in the hands of the public ( $\Delta C_o$ ) would, *ceteris paribus*, reduce the money stock,<sup>12</sup> but because the Federal Reserve increases its holdings of

Government securities, the effect of that change on the money stock is offset.

Seventy-two per cent of the variation in adjusted Federal Reserve holdings of Government securities is directly related to offsetting these specific sources of potential change in the money stock. Considering the important role which "defensive" operations have traditionally played in Federal Reserve actions, these results are not surprising.<sup>13</sup>

Hendershott found that, of the six items in the money stock identity which were influenced by the public, only member bank borrowings and gold were important in causing the discrepancy between the actual and neutralized money stock. Thus, as a practical matter, if the influence of borrowings and gold on the money stock are offset by variations in Federal Reserve Government security holdings, then the actual money stock will be a less-biased measure of Federal Reserve actions than the neutralized money stock. Our regression test shows this is exactly what happened. Federal Reserve holdings of Government securities tended on the average to offset \$1.18 of every \$1.00 of member bank borrowing and \$.88 of every \$1.00 of gold flows in the same month in which they occurred.

On the basis of the criteria which Hendershott himself established, and which Melichar accepts, the actual money stock is superior to the neutralized money stock as a measure of Federal Reserve Actions. Thus, any analysis or conclusions drawn with respect to Federal Reserve actions on the basis of the neutralized money stock are misleading.

### *Federal Reserve Actions and Monetary Influences*

The preceding empirical investigation established that the observed money stock is a better measure of Federal Reserve actions than the neutralized money stock. However, what if open market operations had not been conducted in a way to offset the influence of borrowings and gold on the money stock? In that case, Hendershott's neutralized money stock would have been a superior measure of Federal Reserve actions. However, even then, Melichar's analysis and conclusions are not necessarily valid, because he ig-

<sup>8</sup>The reserve adjustment was added to Federal Reserve holdings of government securities so that this one variable can simultaneously measure both open market operations and changes in reserve requirements.

<sup>9</sup>Time deposits and excess reserves were not included in this regression because the link between them and open market operations cannot be portrayed with the simple one-to-one correspondence used here.

<sup>10</sup>These are the same symbols used by Hendershott except for the sum variable O and the reserve adjustment on S.

<sup>11</sup>The sign of the coefficient in the Treasury currency variable is positive, while an offset would be negative. However, this coefficient is not statistically significant and no economic interpretation can be or is made on this basis.

<sup>12</sup>An increase in currency (which is a component of the money stock) will cause a decrease in the money stock, because without an offset it would reduce bank reserves, forcing a multiple contraction in demand deposits.

<sup>13</sup>This discussion should not be taken to imply that all Federal Reserve actions are defensive in nature. Given suitable measures of Federal Reserve objectives, they could be included in the regression. For an example of this, see "An Explanation of Federal Reserve Actions (1933-68)" by Michael Keran and Christopher Babb, this *Review*, July 1969.

nores an important theoretical consideration. He implicitly assumes that the least-biased measure of Federal Reserve actions is also the best indicator of monetary influences on the economy. This assumption is not necessarily true.

Consider the period before 1914 when the Federal Reserve did not exist. Does the absence of a central bank mean that there were no monetary influences on the economy? No, obviously such influences did exist. The absence of a central bank only means that the *discretionary* powers which the Federal Reserve now exercises could not be utilized to control the money stock.

In the pre-Federal Reserve era the dominant influence on the money stock was the balance of payments, because of the consequences this had on the domestic stock of gold which supplied the base for the money stock. Because the balance of payments, and therefore the supply of gold, depended to a large extent upon conditions in the United States over the business cycle, movements in the money stock were strongly influenced by domestic economic conditions. This mechanism in no way precluded changes in the money stock from influencing domestic economic activity. Indeed, to the extent that the gold standard was successful in the pre-World War I era, it was due to this essential double link from income to money and from money to income.

The monetary influence on the economy can operate quite independently of the source of the monetary change, irrespective of whether or not the change is the result of discretionary central bank actions or induced movements in the gold stock. A statistical problem related to interpretation of the regression coefficients may arise in a single equation model, however, where income may be influencing the money stock. A statistically significant coefficient relating changes in money to changes in income will not provide statistical proof that the direction of causality goes from money to income, unless the factors determining the movement in the money stock can be shown to be statistically independent of income in

the contemporaneous period (see the companion article by Leonall C. Andersen for a more thorough consideration of this issue.)

Even if the neutralized money stock were an unbiased measure of Federal Reserve actions, it would not necessarily be an accurate measure of monetary influences on the economy. Such a measure can only be derived within the context of a validated economic theory, which specifies the mechanics of the monetary influence. A statistical evaluation of the theoretical link between the monetary variable and the economy is an integral part of the evaluation procedure.

There are two well-specified theories relating monetary influences to the rest of the economy: A neo-Keynesian theory which measures the influence of monetary variables through variations in interest rates, and a modern quantity theory which measures monetary influences through variations in the money stock and related monetary aggregates. No economic theory has been presented either by Hendershott or Melichar which links a neutralized money stock to economic activity.<sup>14</sup> At the very least, such a model would have to show how those changes in the money stock, which were induced by public action, had a different effect on economic activity than those changes in the money stock induced by Federal Reserve actions.

Melichar's use of the neutralized money stock in his analysis of monetary influences on economic activity is inadequate on two counts: first, the neutralized money stock is not an unbiased measure of Federal Reserve actions, and second, no evidence has been presented which supports the position that the neutralized money stock is a good indicator of monetary influences on the economy.

<sup>14</sup>This should not be taken as a comment on Hendershott's book because his interest is in measuring Federal Reserve actions, not monetary influences on the economy. However, when one uses the neutralized money stock in an analysis of economic activity (as Melichar does), some model linking it to economic activity is called for.

*See the companion article beginning on the next page for statistical evidence relating to other aspects of the reverse-causation argument.*