Comment on the Long-Run and Short-Run Demand for Money

Karl Brunner
Ohio State University - Main Campus

Allan H. Meltzer
Carnegie Mellon University, am05@andrew.cmu.edu

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(Continued on inside back cover)
Comment on the Long-Run and Short-Run Demand for Money

Karl Brunner*
Ohio State University

Allan H. Meltzer*
Carnegie-Mellon University

In his recent contribution to the theory and empirical analysis of the demand for money, Gregory Chow attempted to reconcile the short- and long-run behavior of the demand for money by “introducing a mechanism for the adjustment of actual money stock to desired stock . . .” (Chow, 1966, p. 111). In this brief comment, we will argue that his formulation of the adjustment equation contains implications that make it difficult to accept and that his empirical evidence does not distinguish the “relative importance of current income as compared with wealth or permanent income” (Chow, 1966, p. 111), as he claims. Further, we show that when income and prices are not combined in a single variable, nominal income, his more important conclusions about the effect of current income on the demand for money are reversed.

Some Problems in the Theory

Chow’s theory of the demand for money makes the long-run demand depend on the services provided by money. Short-run demand deviates from long-run demand because (1) time is required for adjustment of the stock, and (2) changes in money stock are partly the result of current saving. The long-run function is

\[ M_t^* = b_0 + b_1 A_t + b_2 R_t, \]  

(1)

and the adjustment equation is

\[ M_t - M_{t-1} = c(M_t^* - M_{t-1}) + d(A_t - A_{t-1}). \]  

(2)

* Both authors acknowledge financial support from the National Science Foundation.

1 Definition of the symbols: \( M^* \), desired money balance; \( M_t \), actual money balance; \( A_t \), the public’s wealth; \( R \), an interest rate; \( Y_p \), permanent income; \( Y \), current income; \( \theta \), the average and marginal propensity to consume. Money is defined as currency and demand deposits throughout.
If $A_t$ is total human and non-human wealth, $A_t - A_{t-1}$ is current saving, so that

$$A_t - A_{t-1} = Y_t - \theta Y_{pt}. \quad (3)$$

Substituting equations (3) and (1) into (2) and approximating $A_t$ in equation (1) by permanent income, $Y_{pt}$, we have

$$M_t = cb_0 + (cb_1 - d\theta) Y_{pt} + cb_2 R_t + (1 - d) M_{t-1} + d Y_t. \quad (4)$$

The long-run equation is similar to the equation we have used in our own work. The problems on which we wish to comment arise from the use of the adjustment equation (2). It is from this equation that Chow obtains the implication that current income has a positive effect on short-run money holdings, and the empirical findings that support his conclusion.

Several aspects of Chow's adjustment equation require comment. First, if the public holds the equilibrium money balance and there is no change in the quantity of money, $M^*_t = M_t = M_{t-1}$, equation (2) shows that saving must be zero, that is, $A_t = A_{t-1}$. Thus Chow's adjustment equation implies that, when the money stock remains constant and in equilibrium, the economy as a whole remains in a steady-state equilibrium. This is a strong implication of a constant money stock.

Second, there are similar problems in the logarithmic form of his equations. Again, if $M^*_t = M_t = M_{t-1}$, the ratio form of his equation reduces to $Y = \theta Y_{pt}$, so that income equals consumption whenever desired and actual money balances are equal and constant. Again, a steady-state equilibrium for the economy is a consequence of an unchanged equilibrium money stock.

Chow's adjustment equation contains other strange implications. These implications depend on his assumption that $d$ in equation (2) is a constant. It is clear by inspection that his equation implies that, when there is a decline in the stock of money ($M_t < M_{t-1}$) and saving is non-negative ($A_t \geq A_{t-1}$), there is an excess supply of money ($M_{t-1} > M^*_t$). In fact the stock of money declined when saving was positive during the contractions of 1920-21, 1929-31, 1936-37, 1948-49, and as recently as the summer of 1966. According to Chow's adjustment equation, these periods were characterized by an excess supply of money. Again, the implications of Chow's equation are difficult to reconcile with current or received versions of monetary theory. The implications suggest that Chow's adjustment equation should be rejected.

Chow's theory also implies that the coefficients of lagged money balances and current income sum to unity, a finding that is not well supported by the results he presents. Furthermore, there is some inconsistency in the treatment of transitory income between equation (3) and the assumption that $A_t$ is approximated by $Y_{pt}$. Equation (3) makes saving equal to the difference between income and consumption, so that saving includes all current transitory income. Had Chow used the approximation $A = Y_{pt}$ throughout, he would have had saving = $Y_{pt} - Y_{pt-1}$ in place of equation (3), and saving would be independent of transitory income.

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The problem could be resolved by replacing Chow's assumption of a constant effect of saving with a variable ranging from zero to one. The variable effect of saving on money might then depend on asset yields and various costs. A rationale might also be developed in terms of the costs of adjusting and acquiring information about non-monetary assets.

However, any reinterpretation that makes the effect of saving on money a variable rather than a constant substantially changes Chow's analysis. At best, the term $dY$ in his regressions (see equation [4]) combines the influence of asset yields, adjustment costs, and nominal income on money balances. At worst, the effect that Chow attributes to current income may be largely the effect of prices and rates of return. Some empirical findings on this point are presented below.

Chow's choice of variables also requires comment. He uses nominal values of income and wealth in both his demand function and his adjustment equation. The assumption that the demand equation is homogeneous of first degree in prices and the value of financial assets makes acceptable the use of nominal values to obtain regression estimates for the long-run equation. But how do we interpret the effect of prices on his adjustment equation? Are prices assumed to adjust at the same speed as real income? Or is the public indifferent to the distribution of nominal income between prices and real income when adjusting money balances? Both interpretations seem implausible. Differences in the rates of adjustment of prices and quantities appear to be a main element in the process by which an economy adjusts to cyclical disturbances.

Similar problems result from Chow's treatment of the role of saving in the adjustment equation. If the variables are intended to be nominal values, Chow's equation states that individuals adjust money balances by the same amount whether nominal saving is a result of a change in real wealth or a change in prices. If the variables are intended to be real variables, Chow has ignored differences in the effect of price and output changes in his theory of adjustment.

Some Problems with the Evidence

In most of his empirical estimates, Chow used nominal values of all variables. The only exceptions are tests of his long-run equation (1) used to establish that the coefficient for prices is not statistically significant and that the coefficient of $Y_p$ is unity when nominal values of $M$ and $Y_p$ are used. On the basis of these findings from his long-run equation, Chow assumes that the results apply to the adjustment equation as well.\(^3\)

\(^3\) He also assumes that this result can be used in the linear version of his equation. In all tests of the linear equation, Chow ignores the effect of prices on the estimated intercept. Moreover, he fails to note that the intercept of the long-run linear equations is larger than the level of money balances in most of the years included in his data.
We have re-estimated equation (4) above, adding prices as an additional explanatory variable and using data for 1900–1958, excluding the years 1942–51 when prices and/or interest rates were controlled. The regression estimates with standard errors in parentheses are shown in Table 1. All variables are in logarithms; \( Y, y, Y_p, \) and \( y_p \) are logarithms of nominal and real income and nominal and real permanent income, respectively; \( W \) and \( W/P_a \) are logarithms of nominal and deflated non-human wealth; \( P \) is the log of the price level, \( R \) is the log of interest rates, and \( DW \) is the Durbin-Watson statistic. Other symbols are defined above. Below each of our equations, we have reproduced Chow's similar equation. The principal difference between our results and his arises because we used deflated values and estimated the effect of \( P \) separately, while Chow used nominal values.

The results are strikingly different. The short-run effect on money that Chow attributes to nominal income (his equation [3.1]) does not appear to be the effect of income. Our equation (5A) suggests that real income has no significant effect on the demand for real balances. Similar results are obtained using real wealth in place of real permanent income or excluding both wealth and permanent income from the money equation, as in our equation (6). These findings are contrary to Chow's adjustment hypothesis and to his assumption of a constant effect of current saving on the demand for money.

The results in Table 1 also bear on Chow's conclusion about the relative influence of income, permanent income, and non-human wealth on the demand for money. He was unable to replicate the findings that one of us (Meltzer, 1963) reported earlier which showed that, when real non-human wealth is included in the demand function, current real income has no significant effect on the demand for money.\(^4\) The results here support our earlier conclusion.

Furthermore, Chow claims that permanent income is a better measure of the constraint on money balances than non-human wealth. This conclusion is based on regressions in which both nominal permanent income and nominal non-human wealth appear as determinants of the demand for money. Chow found that the \( t \)-statistic was larger for \( Y_p \) than for \( W \) and based his conclusion on this finding.

The conclusion is unwarranted. One cannot measure the relative importance of alternative wealth variables by comparing \( t \)-statistics. Such

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\(^4\)From correspondence with Chow, it appears that the difference between his results and Meltzer's is due to some very slight differences in the measure of wealth that was used.
<table>
<thead>
<tr>
<th>Equation</th>
<th>Intercept</th>
<th>R</th>
<th>$y_p$ or $y_p$</th>
<th>y or Y</th>
<th>$W/P_n$ or W</th>
<th>$M_{t-1}$</th>
<th>P</th>
<th>$R^2$</th>
<th>DW</th>
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<tr>
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<td>-2.50</td>
<td>-.560</td>
<td>.432</td>
<td>-.032</td>
<td>...</td>
<td>.439</td>
<td>.739</td>
<td>.998</td>
<td>1.28</td>
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<tr>
<td>Chow's (3.1)</td>
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<td>-.332</td>
<td>.062</td>
<td>.327</td>
<td>...</td>
<td>.588</td>
<td>...</td>
<td>.999</td>
<td>N.A.</td>
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<tr>
<td>Our (5B)</td>
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<td>.367</td>
<td>.450</td>
<td>.672</td>
<td>.988</td>
<td>1.33</td>
</tr>
<tr>
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<td>...</td>
<td>.228</td>
<td>.172</td>
<td>.522</td>
<td>...</td>
<td>.999</td>
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<td>...</td>
<td>.704</td>
<td>.508</td>
<td>.997</td>
<td>1.26</td>
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<tr>
<td>Chow's (3.5)</td>
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<td>.363</td>
<td>...</td>
<td>.610</td>
<td>...</td>
<td>.999</td>
<td>N.A.</td>
</tr>
</tbody>
</table>

* Chow's estimates from his Table 2 (Chow, 1966) and based on data for 1897–1958, excluding 1917–19 and 1941–45. Deflated values are used in our regressions; nominal values were used by Chow.
statistics are conditional and therefore depend on the other variables included in the regression. More generally, one cannot reach a conclusion about the superiority of \( Y = a_0 + a_1 X_1 \) or \( Y = b_0 + b_1 X_2 \) by estimating the coefficients and t-statistics for \( Y = c_0 + c_1 X_1 + c_2 X_2 \).\(^5\) Permanent income may be a better measure of wealth than the variable we have used, non-human wealth. Until some evidence is presented, we remain unconvinced.

**Conclusion**

Our discussion of Chow's short-run demand function for money in this comment should not obscure the fact that we share a large amount of common ground. Each of us views the long-run demand function for money as the demand to hold a stock which yields a variety of services. None of us views money in terms of the separable motives for holding money, and we seem to agree that approaches based on motives have not yielded a useful empirical theory. We may even agree that any attempt to analyze money demand on the basis of given payment schedules misses an essential part of the problem.

However, our agreement does not carry over to the adjustment equation. The hypothesis that Chow used to explain the short-run adjustment of money balances seems to be deficient. He combines the effect of price and output changes on money balances by using nominal income and nominal money stock throughout; his assumption of a constant elasticity of changes in money balances with respect to current saving denies the important short-run influence of changes in relative prices and interest rates on the allocation of saving. Moreover, the adjustment equation leads Chow to expect—and to find—a significant effect for current income on the short-run demand for money. Our findings here suggest that, when price and output changes are separated, the effect of real income on the demand for money is inconsequential, contrary to his adjustment equation and his empirical findings.

**References**


\(^5\) Albert Madansky has constructed and circulated a counter-example which shows the logical fallacy in Chow's inference. We will furnish a copy on request. Madansky (1964) has demonstrated in another note that Chow's criticism of our velocity regression does not hold. Chow asserts that we obtain positive coefficients for transitory income in our velocity equation because income appears in both the dependent and independent variable. Madansky shows that this is not a sufficient condition for implicit correlation.


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