MONEY MULTIPLIER FORECASTS
FOR 1979

James M. Johannes
and
Robert H. Rasche

Michigan State University
Department of Economics

Prepared for Shadow Open Market Committee

March 11-12, 1979
FORECASTS OF MONEY MULTIPLIERS FOR 1979

1979 is probably the most inopportune time to attempt to implement a forecasting procedure based on the Johannes-Rasche money multiplier models. The basic presumption behind those models is that various portfolio allocation decisions can be represented in a form that is a stationary stochastic process and thus is amenable to modeling by Box-Jenkins techniques.

The components of our forecasting model are the familiar components of the money multiplier, the currency demand-deposit ratio; the government deposit-demand deposit ratio; the time deposit-demand deposit ratio (split into two parts, one for all time deposits other than large CD's, and one for large CD's); the ratio of reserves adjusted for reserve requirement changes to total deposits; and the ratio of borrowings to total deposits. Just as we had completed the construction of the models, the Federal Reserve implemented its proposal for automatic transfer service (ATS). Consequently, it is no accident that we stopped the forecasts that appear in the paper with October, 1978. Since we have only about three months elapsed time since the introduction of the ATSs, there is no way that this regulatory innovation can be adequately modeled. All that we can do at the moment is attempt to establish some extreme cases and investigate the range of possible outcomes predicted by the model.

The simplest, though undoubtedly inaccurate assumption about the current state of the world is that the introduction of ATS made no difference in portfolio allocations of various economic units. This
amounts to assuming that all of the ATS balances were made available out of funds formerly held in savings accounts at commercial banks. Under this assumption, there would be no shifts among the various asset categories that we have modeled, and the observed series subsequent to November 1, 1978 would continue to be generated by the same processes that we have modeled. Thus the predictions of the various multiplier components from our models would continue to be unbiased predictions of the observed component series. We feel that this assumption is inappropriate. Nevertheless, we have constructed one set of forecasts, starting from initial conditions of October, 1978, so that we might check the forecast biases against the actual November, December experience.

An alternative and probably equally inaccurate assumption is that all of the ATS balances came about as a result of a portfolio shift from demand deposit accounts to ATS accounts. We feel that this is inaccurate because of (1) the relatively high minimum or average balance requirements that seem to be typical of ATS accounts, and (2) the very high service charges levied against depositors in the event that these requirements are not observed. Our relatively small sample of newspaper advertisements and inquiries around various midwestern locations suggests that 1300 to 2000 dollars minimum or average balance requirement for "free" ATS accounts is quite typical. We feel that it is unlikely that all of the minimum balance requirements were met by portfolio reallocations from demand deposits to time deposits, but rather came out of some other forms of asset holdings, probably in part from savings deposits at commercial banks, but likely in part from accounts at thrift type institutions.
To introduce this assumption into our models requires that we adjust the forecasts from the models for the currency ratio, the other time deposit ratio, and the CD ratio. The adjusted reserve ratio and the borrowings ratio should not be affected under this assumption, since these ratios are constructed relative to total deposits at commercial banks. If the only portfolio shift that occurs is a reallocation of assets from demand deposits to savings deposits, total deposits at commercial banks are unaffected. The adjusted reserve ratio should also be unaffected since any reserves released by the shift among reserve classes should be compensated for by the adjustment factor.

If we assume that the only shift that occurred was from demand deposits to other time deposits (ATS accounts), then the forecasts from our models for the currency ratio and the CD ratio should be biased downward relative to the observed values, since the models do not account for the assumed reduction in the denominator of these fractions. Our forecast of the other time deposit ratio is subject to two biases under the stated assumption, since the model does not account for the downward shift in the denominator of the ratio, nor the upward shift in the numerator.

Let \( D \) be the amount of demand deposits that would have been observed in the absence of the ATS regulation, and \( T_1 \) be the amount of other time deposits that would have been observed in the absence of the change. Let \( S \) indicate the amount of the assumed shift in assets from the demand deposit category to ATS accounts. Then the currency ratio predicted by the model, \( k^P \), is \( C/D \), where \( C \) is currency in the hands of the public, but the observed figure is \( C/(D-S) = k \). If we adjust (i.e. multiply) the predicted ratio by \( D/(D-S) \), then the adjusted
predicted ratio should be an unbiased predictor of the observed k.

A similar argument and identical adjustment holds for the CD ratio,
and the government deposit ratio. The question of how to estimate the
ratio D/(D-S) will be discussed below.

Two adjustments are required in the case of the other time
deposits ratio, under the assumed asset demand adjustment. First, the
predicted ratio will be biased downward because the denominator will be
overpredicted as in the ratios discussed above. On the other hand, the
predicted ratio will have an additional downward bias because the
numerator will be underpredicted given the assumed shift out of demand
deposits into ATS accounts. The observed ratio is \( \frac{T_1 + S}{(D - S)} \)
where S and D are defined above, and \( T_1 \) is the amount of other time
deposits that would have been observed in the absence of the ATS
regulation. The other time deposit ratio predicted by the model, \( t^{\prime}_1 \),
is \( \frac{T_1}{D} \). If we adjust the predicted ratio by multiplying by \( D/(D - S) \)
and by \( (T_1 + S)/T_1 \), then the adjusted predicted ratio should be an
unbiased predictor of the observed \( t_1 \).

A third assumption on the possible portfolio shifts that occurred
as a result of ATS might be that the bulk (or all) of the ATS balances
came as a result of a shift out of other assets such as balances in
thrift institution accounts. Assume, for purposes of argument, that
all of the ATS balances came about as a result of withdrawals from
thrift institutions. The immediate impact of this is probably identical
to the second assumption; namely that the ATS balances come at the
expense of demand deposits. In this case, however, it is demand
balances owned by the thrift institutions, not those owned by the
individuals establishing the ATS accounts. This assumes that the thrifts
do not react by drawing down their vault cash, a circumstance that we
regard as unlikely. In the longer run, the thrifts will probably react to the outflow of funds by reducing their loan portfolio. The ATS balances probably still come at the expense of demand deposits but in this case demand deposits that would have accrued to the ultimate recipients of the proceeds of the thrift institution loans. If the ATS balances come as a result of shifts from both demand deposits of the individuals establishing ATS accounts, and from balances previously held by these individuals at thrift institutions, then the net result is exactly the same as under our second set of assumptions.

The problem remaining is to obtain some estimate of the ratios \((T_1 + S)/T_1\) and \(D/(D - S)\). Under our second (or third) assumption, \(S\) is the amount of ATS balances. The release from the St. Louis Federal Reserve Bank, U.S. Financial Data for February 21, 1979, contains estimates of ATS balances weekly since the beginning of November. We have constructed monthly estimates from these data as 1.499, 3.106, and 4.130 billion dollars for November, December and January (incomplete) respectively. We have further assumed that the recently published monthly seasonally unadjusted data for demand deposits and other time deposits measure \(D - S\) and \(T_1 + S\) respectively during November and December. For January, we have constructed an estimate of the monthly data for \(T_1 + S\) and \(D - S\) by taking the seasonally adjusted weekly average numbers in the latest U.S. Financial Data (February 21, 1979), reseasonalizing using the recently published weekly seasonal factors, and averaging based on the number of days in each week in the month of January. The resulting factors for our two ratios are:
<table>
<thead>
<tr>
<th></th>
<th>((T_1 + S)/T)</th>
<th>(D/(D - S))</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 1978</td>
<td>1.0030</td>
<td>1.0056</td>
</tr>
<tr>
<td>December 1978</td>
<td>1.0059</td>
<td>1.0110</td>
</tr>
<tr>
<td>January 1979</td>
<td>1.0081</td>
<td>1.0154</td>
</tr>
</tbody>
</table>

We have applied these factors to the predicted multiplier components for November and December, 1978. The resulting \(M_1\) multiplier predictions for these two months (on a seasonally unadjusted basis) for the net monetary base are:

<table>
<thead>
<tr>
<th></th>
<th>Actual</th>
<th>Predicted with Adjustment</th>
<th>Predicted</th>
</tr>
</thead>
<tbody>
<tr>
<td>November</td>
<td>2.568</td>
<td>2.588</td>
<td>2.599</td>
</tr>
<tr>
<td>December</td>
<td>2.584</td>
<td>2.596</td>
<td>2.616</td>
</tr>
</tbody>
</table>

For each of the two months, the multiplier predicted without adjustment by our models substantially overpredicts the observed multiplier, as we expected. The adjustment factors substantially reduce the prediction error; indeed, the adjusted prediction for December is highly accurate. An examination of the errors in the individual component ratios for November indicates that the predictions of the \(k\) and \(t_1\) ratios are highly accurate after the adjustment factor has been applied, and that the major sources of the forecasting error for the multiplier are errors in the \(t_2\) (i.e. CD to demand-deposit) and borrowing ratios. Given the November 1 announcement of the rescue effort for the dollar and the associated sharp increases in the discount rate and other short term rates, we are not surprised that this month produces a large forecast error for these ratios (especially the CD ratios) relative to the sample period performance. We would expect a large forecast error even if the situation had not been complicated by the presence of the ATS change.
The accuracy of the adjusted prediction for December suggests that the adjustments are appropriate until such time as more data are available with which to reconstruct the model.

The remaining problem is how to forecast the adjustment factor. In the results reported below for the calendar year 1979 we have constructed adjusted forecasts under the assumption that the January, 1979, adjustment ratios will remain constant throughout the year. This implicitly involves the assumption that the transition period of adjustment for ATS balances has been completed and that in the future they will grow at the same rate as conventional demand deposits, and that there is no seasonal fluctuation between AFT balances and conventional demand deposits. Given the available history, there is no way of verifying these assumptions at this time.
IMPLICATIONS OF MULTIPLIER FORECASTS FOR
DIFFERENTIAL GROWTH RATES OF MONETARY AGGREGATES

Each month, the FOMC adopts short-run growth targets for various monetary aggregates. Each quarter, the chairman of the Board of Governors testifies before Congress on the FOMC’s long-run growth objectives for various monetary aggregates. The long-run objectives are stated as a tolerable range of annual growth rates from a base value equal to the previous quarter’s average value of the individual aggregates. In practice, the "long-run" is one quarter, not one year, since the base value is reset each quarter even if the target growth rates are not changed.

Since for each month:

\[ M_1 = B_1 \]

then

\[ \bar{M}_1 = \bar{B}_1 \]

where \( \bar{M}_1 \), \( \bar{B} \) and \( \bar{\bar{M}}_1 \) are the quarterly geometric averages of the monthly values of the monetary aggregates, the base multipliers, and the net monetary base, respectively.

Taking logarithms:

\[ \ln \bar{M}_1 = \ln \bar{B}_1 + \ln \bar{\bar{B}} \]

So in log first differences (percentage changes) at annual rates

\[ 4\Delta \ln \bar{M}_1 = 4\Delta \ln \bar{B}_1 + 4\Delta \ln \bar{\bar{B}} \]

If two different monetary aggregates are compared, \( M_1 \) versus \( M_j \), we can examine the forecasts for the differential growth rates as:
\[ 4\Delta \ln \bar{m}_j - 4\Delta \ln \bar{m}_1 = 4\Delta \ln \bar{m}_j - 4\Delta \ln \bar{m}_1 + 4\ln \bar{m} - 4\ln \bar{m}_1 \]

This forecast of the differential growth rate between two monetary aggregates is only an approximation to the differential growth rate in the FOMC long-run targets, since our computation uses quarterly geometric averages, while the FOMC calculations are in terms of quarterly arithmetic averages. Given the relative magnitude of the month-to-month changes in the seasonally adjusted series, the approximation error should be extremely small. For example, for 78 IV on a seasonally adjusted basis, the quarterly arithmetic average for \( M_1 \) is 361.37, while the quarterly geometric average is 361.37. Similarly, the arithmetic average for \( M_2 \) is 873.83 while the geometric average is 873.83.

On the basis of the monthly multiplier forecasts presented above, our forecasts of the annual growth rate of \( M_2 \) relative to \( M_1 \) are:

<table>
<thead>
<tr>
<th>78IV - 79I</th>
<th>6.46</th>
<th>Percent/Ann.</th>
</tr>
</thead>
<tbody>
<tr>
<td>79I - 79II</td>
<td>.61</td>
<td>Percent/Ann.</td>
</tr>
<tr>
<td>79II - 79III</td>
<td>1.23</td>
<td>Percent/Ann.</td>
</tr>
<tr>
<td>79III - 79IV</td>
<td>1.63</td>
<td>Percent/Ann.</td>
</tr>
</tbody>
</table>
## Predicted Net Monetary Base Multipliers for 1979

(Initial Conditions December, 1978: Adjusted for ATE)

<table>
<thead>
<tr>
<th></th>
<th>m₁</th>
<th>m₂</th>
<th>m₃</th>
<th>m₄</th>
<th>m₅</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>2.5305</td>
<td>6.1313</td>
<td>10.4756</td>
<td>6.8173</td>
<td>11.1616</td>
</tr>
<tr>
<td>February</td>
<td>2.5020</td>
<td>6.2331</td>
<td>10.7110</td>
<td>6.9224</td>
<td>11.4003</td>
</tr>
<tr>
<td>March</td>
<td>2.5058</td>
<td>6.2514</td>
<td>10.7597</td>
<td>6.9473</td>
<td>11.4555</td>
</tr>
<tr>
<td>April</td>
<td>2.5499</td>
<td>6.2631</td>
<td>10.7566</td>
<td>6.9711</td>
<td>11.4646</td>
</tr>
<tr>
<td>May</td>
<td>2.4808</td>
<td>6.1874</td>
<td>10.6635</td>
<td>6.8818</td>
<td>11.3579</td>
</tr>
<tr>
<td>June</td>
<td>2.5020</td>
<td>6.1869</td>
<td>10.6699</td>
<td>6.8887</td>
<td>11.3718</td>
</tr>
<tr>
<td>July</td>
<td>2.5008</td>
<td>6.1488</td>
<td>10.6146</td>
<td>6.8507</td>
<td>11.3165</td>
</tr>
<tr>
<td>August</td>
<td>2.4836</td>
<td>6.1631</td>
<td>10.6557</td>
<td>6.8598</td>
<td>11.3523</td>
</tr>
<tr>
<td>September</td>
<td>2.4969</td>
<td>6.1729</td>
<td>10.6831</td>
<td>6.8759</td>
<td>11.3861</td>
</tr>
<tr>
<td>October</td>
<td>2.4970</td>
<td>6.1594</td>
<td>10.6653</td>
<td>6.8613</td>
<td>11.3673</td>
</tr>
<tr>
<td>November</td>
<td>2.4830</td>
<td>6.1147</td>
<td>10.5891</td>
<td>6.8189</td>
<td>11.2932</td>
</tr>
<tr>
<td>December</td>
<td>2.4983</td>
<td>6.0759</td>
<td>10.5034</td>
<td>6.7859</td>
<td>11.2134</td>
</tr>
</tbody>
</table>

### Not Seasonally Adjusted

<table>
<thead>
<tr>
<th></th>
<th>m₁</th>
<th>m₂</th>
<th>m₃</th>
<th>m₄</th>
<th>m₅</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td>2.5328</td>
<td>6.2069</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>February</td>
<td>2.5143</td>
<td>6.1854</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>March</td>
<td>2.5148</td>
<td>6.1908</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>April</td>
<td>2.5155</td>
<td>6.1836</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>May</td>
<td>2.5099</td>
<td>6.1794</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>June</td>
<td>2.5046</td>
<td>6.1702</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>2.5030</td>
<td>6.1663</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>August</td>
<td>2.4987</td>
<td>6.1777</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>September</td>
<td>2.4991</td>
<td>6.1742</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>October</td>
<td>2.4884</td>
<td>6.1542</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>November</td>
<td>2.4816</td>
<td>6.1652</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>December</td>
<td>2.4722</td>
<td>6.1419</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Seasonally Adjusted
Appendix I: Notation

k  Currency/Demand Deposits
s  Government Deposits/Demand Deposits
\( t_1 \)  Time and Savings Deposits less CD's/Demand Deposits
\( t_2 \)  CD's/Demand Deposits
\( t_3 \)  Deposits at Savings Institutions, Mutual Savings Banks and Savings and Loans/Demand Deposits
\( r+1 \)  Adjusted Reserves/Total Deposits
b  Member Bank Borrowings/Total Deposits

CD's  Negotiable Certificates of Deposit over $100,000
Total Deposits  Commercial Bank Demand Deposits, Time and Saving Deposits and U.S. Government Deposits

\( D_1 \)  A Dummy variable for the period 1966 7-12
\( D_2 \)  A Dummy variable for the period 1968 12 to 1970 6
\( D_3 \)  A Dummy variable for the periods 1967 1-2 and 1970 7-8
B  Back operator notation, i.e. \( B^iX_t = X_{t-i} \)
\( \ln \)  Notation for natural log
a  The estimated residual, or innovation.
Appendix II: The Multiplier Component Models

1. \((1 - B^{12}) \quad (1 - B) \quad \ln k = (1 + .1992B^3 + .1568B^6 + .1983B^9 - .4353B^{12})a\)
   \[\chi^2 = 31.50 \quad (df = 26) \quad S.E. = .5257x10^{-2} \quad \text{Sample: 55.1 - 78.3}\]

2. \((1 - B^3) \quad (1 - B^{12}) \quad (1 - B) \quad \ln k = (1 + .6924B^3)(1 - .6297B^{12})a\)
   \[\chi^2 = 35.18 \quad (df = 28) \quad S.E. = .546x10^{-2} \quad \text{Sample: 55.1 - 78.3}\]

3. \((1 - B^3) \quad (1 - B^{12}) \quad (1 - B) \quad \ln t_1 = (1 + .2308B)(1 - .6826B^3)(1 - .5954B^{12})a\)
   \[\chi^2 = 41.03 \quad (df = 27) \quad S.E. = .663x10^{-2} \quad \text{Sample: 55.1 - 78.3}\]

4. \((1 - B^{12}) \quad (1 - B) \quad \ln g = (1 + .3931B^2)(1 - .2821B^2)(1 - .6000B^{12})a\)
   \[\chi^2 = 27.41 \quad (df = 27) \quad S.E. = .175 \quad \text{Sample: 55.1 - 78.3}\]

5. \((1 - B^{12}) \quad (1 - B) \quad \ln(r + 4) = (1 - .5873B + .2980B^2 - .3435B^{12})a\)
   \[\chi^2 = 27.96 \quad (df = 27) \quad S.E. = .927x10^{-2} \quad \text{Sample: 68.10 - 78.3}\]

6. \((1 - B) \quad \ln b = a\)
   \[\chi^2 = 26.36 \quad (df = 30) \quad S.E. = .466 \quad \text{Sample: 68.10 - 78.3}\]

7. \((1 - B^3) \quad (1 - B^{12}) \quad (1 - B) \quad \ln t_2 = (1 + .3798B^3)(1 - .5983B^{12})a\)
   \[\chi^2 = 28.52 \quad (df = 28) \quad S.E. = .52x10^{-2} \quad \text{Sample: 59.1 - 78.3}\]

8. \((1-B)\ln t_2 = -.0048B_1 - .0468B_2 + .1197B_3 + [(1-.3913B)(1-.3728B^3)]^{-1}\)
   \[\chi^2 = 36.27 \quad (df=27) \quad S.E. = .37x10^{-1} \quad \text{Sample: 61:1 - 78.3}\]