MACROECONOMIC MODELING OF
MONEY, CREDIT, AND BANKING

Iman Anabtawi
O'Malley & Meyers

and

Gary Smith
Pomona College

Although financial markets are very competitive, few economists use supply and demand to explain asset yields and quantities. Some instead focus on monetary aggregates, emphasizing deposit creation by banks but slighting interest rates, while others concentrate on interest rates but pay little attention to asset quantities. Each approach has difficulty analyzing a variety of important and interesting financial market events. While few academics use a supply-and-demand approach (some exceptions are Brainard and Tobin [1968], Friedman and Reley [1977], Hendershott [1977], and Tobin [1969]), many financial market participants believe that interest rates are determined by the supply and demand for credit, and closely monitor federal deficits, foreign capital movements, and household saving — influences that are conspicuously absent from conventional deposit-multiplication models and interest rate equations.

This paper compares a supply-and-demand model of financial markets to deposit-multiplier models, interest rate reduced forms, the textbook IS-LM model, and the credit market. A linear approximation is used to analyze a variety of events, and a nonlinear simulation model gives concrete examples of plausible events that simpler models find paradoxical: some events stimulate the economy but contract M1; open market purchases need not be multiplied by the banking system to be powerful; business-cycle fluctuations in tax revenue can have strong effects on financial markets; and increased intermediation can be contractionary.

A FRAMEWORK

Because we are interested in the effects of financial events on aggregate demand, we focus on the demand side of the economy, using a discrete-period model to facilitate analysis of the effects of saving and dissaving on financial markets. The model's balance sheets are shown in Table 1. The entries in Table 1 are nominal flows — uses of funds are positive and sources are negative; variables with -1 subscripts are the stocks at the end of the previous period. We won't analyze the consequences of changes in the price level, inflation expectations, and inherited asset stocks and so have omitted these functional arguments.

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TABLE 1
Balance Sheets

<table>
<thead>
<tr>
<th>Households</th>
<th>Non-financial Businesses</th>
<th>Private Banks</th>
<th>Treasury</th>
<th>Central Bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages, profits and taxes</td>
<td>T - Y</td>
<td>Y</td>
<td>0</td>
<td>-T</td>
</tr>
<tr>
<td>Goods and services</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>0</td>
</tr>
<tr>
<td>Cash and reserves</td>
<td>M1 = Ti</td>
<td>M1 = T, R, L</td>
<td>M1 = Y, R, L</td>
<td>Y</td>
</tr>
</tbody>
</table>

**The first transaction row in Table 1 encompasses wages and profits distributed by businesses and taxes paid by households. The second row is purchases of goods and services, and, in the IS-LM tradition, aggregate demand, C + I + G, determines how much output Y firms produce, which is, in turn, how much income firms distribute as wages and profits [Smith, 1980a]. The last three rows encompass financial markets. Cash is the nation’s monetary base; currency held by the public plus bank reserves. Bank deposits pay an interest rate r while credit pays an interest rate R. Households, businesses, and government finance much of their spending from internally generated funds—income, profits, and taxes, respectively. However, a substantial amount is financed externally, and much of this borrowing passes through financial intermediaries. Credit excludes the funds that flow into financial institutions (or between institutions) and includes the funds that flow out to finance spending since it would be double-counting to include both depositor loans to banks and bank loans to customers.**

There are, of course, many different financial intermediaries and many types of deposits. Because our model emphasizes the consequences of shifts among assets with different reserve requirements, "deposits" include only transaction accounts, which, in the United States, are currently subject to a 10 percent reserve requirement. For our macroeconomic purposes, there is no difference between funds in a money market deposit account, a money market fund, or in T-bills and so these are all treated as direct purchases of securities.

Households allocate their disposable income X = Y - T among commodities and financial assets: Y - T = C + A - A 1 + U - U 1 + V - V 1 . Consumption depends only on disposable income. Asset demands are assumed to be gross substitutes, in that a higher deposit rate increases the demand for deposits and reduces the demand for cash and credit instruments, while a rise in the credit rate increases the demand for securities at the expense of cash and deposits. Using subscripts to denote partial derivatives, the adding-up restrictions are C(Y, A 1, U 1, V 1, V 1, A 1, U 1, V 1, V 1) = 1; A(Y, A 1, U 1, V 1, V 1, A 1, U 1, V 1, V 1) = 0; and A(Y, A 1, U 1, V 1, V 1, A 1, U 1, V 1, V 1) = 0.

Businesses distribute all income as wages and profits, and borrow to finance investment spending—which is encouraged by a high level of economic activity, but discouraged by high interest rates. The budget constraint E = E 1 implies the adding-up restrictions E 1 = L 1 and E 1 = L 1. Banks provide credit by lending a fraction 1 - k of deposits. The fraction k held as idle reserves is determined by the central bank’s reserve requirements, with excess reserves ignored. Since a dollar of deposits costs S and earns (1 - kR), the bank supply of deposits hinges on the rate differential E = (1 - kR) - S. The budget constraint D = KD + L implies the adding-up restriction L 1 = (1 - kR) - S. This model encompasses several simpler models. We examine three of these and then show the extensions provided by our more general approach.

**Deposit Multiplication**

Those economists who focus on a monetary aggregate, such as M1, emphasize the deposits created by fractional reserve banking. Equilibrium of monetary base demand and supply (the third row in Table 1) implies A + kD = H, and rearrangement gives the multipliers for deposits,

\[ D = \frac{1}{k} (H + AD) \]

and for the monetary aggregate M1,

\[ M1 = D + A = \frac{1}{k} + AD (H + AD) \]

both of which depend on k (bank reserves relative to deposits) and on AD (private currency holdings relative to deposits). Deposits are a bank liability, matched on the asset side of the balance sheet by reserves and loans. The budget constraint \[ D = kD + L \] implies the loan multiplier.
aggregate demand by aiming at a money target. The apparent stability of M1 velocity in the 1970s encouraged the Fed’s October 1979 decision to pay more attention to monetary quantities and less to interest rates. Its monetary targets were subsequently undermined by an unexpected collapse of M1 velocity in 1982, 1985, and 1986. After the 1986 surprise, the Fed stopped setting a target range for M1. A focus on the monetary base and/or deposits, neglecting overall credit, can be a misleading barometer of the economy, as we will now show.

THE MODEL’S SOLUTION

The model in Table 1 is an extension of the familiar IS-LM model, with deposits a third financial asset. Because there are three endogenous variables (Y, R, and S), the deposit market can be incorporated into the LM curve, bearing in mind that deposit market events can shift the LM curve and that the deposit rate itself changes as the economy moves along the LM curve.

An Augmented LM Curve

Using linear approximations for \(U\) and \(D\), deposit equilibrium

\[ U_Y + U_X + U_Z + U_R = D_Y(1 - kR - S) \]

implies

\[ S = -(U_0 - U_Y + \{1 - k\}D_Y + U_0kR)/U_0 + D_Y \]

The substitution of the equilibrium deposit rate into the demand and supply for monetary base

\[ A_Y + A_X + (A_0)(A_0 - k\{1 - k\}D_Y) = H \]

gives the augmented LM condition

\[ (2) \quad A_Y + (A_0)(A_0 - k\{1 - k\}D_Y) = H \]

Money demand is positively related to income \(Y\), but the relationship to the credit rate \(R\) is not unambiguous. If the deposit rate is constant, an increase in the credit rate leads households to acquire more securities and to hold less cash and deposits. This decline in deposits reduces bank demand for reserves, so that the two components of monetary base demand, cash outside banks and bank reserves, both decline. In our deposit equilibrium model, an increase in the credit rate encourages banks to raise the deposit rate. With both interest rates up, the demand for cash outside banks falls, but bank deposits (and hence reserves) may increase. Banks will resist increase
Tobin (1983a; 1983b) has argued that financial deregulation has steepened the LM curve, leaving the economy more vulnerable to purely financial shocks. He reasons that,

The marginal costs of disintermediation are probably fairly constant over normal ranges of variation in the volume of bank deposits and assets. Thus the competitive deposit rate will be below the rates on bank loans and other assets by a fairly constant differential. The public’s demand for deposits, on the other hand, depends principally on the interest differential and on transactions volume. If the differential becomes a constant, the demand for deposits will be independent of the level of interest rates. A rise in market interest rates will not reduce the demand for deposits as it does in the old regime and in the standard model, because the rate paid on deposits will rise too.

[1983a]

However, an important intermediation cost is the foregone interest on required reserves, and this cost rises with the level of interest rates. The relevant interest rate differentials are \((1 - \delta)R - S\) for banks and \(R - S\) for depositors. If banks hold \((1 - \delta)R - S\) constant, then, with a 10 percent reserve requirement, each percentage point rise in \(R\) pulls \(S\) up by only 90 basis points, increasing \(R - S\) by 10 basis points and reducing the demand for deposits. The flexibility of deposit rates does have important implications for monetary policy, but does not necessarily make the LM curve steeper.

\section*{A Credit Market Curve}

Although Walras’ law implies that the credit market can be neglected, an explicit examination may clarify our understanding of the consequences of various economic events. A credit market equilibrium curve analogous to the LM curve above can be derived by using substitutions to eliminate the deposit rate from the deposit equilibrium equation. Equation (4) is a sufficient condition for the credit supply curve to be upward sloping, for much the same reasons given in conjunction with the LM curve. An increase in income has conflicting effects on the demand for credit. As income expands, household saving supplies additional credit and government tax revenue also swells, reducing their demand for credit. The one contrary influence is that a
TABLE 2
A Simulation Model

<table>
<thead>
<tr>
<th>Households</th>
<th>Economic Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Income: ( T = -500 + 0.3Y )</td>
<td></td>
</tr>
<tr>
<td>Consumption: ( C = C_Y + 0.5(Y - T) )</td>
<td></td>
</tr>
<tr>
<td>Wealth: ( W = 500 + Y - T - C )</td>
<td></td>
</tr>
<tr>
<td>Cash: ( M = A + 0.045 + 0.025(Y - T) + 0.02(Y - T)W - 0.009k + 0.009L )</td>
<td></td>
</tr>
<tr>
<td>Deposits: ( D = M - W - 0.045 + 0.025(Y - T)W - 0.009k + 0.009L )</td>
<td></td>
</tr>
<tr>
<td>Securities: ( S = W - 0.045 + 0.025(Y - T)W - 0.009k + 0.009L )</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Businesses</th>
<th>Economic Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment: ( I = 2T(Y - R + k) )</td>
<td></td>
</tr>
<tr>
<td>Banks</td>
<td>Economic Model</td>
</tr>
<tr>
<td>Deposits: ( D = D_A + 0.06(Y(1 - k) - b) - 150(Y(1 - k) - S) )</td>
<td></td>
</tr>
</tbody>
</table>

The CONSEQUENCES OF VARIOUS EVENTS

This model can be used to examine the effects of a variety of economic events on interest rates and asset quantities. The algebraic analysis for a linear approximation is sketched in an appendix and discussed below. The nonlinear simulation model in Table 2 is used to illustrate and confirm the logic.

In the simulation model, the homogeneity in wealth for a given income-wealth ratio follows Tobin (1966); we have omitted lagged asset stocks and other variables that are held constant. The marginal tax rate is 30 percent and the marginal propensity to spend out of disposable income is 0.9, with the remaining 10 percent of an increase in disposable income allocated among cash, deposits, and securities. The initial solutions for household cash, deposits, and securities are $177 billion, $359 billion, and $552 billion, respectively, while GDP is $353 billion, the credit rate 11.3 percent, and the deposit rate 9.4 percent. Interest rates are measured in percentage points in the demand equations, and (at the initial solution) a one-percentage-point rise in the deposit rate increases the demand for deposits by $12 billion while reducing the demand for cash by $3 billion and for securities by $9.4 billion. A one-percentage-point rise in the yield on securities increases securities demand by $10.3 billion, while reducing cash demand by $2.5 billion and deposit demand by $7.8 billion.

A $100 billion increase in national income raises business investment by $10.4 billion, while a one-percentage-point increase in the credit rate reduces investment by $17 billion, from $344.6 billion to $327.6 billion. Bank deposit supply is a quadratic function of the interest rate differential. A one-percentage-point rise in this differential (from 0.56 percent to 1.56 percent) more than doubles bank deposit supply, from $400.3 billion to $883.0 billion.

These specific assumptions are consistent with econometric estimates and other simulation models (e.g., Friedman [1978, 1980];) and (Smith [1980b]) and may provide some suggestive predictions of the consequences of a variety of economic events. To gauge the model's sensitivity, five key parameters \( I \) were allowed to vary by up to 50 percent, adjusting the appropriate intercepts to maintain the initial solution. The marginal propensity to consume out of disposable income was varied from 0.45 to 0.99, by letting \( k \) range from 0.5 to 1.1, in steps of 0.1; the other four, \( S \), ranged from 0.5 to 1.5 in 0.1 steps.

The parameters \( I \) and \( S \) vary the income and interest elasticity of money demand. The short-run income elasticity of M1 demand ranges from 0.14 to 0.35 and the elasticity of M1 demand with respect to R ranges from 0.11 to 0.31 if S is held constant and from 0.02 to 0.07 if S changes by (1 - k) times the change in R. The parameter \( I \) gives different interest elasticities of investment spending, ranging from 0.25 to 0.85; \( S \) varies the interest elasticity of deposit supply from 0.43 to 1.30.

Each of seven events was simulated with 102,457 different combinations of values of the sensitivity parameters. Each cell in Table 3 shows three different results. The middle row in each set of three rows presents the base solution, with all \( I \) = 1. The upper row is the maximum value obtained for any combination of the parameter values; the lower row is the minimum value. Our discussion focuses on the base solutions, with the minimum and maximum values gauging its robustness.

Increased Spending and Credit Demand

An increase in consumer, business, or government spending financed by the sale (or reduced purchase) of securities shifts the IS and VB curves rightward. Increased expenditures raise output, while the sale of securities to finance these expenditures pushes the credit rate upward. The change in the deposit rate is uncertain: the higher credit rate raises banks more eager for deposits and households less so, putting upward pressure on deposit rates; but the increase in national income enlarges saving and may expand household deposits enough to reduce deposit rates. Tor is the direction of change in deposits and M1 certain: the demand for money is enlarged by higher Y, diminished by higher R, and complicated by the uncertain change in S.

In our simulation model, it turns out that deposit rates, deposits, and M1 all rise. The first column of Table 3 shows the specific numbers accompanying a $5 billion increase in government spending. National income rises by $15.63 billion and tax revenue by $4.69 billion, forcing the government to sell $0.31 billion in securities. The

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### TABLE 3
Simulation Results

<table>
<thead>
<tr>
<th></th>
<th>$1Govt Spending Financed by Bonds</th>
<th>$1 Open Market Purchase of Bonds</th>
<th>$1 Shift in Demand from Cash to Bonds</th>
<th>$1 Shift in Demand from Cash to Deposits</th>
<th>$1 Shift in Demand from Deposits to Bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>National</td>
<td>+24.69</td>
<td>38.21</td>
<td>+13.87</td>
<td>+8.61</td>
<td>+4.65</td>
</tr>
<tr>
<td>Credit</td>
<td>+1.14</td>
<td>-0.34</td>
<td>-0.87</td>
<td>-0.44</td>
<td>-0.24</td>
</tr>
<tr>
<td>Rate</td>
<td>+0.05</td>
<td>-0.16</td>
<td>-0.15</td>
<td>-0.17</td>
<td>-0.14</td>
</tr>
<tr>
<td>Deposit</td>
<td>+0.14</td>
<td>-0.05</td>
<td>-0.28</td>
<td>-0.46</td>
<td>-0.38</td>
</tr>
<tr>
<td>Bank</td>
<td>+1.09</td>
<td>+0.62</td>
<td>+0.88</td>
<td>+0.94</td>
<td>+0.94</td>
</tr>
<tr>
<td>Deposits</td>
<td>+0.28</td>
<td>-0.99</td>
<td>-0.93</td>
<td>-0.93</td>
<td>-0.93</td>
</tr>
<tr>
<td>Cash Flows</td>
<td>-0.20</td>
<td>+0.62</td>
<td>+0.92</td>
<td>+0.92</td>
<td>+0.92</td>
</tr>
<tr>
<td>Household</td>
<td>+0.58</td>
<td>+0.96</td>
<td>+1.77</td>
<td>+1.77</td>
<td>+1.77</td>
</tr>
<tr>
<td>Securities</td>
<td>+0.53</td>
<td>+0.96</td>
<td>+1.39</td>
<td>+1.39</td>
<td>+1.39</td>
</tr>
<tr>
<td>Purchases</td>
<td>-0.38</td>
<td>+0.52</td>
<td>+0.66</td>
<td>+0.66</td>
<td>+0.66</td>
</tr>
<tr>
<td>Bank</td>
<td>+0.96</td>
<td>+0.96</td>
<td>+1.77</td>
<td>+1.77</td>
<td>+1.77</td>
</tr>
<tr>
<td>Securities</td>
<td>+0.53</td>
<td>+0.96</td>
<td>+1.39</td>
<td>+1.39</td>
<td>+1.39</td>
</tr>
<tr>
<td>Central Bank Securities</td>
<td>-0.38</td>
<td>+0.52</td>
<td>+0.66</td>
<td>+0.66</td>
<td>+0.66</td>
</tr>
<tr>
<td>Treasury</td>
<td>+0.41</td>
<td>-0.57</td>
<td>-0.60</td>
<td>-0.57</td>
<td>-0.57</td>
</tr>
<tr>
<td>Securities</td>
<td>+0.31</td>
<td>-0.27</td>
<td>-0.34</td>
<td>-0.27</td>
<td>-0.27</td>
</tr>
<tr>
<td>Sales</td>
<td>-1.18</td>
<td>-0.57</td>
<td>-0.60</td>
<td>-0.57</td>
<td>-0.57</td>
</tr>
</tbody>
</table>

**An Open Market Purchase**

A central bank purchase of securities increases the supply of money, shifting the LM curve rightward, and increases the demand for securities, shifting the VB curve downward. The credit rate falls and output increases. The deposit rate falls too, because the rise in output increases household deposits, reinforcing banks' diminished enthusiasm for deposits as the credit rate declines.

If deposit rates were fixed, as is the return on cash, then both cash and deposits would gain equally relative to assets whose market-determined rates are falling, and the ratio of cash to deposits might be roughly constant — so that the increase in the monetary base is reliably multiplied into an increase in deposits and the monetary aggregate as in equations (1) and (2). However, a flexible deposit rate declines, increasing the ratio of cash to deposits and reducing the deposit multiplier. The direction of change in deposits is theoretically ambiguous, though the monetary aggregate definitely increases if equation (4) holds.1

Table 3 shows the specific simulation results for a $1 billion open market purchase. Notice how little resemblance there is here to the textbook model of banks as creators of money. It is not money multiplication that converts $1 billion in monetary base into $4.03 billion in business credit; in fact, bank deposits and loans both contract. Increased corporate borrowing is accommodated by the stronger economy, which provides more saving by households and requires less borrowing by the Treasury. Those who sell securities to the central bank do not have to deposit the proceeds in banks for there to be a strong economic stimulus. Indeed, as we will soon see, the consequences are stronger the less bank intermediation takes place.

**Monetized Deficits**

Consider now an increase in government spending that the central bank monetizes with an open market purchase (or, equivalently, an increase in private spending financed by a diminished demand for cash). The VB curve is fixed, while the IS and LM curves shift rightward. Output increases and both the credit and deposit rates fall.2 In Table 3, the central bank's $1 billion purchase plus the diminished Treasury sales provides $4.21 billion in additional credit availability. The household credit supply increases somewhat, while bank deposits drop slightly. Business investment and borrowing increase by $4.19 billion, with banks playing virtually no role.

**A Reduction in Reserve Requirements**

The ratio of bank reserves to assets in the United States has fallen substantially over the years (from 6.2 percent in 1970 to 3.5 percent in 1980 and 1.8 percent in 1990) as reserve requirements have declined and, more importantly, banks have been allowed to introduce liabilities that are subject to little or no reserve requirements. At the conclusion of World War II, nearly 70 percent of all bank funds in the United States came from transaction accounts. Now less than 25 percent does.

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1. Various economic models have been proposed to explain how the money supply is created by banks' increasing their demand deposits. One model focuses on the behavior of banks in setting their reserve ratios to minimize their costs, while another emphasizes the role of banks' interbank lending in determining the supply of money.

2. The IS-LM framework is a macroeconomic model that describes the interaction of the interest rate with the level of output in an economy.
The 1950 Deregulation and Monetary Control Act and subsequent legislation accelerated these trends by reducing reserve requirements and by authorizing banks to raise funds in new ways. In 1983, the pendulum swung back to the extent that more attractive bank transaction accounts (subject to stiffer reserve requirements) lured deposits out of money market funds with no reserve requirements. These sorts of developments make a big difference to the amount of credit flowing through financial institutions. A 10 percent drop in effective reserve requirements immediately frees about $5 billion of bank reserves, just as if the central bank had used open market purchases to increase the nation's monetary base by $5 billion. (For 1983 as a whole, the U.S. monetary base increased by about $36 billion.)

A comparison of the second and fourth columns of Table 3 shows that the consequences of lower reserve requirements and increased open market purchases are very similar. In an open market purchase, the central bank uses new money to purchase securities; when reserve requirements are reduced, private banks use newly freed money to buy securities. A drop in reserve requirements also widens the gap between $1 and S, encouraging banks to seek more deposits for lending; this effect causes R to fall more and S not so much and, on balance, further stimulates the economy.

A Shift From Cash to Securities

Financial innovations have allowed many agents to hold less idle cash and more interest-bearing securities, either directly or indirectly through money-market funds and other means. The macroeconomic effects are identical to an open market purchase, because a reduced demand for cash and increased demand for securities is equivalent to an increased supply of cash and reduced supply of securities: the LM curve shifts rightward and the VB curve shifts downward.

A comparison of the second and fifth columns of Table 3 shows that the only difference is whether it is househods or the central bank that acquires a billion dollars in securities. However, this unimportant distinction always creates a $1 billion difference in the behavior of M1, which turns out here to be the difference between an increase and a decrease. Although a demand shift from cash to securities is clearly expansionary, bank deposits and M1 both decline. Even if a deposit multiplier model could correctly predict the drop in deposits and in M1, it would give the wrong signal about the effects on economic activity.

A Shift From Cash to Deposits

An increased availability of credit cards and automatic-funds-transfer systems reduces the demand for cash and increases the demand for interest-paying deposits. As discussed earlier, the LM and VB curves are both shifted downward by such an event. Deposit and credit rates both fall, while output expands. This is the usual story of banks as creators of money: a conversion of idle cash into deposits that will be loaned out, supplying credit, stimulates the economy. In Table 3 a $1 billion shift in demand from cash to deposits increases national income by almost as much as an open market purchase, because it is equivalent to a central bank decision to acquire $1 billion in deposits rather than securities — an action that is slightly less potent because deposits are subject to reserve requirements.

A Shift from Deposits to Securities

A shift from deposits to securities is expansionary because $1 billion in deposits is partly absorbed by reserve requirements and doesn’t yield a full $1 billion in credit supply. The details are shown in the last column of Table 3. Once again, the LM and VB curves shift downward, for the reasons given along with the description of the LM and VB curves. Contrary to the moral of the bank deposit-multiplier model, disintermediation causes a substantial decline in bank deposits and M1, but is nonetheless expansionary.

One of the most important institutional developments in the United States in the late 1970s was the expansion of money market funds. If we consider these funds financial intermediaries, their increased importance reduced the average reserve requirements on financial intermediaries and it follows immediately that money market funds eased credit market conditions as surely as if legal reserve requirements had been reduced. Now think of money market funds as a thinly veiled direct purchase of business credit by individuals, with the fund merely acting as a securities broker: since money market funds expand credit, disintermediation expands credit.

Another way to see this point is to consider a simple deposit-multipier model in which the cycle of a deposit, loan, expenditure, and redeposit is interrupted after each expenditure by a direct loan and expenditure before the money is redeposited. The extra loan and expenditure during each round is expansionary, yet the deposit-multiplier model treats it as non-event.

Institutional developments (congressional legislation, judicial rulings, or new securities offered by financial entrepreneurs) that encourage direct lending in place of deposits that are subject to reserve requirements expand overall credit. Institutional developments that make deposits subject to reserve requirements more attractive relative to direct lending lighten credit markets. In 1982, 1985, and 1986, M1 surged in the United States while the economy muddled along — causing a large, unexpected drop in velocity. Many observers (e.g., Federal Reserve Bank of San Francisco [1985], Nussel [1987], Wenninger and Radecki [1985/86], and Yardeni and Johnson [1986]) attributed this velocity collapse to an asset swap by investors, from non-M1 assets into transaction deposits, and argued that such a shift wasn’t necessarily expansionary if investors merely wanted to park their money and not spend it. The lesson of our model is that such asset swaps are actually contractionary.

CONCLUSION

James Tobin [1983a] has written that, "As deposits come to bear competitive interest rates, monetary theory ... will have to be rewritten.” His “new view” of banks
correctly argued for a balanced treatment of bank assets and liabilities. But bank assets are not the only source of credit. In the simulations conducted here, the credit market and, in particular, government saving and dissaving have prominence commensurate with the attention paid by financial market participants, and an understanding of financial market developments requires more than a myopic focus on a narrowly defined monetary aggregate.

Table 3 shows that no single monetary rule consistently gauges the change in aggregate demand accurately. The primary problem with interest rate targets is that shifts in the IS curve cause R to move procyclically, while LM shifts move R countercyclically. Thus increases in interest rates cannot be reliably associated with economic strength or weakness, an observation exploited by Posner [1970] and others. The same moral applies to monetary aggregates, to the extent their volatility is influenced by interest rates. When interest rates increase, rising velocity causes money to grow slower than GDP; when interest rates fall, velocity declines and money grows faster than nominal GDP. The first two columns of Table 3 illustrate how equally expansionary fiscal and monetary policies affect M1 differently. The last three columns show that shifts in asset preferences can cause wide disparities in the behavior of M1 and GDP.

After repeated exposure to partial-equilibrium deposit-multiplier models, most economists believe instinctively that it is deposition multiplication that makes monetary policies powerful, by converting high-powered money into a much larger amount of M1. But monetary policy can be powerful without deposit multiplication — indeed, such policies are more powerful the less deposit multiplication takes place; i.e., the mere funds people invest directly, rather than through intermediary accounts subject to reserve requirements. Conversely, an increase in M1 caused by a shift in transaction accounts from assets not subject to reserve requirements tightens financial markets and is actually contractionary. Explicit models of supply and demand can help us understand financial markets and recognize some of the complexities that undermine simple-minded rules.

**APPENDIX**

Arbitrarily omitting the credit market, a linear approximation is

\[
\begin{pmatrix}
-1 - C_y - I_y \\
A_y & A_y + k(1 - h)D_2 & A_y - hD_2 \\
U_y & U_y - (1 - h)D_2 & U_y + hD_2
\end{pmatrix}
\begin{pmatrix}
Y \\
C_y + I_y + G_0 \\
H - h_0 \\
-U_0
\end{pmatrix}
\]

The Jacobian determinant is

\[
|J| = (1 - C_y - I_y)(A_yU_y - A_yU_y + D_2(1 - h)h_0 + (1 - h)h_0) - h(Y + (1 - h)D_2) + I_yA_yU_y + A_yD_2 + A_yU_y + hD_2U_y
\]
INTRODUCTION

Economists of the "Classical" school believe that freely functioning markets lead to market-clearing equilibrium outcomes that are Pareto optimal. In this vein, they have attacked New Keynesian efficiency wage models for depicting involuntary unemployment resulting from the failure of the "price" in the labor market to effectively fluctuate. Keynesian economists who are not New Keynesians have also criticized these models.

The purpose of this paper is to show explicitly why New Keynesian efficiency wage models cannot depict involuntary unemployment. New Keynesians do provide intuitive rationales for the efficiency wage effect. Empirical confirmation of the efficiency wage effect offers some support for their theories [Pernecke, 1990]. New Keynesians also re-elevate the importance of providing an explanation for the persisting social problem of involuntary unemployment. But they fail in this theoretical explanation because they adopt the New Classical goal of utilizing neoclassical microfoundations to explain macroeconomic phenomena.

Paul Davidson notes the impossibility of providing neoclassical microfoundations for involuntary unemployment. He further recognizes the need to replace wage rigidity with insufficient effective demand to explain involuntary unemployment. He also refutes the idea that rigid wages create involuntary unemployment by emphasizing the positive influence of wages on aggregate demand [Davidson, 1979, 452-3, 457]. This paper extends these ideas, utilizing New Classical criticisms of New Keynesian efficiency wage models, as well as New Keynesian responses, to identify and explain the specific reasons for the inconsistency between involuntary unemployment and neoclassical microfoundations. The New Keynesian inclusion of the Classical production function helps to create this inconsistency. Also, methodological problems exist in the New Keynesian attempt to model involuntary unemployment within a fundamentally New Classical framework.