NBER WORKING PAPER SERIES

CROWDING OUT OR CROWDING IN? THE ECONOMIC CONSEQUENCES OF FINANCING GOVERNMENT DEFICITS

Benjamin M. Friedman

Working Paper No. 284

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge MA 02138

October 1978

The research reported here is part of the NBER's research program in Financial Markets and Monetary Economics. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

Working Paper 284
October 1978

CROWDING OUT OR CROWDING IN?

THE ECONOMIC CONSEQUENCES OF FINANCING GOVERNMENT DEFICITS

Benjamin M. Friedman

Abstract

The prevailing view of the economic consequences of financing government deficits, as reflected in the recent economics literature and in recent public policy debates, reflects serious misunderstandings. Debt-financed deficits need not "crowd out" any private investment, and may even "crowd in" some. Using a model including three assets — money, government bonds, and real capital — the analysis in this paper shows that the direction of the portfolio effect of bond issuing on private investment depends on the relative substitutabilities among these three assets in the public's aggregate portfolio. Since the all-important substitutabilities that make the difference between "crowding out" and "crowding in" are determined in part by the government's choice of debt instrument for financing the deficit, this analysis points to the potential importance of a policy tool that public policy discussion has largely neglected for over a decade — debt management policy. When monetary policy is non-accommodative, within limits debt management policy can take its place in augmenting the potency of fiscal policy, or in improving the trade-off between short-run stimulation and investment for long-run growth.

Benjamin M. Friedman
National Bureau of Economic Research
1050 Massachusetts Avenue
Cambridge, MA 02138

(617) 868-3929

Brookings Panel on Economic Activity
September 28-29, 1978

Revised
September, 1978

CROWDING OUT OR CROWDING IN?
THE ECONOMIC CONSEQUENCES OF FINANCING GOVERNMENT DEFICITS

Benjamin M. Friedman*

The Federal Government's budget deficit has emerged as a central focus of concern in American public policy debate, attracting anxious attention from a variety of constituencies. The left now raises the spectre of enlarged deficits in opposition to the increasingly audible calls for tax reduction, while the right continues to cite the same threat against new government spending initiatives. In either case the (usually implicit) presumption of ill effects from a sustained deficit is an essential underpinning of the argument. The economic consequences of government deficits — usually alleged to be either inflationary (in the sense of raising prices), or deflationary (in the sense of depressing investment and hence economic growth), or both — today appear with unaccustomed urgency in discussions of hitherto unexciting policy issues. Several state legislatures have proposed a Constitutional amendment prohibiting the Federal Government from spending beyond its receipts. In 1976 the victorious Democratic (!) Presidential candidate campaigned on a pledge to balance the government budget by 1980.

Even a cursory look at the relevant historical data (see Table 1) suggests why the furor has so recently intensified so sharply. Since the mid 1970's the Federal Government's excess of expenditures over receipts

TABLE 1

FEDERAL GOVERNMENT BUDGETS IN THE POSTWAR ERA

	Billions of Dollars			% of GNP		
Calendar Year	Receipts	Expenditure	Difference	Receipts	Expenditure	Difference
1946	39.1	35.6	3.5	18.7	17.0	1.7
1947	43.2	29.8	13.4	18.6	12.8	5.8
1948	43.2	34.9	8.3	16.7	13.5	3.2
1949	38.7	41.3	-2.6	15.00	16.0	-1.0
1950	50.0	40.8	9.2	17.5	14.3	3.2
1951	64.3	57.8	6.5	19.5	17.5	2.0
1952	67.3	71.1	-3.7	19.4	20.5	-1.1
1953	70.0	77.1	-7.1	19.2	21.1	-1.9
1954	63.7	69.8	-6.0	17.4	19.1	-1.7
1955	72.6	68.1	4.4	18.2	17.1	1.1
1956	78.0	71.9	6.1	18.5	17.1	1.4
1957	81.9	79.6	2.3	18.5	18.0	0.5
1958	78.7	88.9	-10.3	17.5	19.8	-2.3
1959	89.8	91.0	-1.1	18.5	18.7	-0.2
1960	96.1	93.1	3.0	19.0	18.4	0.6
1961	98.1	101.9	-3.9	18.7	19.5	-0.7
1962	106.2	110.4	-4.2	18.8	19.6	-0.8
1963	114.4	114.2	0.3	19.2	19.2	0.0
1964	114.9	118.2	-3.3	18.1	18.6	-0.5
1965	124.3	123.8	0.5	18.1	18.0	0.1
1966	141.8	143.6	-1.8	18.8	19.1	-0.2
1967	150.5	163.7	-13.2	18.9	20.6	-1.7
1968	174.7	180.6	-5.8	20.1	20.8	-0.7
1969	197.0	188.4	8.5	21.1	20.1	0.9
1970	192.1	204.2	-12.1	19.6	20.8	-1.2
1971	198.6	220.6	-22.0	18.7	20.7	-2.1
1972	227.5	244.7	-17.3	19.4	20.9	-1.5
1973	257.9	264.8	-6.9	19.7	20.3	-0.5
1974	288.6	299.3	-10.7	20.4	21.2	-0.8
1975	286.2	356.8	-70.6	18.7	23.3	-4.6
1976	331.4	385.2	-53.8	19.5	22.7	-3.5
1977	374.5	422.6	-48.1	19.8	22.4	-2.6

Source: U.S. Department of Commerce, National Income and Product Accounts.

has strayed widely from the predominant pattern, experienced during the previous quarter century, of typically modest deficits that become somewhat less modest during recessions. As the U.S. economy sustained its most severe downturn since the 1930's, the deficit quickly rose to a postwar record level — and not just as a dollar magnitude, which could be misleading in a growing and inflationary economy, but also in relation to the underlying scale of economic activity. Even now that the economy has regained an activity rate about consistent with many economists' estimates of the "non-accelerating-inflation rate of unemployment," the deficit remains an unprecedented 2 percent or more of the gross national product. Moreover, campaign rhetoric to the contrary, there appears to be little if any prospect of balancing the budget by the end of the decade.

While the events surrounding the growing controversy over the government's budget deficit are clear enough, there is little apparent agreement on the reasons why deficits are to be opposed. Several years ago, when a simple-minded version of monetarism had its greatest hold on the thinking of business and public policy decision makers, the dominant reasoning was that deficits were inflationary because they led to excessive money creation which in turn raised prices. Once the huge deficits of 1975 and 1976 failed to elicit a comparable bulge in monetary growth, however, attention turned to the effects of deficits financed not by money but by issuing interest-bearing government debt. Since then most discussions of the subject have typically stemmed (often in indirect, difficult to trace, ways) from either or both of two propositions about debt-financed deficits.

The first proposition is that even debt-financed deficits are inflationary, because what matters for prices is not just the money stock but instead some combination of money plus the outstanding interest-bearing government debt (or maybe just the short-term component of that debt). In other words, under this view the stock of "money" determining prices is really an "effective money" that includes assets other than just deposits and currency, and perhaps combines them with weights not restricted to zeroes or ones. Although years ago some economists advanced "total liquid asset" theories of income determination,[1] recently no one has actively investigated this hypothesis — perhaps because those who are now most eager to advance it are reluctant to pursue (and in many cases, even to recognize) its starkly anti-monetarist features.[2]

The second proposition, which is the focus of attention in this paper, is that debt-financed deficits "crowd out" interest-sensitive private-sector spending — in particular, investment in homes and in new productive capacity. Such a result, if true, would highlight two serious drawbacks to the traditional Keynesian notion of using deficit-causing fiscal policy as an engine of economic stimulation. It would reduce (perhaps to zero) the potency of fiscal policy for such stimulative purposes, since government spending would be a substitute for, rather than an addition to, private spending. And it would create a trade-off between whatever short-run advantages of income expansion remained and the longer-run benefits of productivity and growth associated especially with investment in new plant and equipment. The "crowding out" aspects of debt-financed fiscal policy have undergone substantial analysis in the academic literature and have received widespread attention in the financial press and more generally among the government and business communities. Discussion along these lines abated somewhat after interest rates on private borrowing failed to rise during 1975 and 1976, but it has picked up again as the deficit has remained large and fixed investment slow to regain vigor during the subsequent recovery. With fuller employment of the economy's resources, and continuing large deficits in prospect, fears are rising that the "crowding out" which failed to materialize in 1975-76 could be a major problem in 1979-80.

In discussions of fiscal policy, "crowding out" is a much used phrase with several diverse meanings. Economists have long agreed that, if the supply of goods and services is fixed and resources are fully employed, then the government can claim more of the economy's output only by somehow denying it to private applications. Wholly apart from financial effects, in this case the "crowding out" of real private spending by price inflation (sometimes called "forced saving"), for example, is well recognized. Conversely, if resources are unemployed and if the demand for capital stock responds to observed or expected demand for final product, then by increasing utilization levels government spending can stimulate investment in productive capacity and thereby increase real private spending also. The Congressional Budget Office, for example, has described such familiar accelerator-based effects as "crowding in."[3] Neither of these essentially real-sector arguments for "crowding out" or "crowding in" has much to do with whether the additional government spending is accompanied by a deficit — or, if so, how that deficit is financed.

By contrast, much of the recent interest in the possibility of "crowding out" has explicitly focused not merely on deficit spending but more specifically, given the experience of the mid 1970s, on deficits financed by issuing interest-bearing debt rather than money. The literature to date has distinguished two different ways in which such "financial crowding out" can occur — one associated with the demand for money for transactions purposes, and one with wealth effects on portfolio behavior. In either case, "financial crowding out" can take place independently of "real crowding out," and therefore can occur without the economy's being at full employment. Hence "financial crowding out" potentially represents an even stronger argument against deficit spending for expansionary purposes. It is primarily the effect associated with the financing of the government deficit, especially the presumed consequences for private investment spending, that has recently attracted so much attention.

The object of this paper is to show that the prevailing view of the economic consequences of financing government deficits, as reflected in the recent economics literature and in recent policy debates, reflects serious misunderstandings. Debt-financed deficits need not "crowd out" any private investment, and may even "crowd in" some. And the reasons why this is so point to the potential importance of a policy tool that economists both in and out of government have largely neglected for over a decade — debt management policy. In order to focus sharply on "financial crowding out," independently of the undisputed real-sector-only phenomena noted above, the analysis in this paper not only assumes that there are unemployed resources in the economy but also disregards any accelerator-type effects.

The first section of the paper examines, both analytically and empirically, the "transactions crowding out" associated since Hicks with the slope of the LM curve.[4] This section reviews the familiar IS-LM model and the existing econometric evidence on the LM curve's slope, but in interpreting this evidence the discussion raises the question of whether the usual treatment of this issue overstates the potency of short-run crowding out by failing to distinguish among the several different interest rates central to the IS-LM model.

The second section deals with the "portfolio crowding out" emphasized by Milton Friedman,[5] and to date most rigorously analyzed by Blinder and

Solow and by Tobin and Buiter.[6] Using a model including three assets — money, government bonds, and real capital — the analysis shows that even the sign of the portfolio effect of bond issuing on private investment depends on the relative substitutabilities among these three assets in the public's aggregate portfolio. The well known Blinder-Solow analysis, with its presumption of a negative effect, is simply the special case associated with the arbitrary (and rather implausible) assumption that government bonds and real capital are perfect substitutes. Since the question of whether or not the demand for money depends on portfolio wealth has properly emerged as a key issue in assessing the empirical importance of "portfolio crowding out," this section also presents econometric evidence indicating that money demand does indeed depend on wealth as well as income — in other words, that people hold money balances for both transactions and portfolio reasons. In addition, the discussion digresses briefly to show that including wealth in the money demand function makes a large contribution to solving Goldfeld's missing money mystery, as well as to explaining Hamburger's mysterious proposed solution.[7]

The third section extends the "portfolio crowding out" model to show that the all-important substitutabilities that make the difference between "crowding out" and "crowding in" are determined in part by the government's choice of debt instrument for financing the deficit. Hence when monetary policy is non-accommodative, within limits debt management policy can take its place in augmenting the potency of stimulative fiscal policy, or in improving the otherwise fixed trade-off between short-run stimulation and investment for long-run growth.

A final section summarizes the implications of these findings for fiscal, monetary and debt management policies.

TRANSACTIONS CROWDING OUT

The "transactions crowding out" associated with a government deficit financed by issuing non-money claims has been a standard part of the Keynesian fiscal policy analysis at least since Hicks' formalization of it in the IS-LM model. By increasing the level of economic activity, the spending increase (or tax cut) that gives rise to the deficit also increases the demand for money for transactions purposes. If the supply of money remains fixed, and if the money market is to clear, then some other factor must generate a precisely offsetting decrease in money demand. If the public's demand for money balances is interest sensitive, either because of portfolio considerations or simply because of the inventory-theoretic considerations applied to transactions balances by Baumol and Tobin,[8] the factor that accounts for the required offset for money demand is an increase in "the interest rate" earned by non-money claims. Since at least part of private spending depends (presumably negatively) on the interest rate, however, the interest rate increase that is necessary to clear the money market also erodes some of the income-expansionary effect of the initial fiscal policy action.

The IS-LM Model Without Wealth Effects.

Although the mechanism of transactions crowding out is sufficiently familiar to require no formal exposition, briefly retracing it in terms of the standard Hicksian IS-LM model will be useful not only to facilitate a discussion of empirical magnitudes but also to motivate the subsequent analysis of portfolio crowding out.

In linear form, the static equilibrium version of the underlying model includes a goods market consisting of a consumption function, an investment function (without accelerator effects) and a spending-income identity,[9]

(1) $$C = c_0 + c_1 (Y - T), \qquad 0 < c_1 < 1$$

(2) $$I = i_0 + i_1 r, \qquad i_1 < 0$$

(3) $$Y = C + I + G$$

and a money market consisting of a money demand function and a market-clearing equilibrium condition,

(4) $$M^D = m_0 + m_1 Y + m_2 r, \qquad m_1 > 0 > m_2$$

(5) $$M^D = M$$

where

C = private consumption spending
G = government purchases of goods and services
I = private investment spending
M^D= demand for money
M = supply of money
r = "the interest rate" on non-money claims
T = taxes
Y = income (total spending).

Since there are assumed to be unemployed resources, there is no representation of supply in the goods market, and goods prices are held constant and (for simplicity) normalized to unity.

With G, T and M treated as exogenous, (1)-(5) suffice to determine C, I, M^D, r and Y. The more compact IS-LM form of the model follows from solving (1)-(3) into a goods-market equilibrium or IS curve relating Y and r,

(6) $$Y = \frac{c_0 + i_0 - c_1 T + G}{1 - c_1} + \frac{i_1}{1 - c_1} r$$

and likewise solving (4) and (5) into a money-market equilibrium or LM curve,

(7) $$Y = \frac{M - m_0}{m_1} - \frac{m_2}{m_1} r.$$

Since the IS curve relates Y negatively to r while the LM curve relates Y positively to r, except for pathological values the model yields general equilibrium in (r, Y) space as shown in Figure 1 by the intersection of curves IS_0 and LM_0 conditional on values G_0, T_0 and M_0.

In the absence of any crowding out, the effect on Y of an increase in G would be, from (6), simply the partial derivative

(8) $$\frac{\partial Y}{\partial G} = \frac{1}{1 - c_1}$$

that is, the familiar "consumption multiplier." Figure 1 indicates this goods-market-only dependence of Y on G by the rightward shift from curve IS_0 conditional on G_0 to curve IS_1 conditional on G_1. Instead of the old equilibrium value Y_0, the partial equilibrium, conditional on holding the interest rate constant at r_0, is $Y' > Y_0$. But the pair (Y', r_0) cannot satisfy the money-market equilibrium condition, since by assumption the pair (Y_0, r_0) did so and $Y' \neq Y_0$. Hence the point (Y', r_0), which lies to the right of the LM curve in Figure 1, is not a point of general equilibrium.

To find the general equilibrium it is necessary to solve the IS-LM model of (6) and (7) for its reduced-form equation for Y,

(9) $$Y = \frac{(m_2c_0 + m_2i_0 - i_1m_0) - m_2c_1T + i_1M + m_2G}{m_2(1 - c_1) + i_1m_1}$$

so that the relevant total derivative expresses the effect of G on Y as

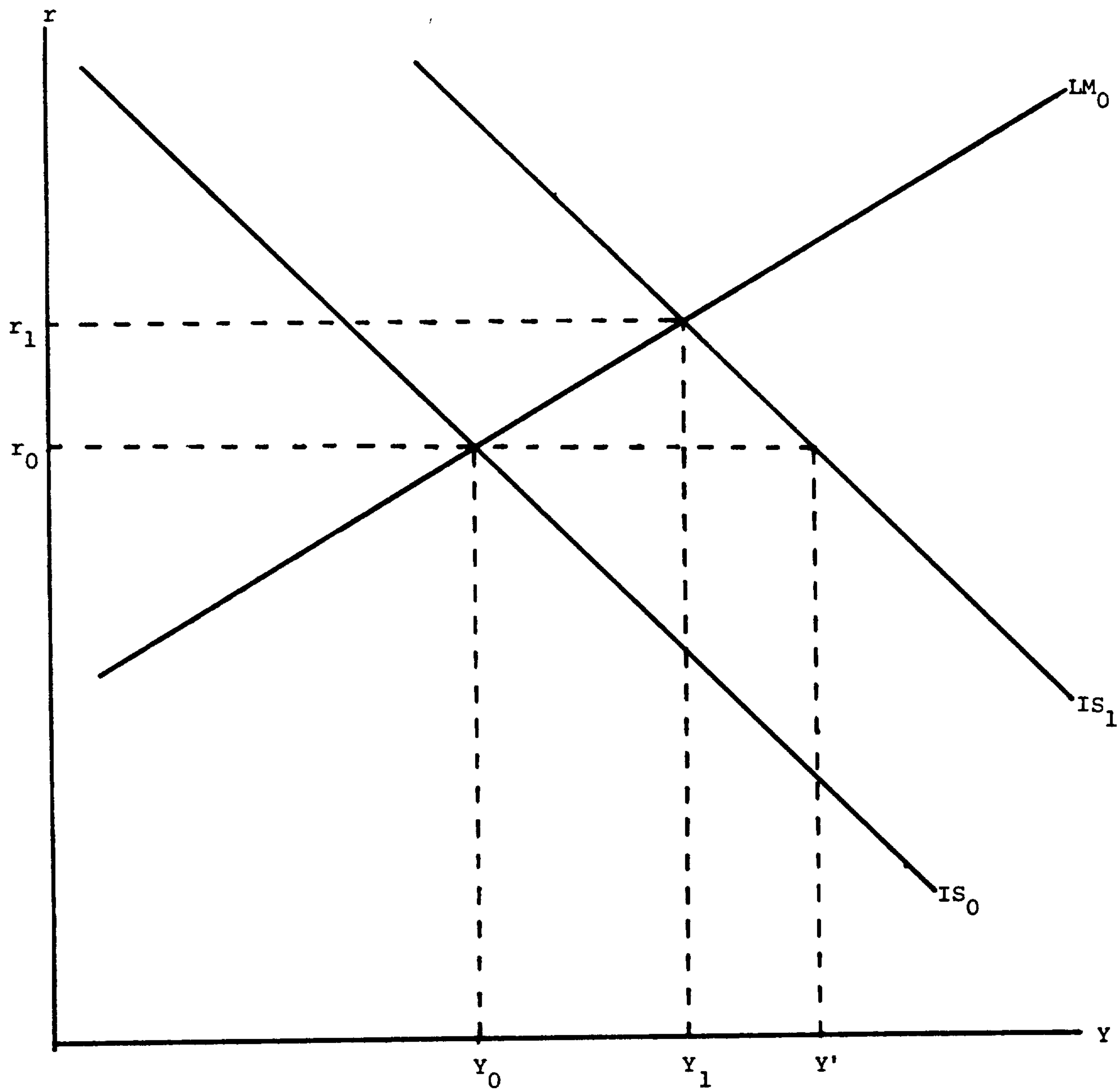

FIGURE 1

TRANSACTIONS CROWDING OUT IN THE IS-LM MODEL WITHOUT WEALTH EFFECTS

$$(10) \qquad \frac{dY}{dG} = \frac{m_2}{m_2(1 - c_1) + i_1 m_1} .$$

Since the denominator of (10) is unambiguously negative, while the interest elasticity m_2 is nonpositive, the effect is positive as expected. Moreover, (10) clearly indicates two important aspects of transactions crowding out. First, if $m_2 = 0$ (that is, if money demand is interest inelastic), G has no effect whatever on Y. In graphical terms, (7) implies a vertical LM curve at $Y = \frac{M - m_0}{m_1}$ if $m_2 = 0$, so that the only consequence of shifting IS_0 to IS_1 is a higher interest rate. Second, given $m_2 \neq 0$ (and given the other coefficient signs noted above), the total derivative in (10) is strictly less than the partial derivative in (8) as long as $i_1 \neq 0$ (that is, investment is interest sensitive) and $m_1 \neq 0$ (that is, money demand does depend on income, so that the constant interest rate leading to Y' in Figure 1 does not obtain). In graphical terms, the general equilibrium value Y_1 associated with the intersection of LM_0 and IS_1 must be strictly greater than Y_0 but less than Y', as long as the IS curve is nonvertical and the LM curve is nonhorizontal. Solving the model for the corresponding reduced-form equation for r,

$$(11) \qquad r = \frac{-[m_0(1 - c_1) + m_1(c_o + i_0)] - m_1 c_1 T + (1 - c_1)M - m_1 G}{m_2(1 - c_1) + i_1 m_1}$$

and examining the total derivative

$$(12) \qquad \frac{dr}{dG} = \frac{-m_1}{m_2(1 - c_1) + i_1 m_1}$$

confirms that the reason for $Y_1 < Y'$ is a rise in the interest rate from r_0 to r_1.

Empirical Magnitudes and Some Multiple-Asset Implications

How important is transactions crowding out likely to be in practice? The most familiar answer, often said to be based on an accumulation of econometric evidence indicating a relatively steep LM curve — that is, indicating a relatively small interest sensitivity of money demand — is that transactions crowding out is likely to be large in comparison with the effect of the underlying fiscal action. On closer inspection, however, this answer turns out to depend in large part on a failure to distinguish among the yields on distinct kinds of non-money claims.

Table 2 summarizes some short- and long-run parameter estimates, drawn from several sources, that are relevant for calculating the implied magnitude of transactions crowding out.[10] In all cases the underlying equations are estimated (for quarterly data) in logarithmic form, so that the most immediate interpretation is in terms of percentage changes; conversion to dollar magnitudes in turn depends on the base chosen. The first line of the table indicates the interest elasticity of real spending, taken from the directly estimated IS curve in the Pirandello Model which I presented in an earlier paper.[11] The next three lines indicate the income elasticity of the demand for money, taken in turn from Goldfeld's M-1 equation, the Pirandello Model's M-2 equation, and Hamburger's M-1 equation.[12] The final three lines indicate the interest elasticity of the demand for money taken from the same three equations.

Table 3 presents a set of calculations, based on the parameter estimates in Table 2, of the effectiveness of fiscal policy after allowing for transactions crowding out. The summary statistic shown is the ratio of the total derivative in (10) to the partial derivative in (8) — that is, the ratio of the general equilibrium effect of debt-financed government spending

TABLE 2

ELASTICITY ESTIMATES FOR THE IS-LM MODEL

Model	Short-Run Value	Long-Run Value
Interest Elasticity of Real Spending		
B. Friedman	-0.0948	-0.173
Income Elasticity of Money Demand		
S. Goldfeld (M-1)	0.193	0.682
B. Friedman (M-2)	0.362	1.18
M. Hamburger (M-1)	0.110	1.00
Interest Elasticity of Money Demand		
S. Goldfeld (M-1)	-0.064	-0.226
B. Friedman (M-2)	-0.0512	-0.166
M. Hamburger (M-1)	-0.074	-0.673

TABLE 3

ESTIMATES OF THE EFFECTIVENESS OF FISCAL POLICY AFTER ALLOWANCE FOR TRANSACTIONS CROWDING OUT

Money Demand Function	Short-Run Value	Long-Run Value
S. Goldfeld (M-1)	0.930	0.657
B. Friedman (M-2)	0.849	0.448
M. Hamburger (M-1)	0.876	0.796

on income, including the allowance for transactions crowding out, to the corresponding partial-equilibrium goods-market-only effect excluding any transactions crowding out. In all three sets of calculations the interest elasticity of spending is taken from the Pirandello Model.

For purposes of estimating the magnitude of transactions crowding out it is essential to coordinate the interest rate used to measure the interest elasticity of money demand with that used to measure the interest elasticity of spending. Otherwise the implied IS and LM curves exist on graphs with different vertical axes,[13] and their relative slopes are not comparable. Although the simplified IS-LM model usually refers to "the interest rate" on non-money claims, in fact the yields earned on different claims behave differently. Moreover, it is well known that the interest elasticity estimate found for the money demand function typically depends in a regular way on which interest rate(s) the equation includes. Specifically, money demand nearly always shows a small elasticity with respect to short-term interest rates — for example, the yields on time deposits and commercial paper as in the Goldfeld equation, or the yield on Treasury bills as in the Pirandello Model. Conversely, money demand usually shows a large elasticity with respect to long-term interest rates — for example, the yields on long-term government bonds and equities, as in the Hamburger equation.

In comparing one long-run equilibrium with another, it is plausible to assume that alternative non-money claims will exhibit identical movements in yields — apart from the important portfolio effects emphasized in the next section — so that this coordination problem does not arise in calculating the magnitude of long-run transactions crowding out. In the short run, however, the typical experience is that interest rates on long-term non-money claims are less volatile than those on short-term non-money claims. Figure 2

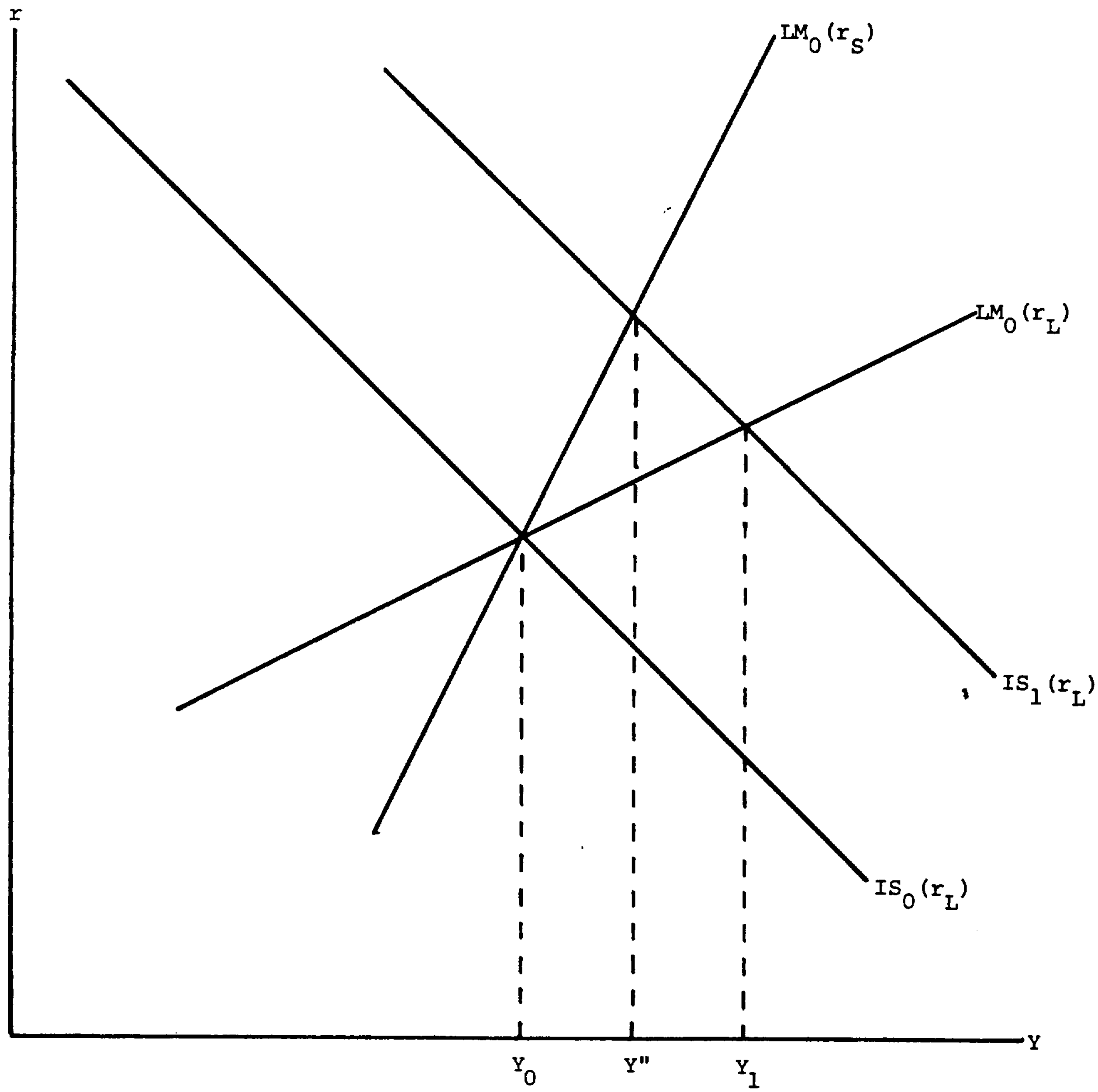

FIGURE 2

TRANSACTIONS CROWDING OUT: THE TERM STRUCTURE DISTINCTION illustrates the implication of this distinction for the calculation of the magnitude of short-run transactions crowding out by plotting two LM curves, $LM_0(r_L)$ and $LM_0(r_S)$, relating money demand to long-term and short-term interest rates, respectively. Figure 2 also makes explicit that IS curves IS_0 and IS_1 as in Figure 1 both relate spending to long-term interest rates, since the interest rate used to estimate the interest elasticity of spending shown in Table 2 and used in all of the calculations presented in Table 3 is the yield on long-term corporate bonds.[14] The correct short-run effect of the fiscal policy that shifts IS_0 to IS_1 is to raise income from Y_0 to Y_1, the intersection of the mutually consistent $IS_1(r_L)$ and $LM_0(r_L)$. Since $LM_0(r_S)$ is steeper than $LM_0(r_L)$, the point Y" at which $IS_1(r_L)$ and $LM_0(r_S)$ intersect underestimates the effectiveness of fiscal policy in the presence of transactions crowding out.

Since both the Goldfeld and the Pirandello Model equations relate money demand to short-term interest rates, they are analogous to curve $LM(r_S)$. Hence some correction for the greater volatility of short-term interest rates is necessary to render the calculation of the magnitude of short-run transactions crowding out comparable to point Y_1, rather than Y", in Figure 2. The calculations reported in Table 3 use the Pirandello Model's term structure equation for this purpose.[15] By contrast, Hamburger's equation relates money demand to long-term interest rates, so that it is already analogous to curve $LM_0(r_L)$. Hence calculating the short-run transactions crowding out effect directly from it and the $IS(r_L)$ slope is correct.

The first pair of calculations shown in Table 3 is based on Goldfeld's M-1 demand equation. In the short run the term-structure-adjusted LM curve is sufficiently flat to offset less than one-tenth of the effect on income (spending) associated with the rightward shift of the IS curve. In the long run the interest elasticity of money demand increases more than does the income elasticity, and the interest elasticity of spending also becomes greater. Because of the steeper LM and flatter IS curves, in the long run transactions crowding out offsets about one-third of the IS curve's rightward shift. The second pair of calculations, based on the Pirandello Model's M-2 equation, is roughly similar, although it indicates a somewhat greater crowding-out effect because of the larger estimated income elasticity of M-2 demand. Fixing M-1 and fixing M-2 are not the same policy when their respective income elasticities differ — as most empirical estimates indicate. Finally, the pair of calculations based on Hamburger's M-1 demand function indicates about the same amount of crowding out in the short run but noticeably less in the long run, primarily because of the large estimated long-run interest elasticity.

Especially in the short run, all three calculations reported in Table 3 indicate that transactions crowding out offsets only a small part of the expansionary effect of government spending. A key reason for the contrast between this result and familiar presumptions based on notions of the steepness of the LM curve probably stems from a failure to consider the implications of the different measured elasticities of money demand with respect to short- versus long-term interest rates.[16] In the long run, transactions crowding out is somewhat more powerful, but even then half or more of the expansionary effect remains.

Summary

Several useful conclusions emerge from a review of the theory and evidence pertaining to transactions crowding out.

First, there is no disagreement that, with nonaccommodative monetary policy, transactions crowding out offsets some part of the effect of fiscal policy on income. Only with a vertical IS curve will it offset none of the effect, and only with a vertical LM curve will it offset all of it.

Second, in the short run the amount of the offset is probably small — say, of the order of one-tenth.

Third, in the long run the amount of the offset is almost certainly greater — say, of the order of one-third or more.

Fourth, because of the different income elasticities of the public's demands for time and demand deposits, the offset is greater if monetary policy fixes M-2 than if it fixes M-1.

PORTFOLIO CROWDING OUT/IN[17]

If transactions crowding out does not vitiate the intended effect of a fiscal policy action accompanied by unaccommodative monetary policy, the question of the potency of fiscal policy with a fixed money stock hinges (from a financial perspective) on "portfolio crowding out." Here the explicit portfolio effects associated with financing the deficit (or disposing of a surplus) by issuing (or retiring) interest-bearing government debt assume primary importance.[18] The underlying mechanisms are both more complicated and less familiar than those that give rise to transactions crowding out. Introducing wealth into the model is an essential first step. Beyond wealth effects per se, however, it is necessary to introduce a more complete representation of the public's asset-holding preferences.

It is an anomaly that the economic consequences of the resulting portfolio effects have come to be conventionally known as "crowding out." In fact, the net result may be either "crowding out" or "crowding in." In other words, bond financing of government deficits may either increase or decrease private investment spending. The incorrect but nonetheless currently standard view that a decrease in investment is the only possible result turns out to be due to the failure to consider adequately the public's portfolio behavior. Clearing up this misunderstanding is an important precursor to sensible analysis of fiscal policy.

Crowding Out or Crowding In

Wealth effects exert important and long recognized influences on economic behavior in both the goods market and the asset markets. First, in the goods market the idea of positive wealth effects on consumption dates at least to Pigou, and Keynes argued for an analogous effect on investment.[19] More recently Modigliani and others have formalized this relationship in the "life cycle" model, and both he and Tobin and Dolde have elaborated the associated linkages and explored the empirical evidence.[20] For purposes of the current discussion it is sufficient simply to use a solved-out IS curve analogous to (6) but incorporating the wealth effects operating within the goods market,

$$(13) \qquad Y = y_0 + y_1 G + (1 - y_1)T + y_2 r + y_3 W, \qquad y_3 > 0 > y_2, \; y_1 > 1$$

where W is total real wealth held by the private sector.[21]

A minimal model for the analysis of portfolio crowding out includes three distinct components of private wealth,

$$(14) \qquad W = M + B + K$$

where M is again the money stock, B and K are respectively the outstanding stocks of interest-bearing (that is, non-money) government debt and real capital, and the continued assumption of constant goods prices normalized to unity avoids the need to distinguish between real and nominal magnitudes.[22] The key source of variation of wealth for purposes of the current discussion is the government budget constraint emphasized by Christ and Silber,[23]

$$(15) \qquad G - T = dM + dB.$$

A useful simplifying assumption underlying the (implicitly one-period) static equilibrium analysis, comparable to that of the paper's first section, is that the initial equilibrium corresponding to IS_0 and LM_0 in Figure 1 is characterized by a balanced budget, G = T, and that taxes remain unchanged.[24] Hence any government spending increase (or decrease) dG precisely equals the combination dM + dB that finances it. A further simplifying assumption, again in the one-period static equilibrium context, is that K is fixed, so that dW also equals dM + dB. In other words, the investment component of income does not increase the capital stock within the period under analysis.[25]

Behavior in the asset markets, which remains to be represented, is the heart of the matter. Since in general the public holds all three assets (M, B, K) in its portfolio, in principle it is necessary to specify three distinct asset demands. Because of the balance sheet constraint emphasized by Brainard and Tobin,[26] however — that is, as a consequence of (14) — any one such asset demand is a linear combination of the other two and (predetermined) wealth. Hence there are only two independent asset demands, and which two are specified is irrelevant. Even so, the need to specify explicitly the portfolio behavior describing the demands for two assets serves as a useful reminder of the multiplicity of asset markets and the important interrelations among them. By contrast, the standard Keynesian model has only two kinds of assets (money and the collectivity of non-money claims, usually called "capital"), so that, after applying the balance sheet constraint, it is necessary to specify only one asset demand — usually the demand for money. While the resulting model is therefore equivalent to one specifying instead the demand for non-money claims, the convention of specifying only the demand for money has often spawned confusion.[27]

A large literature has investigated the properties of asset demand systems derived from various sets of assumptions about portfolio investors' objectives and their assessments of the risks and rewards attendent upon holding each specific asset. The common presumption underlying nearly all of these treatments is that investors are risk averse, and that at most one asset bears a certain return. For purposes of the analysis here, it is useful to think of the return to holding money as fixed (for convenience, at zero) and the respective returns to holding both bonds and capital as uncertain. Especially in the monetary economics literature, it is customary to express asset demands as both linear in expected returns and first-degree homogeneous in wealth, so that the proportional allocation of the portfolio is invariant to wealth.[28] For purposes of the analysis here, however, it is more straightforward to preserve the linearity of the model, including the (presumed nonnegative) dependence of each asset demand on total wealth.

A fully specified system of linear asset demands for the money-bonds-capital model is

$$(16)\qquad \begin{bmatrix} M^D \\ B^D \\ K^D \end{bmatrix} = \begin{bmatrix} m_0 \\ b_0 \\ k_0 \end{bmatrix} + \begin{bmatrix} m_1 & m_2 & m_3 \\ b_1 & b_2 & b_3 \\ k_1 & k_2 & k_3 \end{bmatrix} \begin{bmatrix} r_M \\ r_B \\ r_K \end{bmatrix} + \begin{bmatrix} m_4 \\ b_4 \\ k_4 \end{bmatrix} Y + \begin{bmatrix} m_5 \\ b_5 \\ k_5 \end{bmatrix} W$$

where r_M is the known yield on money, r_B and r_K are the respective expected yields on bonds and capital, (M^D, B^D, K^D) indicate the amount of each asset demanded, and the m_i, b_i and k_i are fixed coefficients.[29] From the implications of the balance sheet constraint,

$$(17)\qquad \begin{aligned} & m_i + b_i + k_i = 0, && i = 0,\dots,4 \\ & m_5 + b_5 + k_5 = 1, && \end{aligned}$$

it is possible to specify the entire asset demand system in terms of only two fixed coefficients in each column vector. Moreover, if the Jacobian matrix indicating the relative asset substitutabilities is symmetric, the further constraints

(18) $b_1 = m_2, \qquad k_1 = m_3, \qquad k_2 = b_3$

also apply.[30] From (17) and (18), it is then possible to specify the Jacobian completely by specifiying only three coefficients.

Applying the balance sheet and symmetry constraints in the way which will prove most convenient (since it is analytically irrelevant which coefficients they eliminate) renders the asset demand system (16) as

$$\begin{bmatrix} M^D \\ B^D \\ K^D \end{bmatrix} = \begin{bmatrix} m_0 \\ b_0 \\ -m_0-b_0 \end{bmatrix} + \begin{bmatrix} -m_2-m_3 & m_2 & m_3 \\ m_2 & -m_2-b_3 & b_3 \\ m_3 & b_3 & -m_3-b_3 \end{bmatrix} \begin{bmatrix} r_M \\ r_B \\ r_K \end{bmatrix} + \begin{bmatrix} m_4 \\ b_4 \\ -m_4-b_4 \end{bmatrix} Y + \begin{bmatrix} m_5 \\ b_5 \\ 1-m_5-b_5 \end{bmatrix} W. \tag{19}$$

Within the Jacobian, the purpose underlying the arbitrary selection is to retain explicitly the three off-diagonal coefficients indicating the relative asset substitutabilities. On the common assumption that the three assets are gross substitutes,[31] these three coefficients are each negative, and from (17) the on-diagonal own-yield coefficients are then positive as expected. To complete the specification of behavior in the asset markets, it is necessary only to add the market-clearing equilibrium condition extending (5),

$$\begin{bmatrix} M^D \\ B^D \\ K^D \end{bmatrix} = \begin{bmatrix} M \\ B \\ K \end{bmatrix}. \tag{20}$$

With G, T, M, K, r_M and the initial stock of bonds B_0 treated as exogenous, the eight-equation model consisting of (13) — in which "the interest rate" is now clearly r_K — (14), (15), any two components of (19), and all three components of (20) suffices to determine Y, W, B, r_B, r_K, M^D, B^D and K^D.[32] It is more useful, however, to solve the model into a three-equation form determining Y, r_B and r_K, analogous to the two-equation IS-LM model. With r_M fixed at zero for convenience, the model is

$$(21)\qquad Y = y_0 + y_1G + (1 - y_1)T + y_2r_K + y_3(M + K + B)$$

$$(22)\qquad M = m_0 + m_2r_B + m_3r_K + m_4Y + m_5\ (M + K + B)$$

$$(23)\qquad B = b_0 - (m_2 + b_3)r_B + b_3r_K + b_4Y + b_5\ (M + K + B).$$

Figure 3 plots (21) and (22) in (r_K, Y) space as conditional "IS" and "LM" curves, making explicit that the IS curve as drawn is conditional on the values of G, M, K, B and T, while the LM curve as drawn is conditional on the values of M, K, B and r_B.[33] The dependence of both curves' positions on the three asset quantities, which are given in a balanced budget situation, is straightforward, but the LM curve's dependence on r_B is more interesting. If the model is normalized to solve (21) and (22) for Y and r_K, as implied in Figure 3, then (23) determines r_B — which in turn affects the positions, and hence the intersection, of (21) and (22) in (Y, r_K) space. But both Y and r_K are also arguments of (23). Hence Y, r_K and r_B are jointly determined in a fully simultaneous way, and any representation in only two dimensions is misleading without explicit attention to the omitted codetermined variable.

It is now possible to re-examine the consequences of fiscal policy, using the condensed model of (21)-(23) together with a statement of how

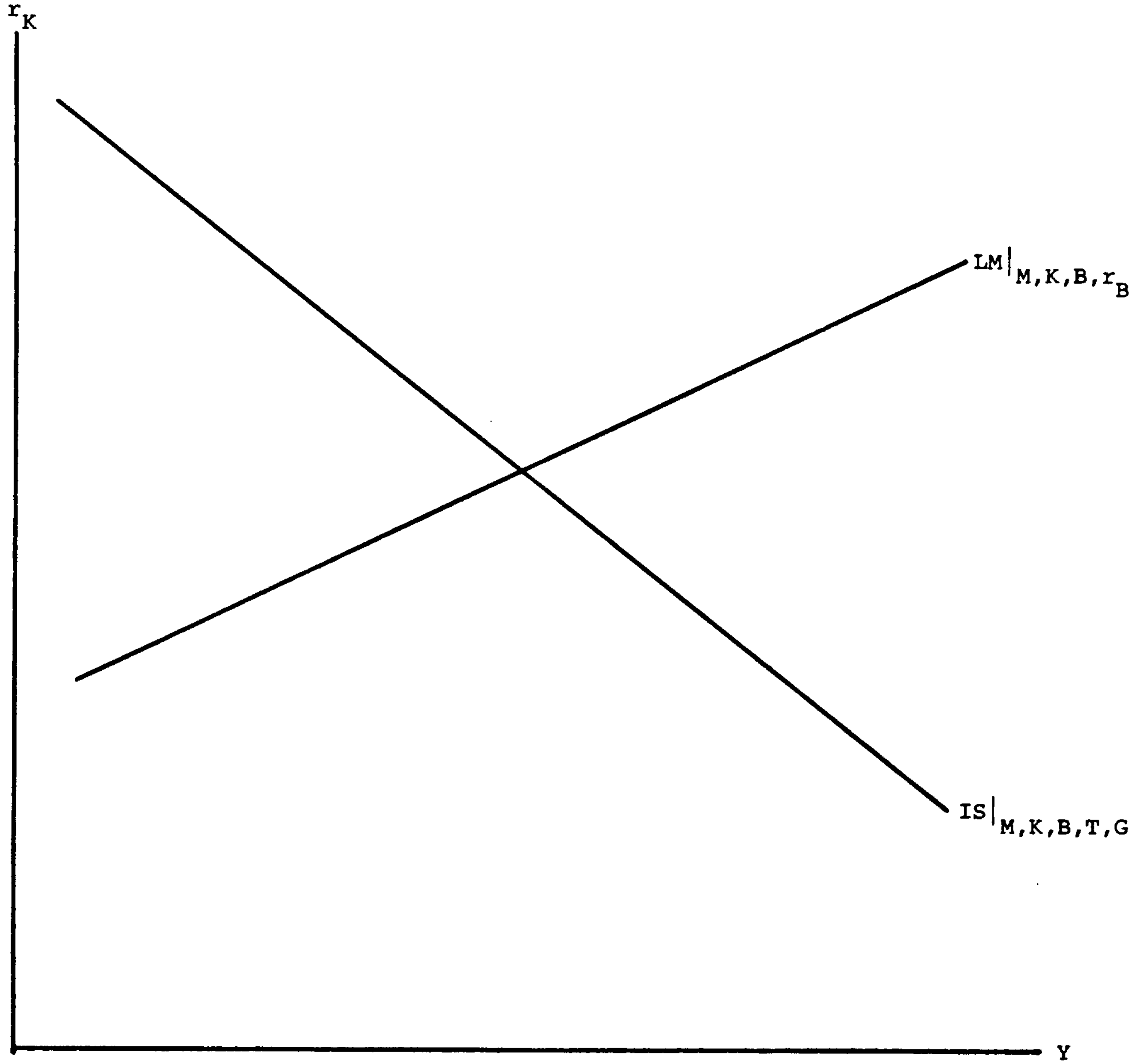

FIGURE 3

CONDITIONAL "IS" AND "LM" CURVES IN THE THREE-ASSET MODEL any associated deficit is financed. The partial equilibrium goods-market-only story differs only slightly from that in the model without wealth effects reviewed in the previous section. From (21) and the government financing constraint $dG = dB + dM$, the effect of raising government spending above the balanced budget level is simply

$$\frac{\partial Y}{\partial G} = y_1 + y_3. \tag{24}$$

Since y_1 here is identical to $\frac{1}{1 - c_1}$ in (8), the goods-market wealth effect of financing the deficit reinforces the usual multiplier effect of fiscal policy. (Hence the rightward shift from IS_0 conditional on G_0 to IS_1 conditional on $G_1 > G_0$, as shown in Figure 4 below, exceeds the analogous rightward IS shift in Figure 1.)

The asset market equations (22) and (23) reflect two effects of deficit spending. "Transactions crowding out" is familiar from the previous section and should require little further discussion. Given $m_4 > 0$, the additional income from the goods-market effect increases the transactions demand for money. If M remains unchanged, either or both of r_B and r_K must rise (recall that m_2, $m_3 < 0$) in order to clear the money market. If both M and B were to remain fixed, in violation of the government financing constraint, solving the model shows that r_B and r_K would both rise. Given $y_2 < 0$, the increase in r_K would in turn offset some part of the goods-market-only income effect. As long as the assets are all gross substitutes, the multi-asset model leaves unchanged the conclusion that transactions crowding out is unambiguously in the "out" direction.

What about "portfolio crowding out"? Under bond financing of the deficit, M again remains unchanged but total wealth M + B + K increases. Given $m_5 > 0$ — an assumption examined empirically below — in the money market the wealth effect reinforces the transactions effect, making the net excess demand for money even greater. Hence an even greater rise in either or both of r_B and r_K is necessary to clear the money market.

In the presence of wealth effects, however, it is not so simple as it was above to determine whether what clears the money market is a rise in both r_B and r_K or in only one. The entire increase in wealth resulting from financing the deficit consists of an increase in the outstanding stock of bonds. Given $0 < b_5 < 1$, however — that is, assuming that people do not want to hold all of their increased wealth in the form of increased bonds, in the absence of yield changes there is a net excess supply of bonds. Moreover, just as the balance sheet constraint implies $b_5 < 1$ if $m_5 > 0$, it is plausible to assume that the counterpart to $m_4 > 0$ is $b_4 < 0$, so that the transactions effect makes this net excess supply of bonds even greater. Since the demand for bonds depends positively on r_B and negatively on r_K, the yield movements that eliminate this net excess supply must be either an increase in r_B (which also helps eliminate the net excess demand for money), or a decrease in r_K (which compounds the net excess demand for money), or both.

Although the linear dependence of the three asset demand equations means that examining the capital market per se can provide no further information, doing so anyway serves as a useful aid to intuition in the multi-equation model. Given $k_5 = 1 - m_5 - b_5 > 0$, the increase in total wealth raises the demand for capital, but in the short run K remains unchanged. On the assumption that $k_4 < 0$, however, the transactions effect reduces the demand for capital. If the portfolio effect outweighs the transactions effect,[34] the yield movements necessary to eliminate the net excess demand for capital must again be either an increase in r_B, or a decrease in r_K, or both.

Because an increase in r_B not only helps eliminate net excess demand in the money market (and the capital market) but also helps eliminate net excess supply in the bond market, r_B unambiguously rises as the result of bond-financed government deficit spending. By contrast, while an increase in r_K helps clear the money market, a decrease in r_K helps clear the bond market (and the capital market). Hence it is impossible to tell a priori whether r_K rises or falls. Since the interest rate effect in the goods market depends on r_K, it is therefore impossible to tell a priori whether the portfolio effect (or the sum of the portfolio effect plus the transactions effect) is to offset or reinforce the income effect of fiscal policy.

Solving (22) and (23) for the partial equilibrium asset-markets-only effect of dB = dG, with Y fixed, shows whether the portfolio effect per se is one of crowding out or crowding in. The relevant partial derivatives — solved out from (22) and (23), and hence partial only in not allowing for (21) — are

$$(25) \qquad \frac{\partial r_B}{\partial G} = -\frac{b_3 m_5 + m_3(1 - b_5)}{\Delta}$$

$$(26) \qquad \frac{\partial r_K}{\partial G} = \frac{m_2(1 - b_5) - m_2 m_5 - b_3 m_5}{\Delta}$$

where determinant Δ is the sum of cross-products of the three key substitution coefficients,

(27) $$\Delta = m_2m_3 + m_2b_3 + m_3b_3.$$

If all three assets are substitutes (m_2, m_3, $b_3 < 0$), Δ is strictly positive. Consequently, as long as people do not want to hold all of the new wealth in bonds ($b_5 < 1$), (25) confirms that r_B unambiguously rises with a bond-financed increase in G. By contrast, as long as people also want to hold at least some of the new wealth in money ($m_5 > 0$), the numerator of (26) consists of one negative term minus two other negative terms, so that whether r_K rises or falls with a bond-financed increase in G — that is, whether the portfolio effect constitutes crowding out or crowding in — depends on the magnitudes of the two key substitution coefficients m_2 and b_3.

Hence the question of whether the portfolio effect of bond-financed deficit spending crowds out or crowds in private investment reduces to the long debated issue of whether bonds are closer portfolio substitutes for money or for capital.[35] Given the symmetry assumption (18), it is convenient to summarize the relevant asset substitutability properties in terms of a "relative substitutability index" defined as

(28) $$\sigma \equiv \frac{m_2}{b_3} \qquad \left(= \frac{b_1}{k_2} \right)$$

—in words, the ratio of the substitutability of bonds for money (and vice versa) to the substitutability of bonds for capital (and vice versa). Given m_2, $b_3 < 0$, σ is strictly positive. If bonds are close substitutes for money but not for capital, m_2 is large and b_3 small, so that σ is large. If bonds are close substitutes for capital but not for money, m_2 is small and b_3 large, so that σ is small. In principle the index σ can describe any position on the relative substitutability scale, ranging from $\sigma = 0$ (bonds and capital are perfect substitutes) to $\sigma = \infty$ (bonds and money are perfect substitutes).

From (26), then, the sign of the portfolio effect of bond-financed deficit spending hinges on the relative substitutability condition

(29) $$\frac{\partial r_K}{\partial G} \gtrless 0 \quad \text{as} \quad \sigma \lessgtr \sigma^*$$

where the critical value σ^* is simply[36]

(30) $$\sigma^* = \frac{m_5}{1 - b_5 - m_5} \qquad \left(= \frac{m_5}{k_5} \right).$$

Hence there is portfolio crowding out when the value of the relative substitutability index (that is, the interest rate coefficient ratio) is smaller than the corresponding wealth coefficient ratio, but portfolio crowding in when the index is greater than the wealth coefficient ratio.

Figure 4 summarizes this analysis graphically by plotting in (r_K, Y) space four conditional "LM" curves representing the money market equilibrium (22). First, $LM_0 \mid_{M_0, K_0, B_0, r_{B0}}$ indicates the locus of (r_K, Y) pairs that will clear the money market given the values of the initial balanced budget equilibrium. Because the bond financing of deficit spending will change B according to $dB = dG$, as well as r_B according to (22), $LM_1 \mid_{B_1, r_{K1}}$ will in general shift as a consequence of the fiscal policy action. The increase in B tends to shift LM_1 leftward (that is, to

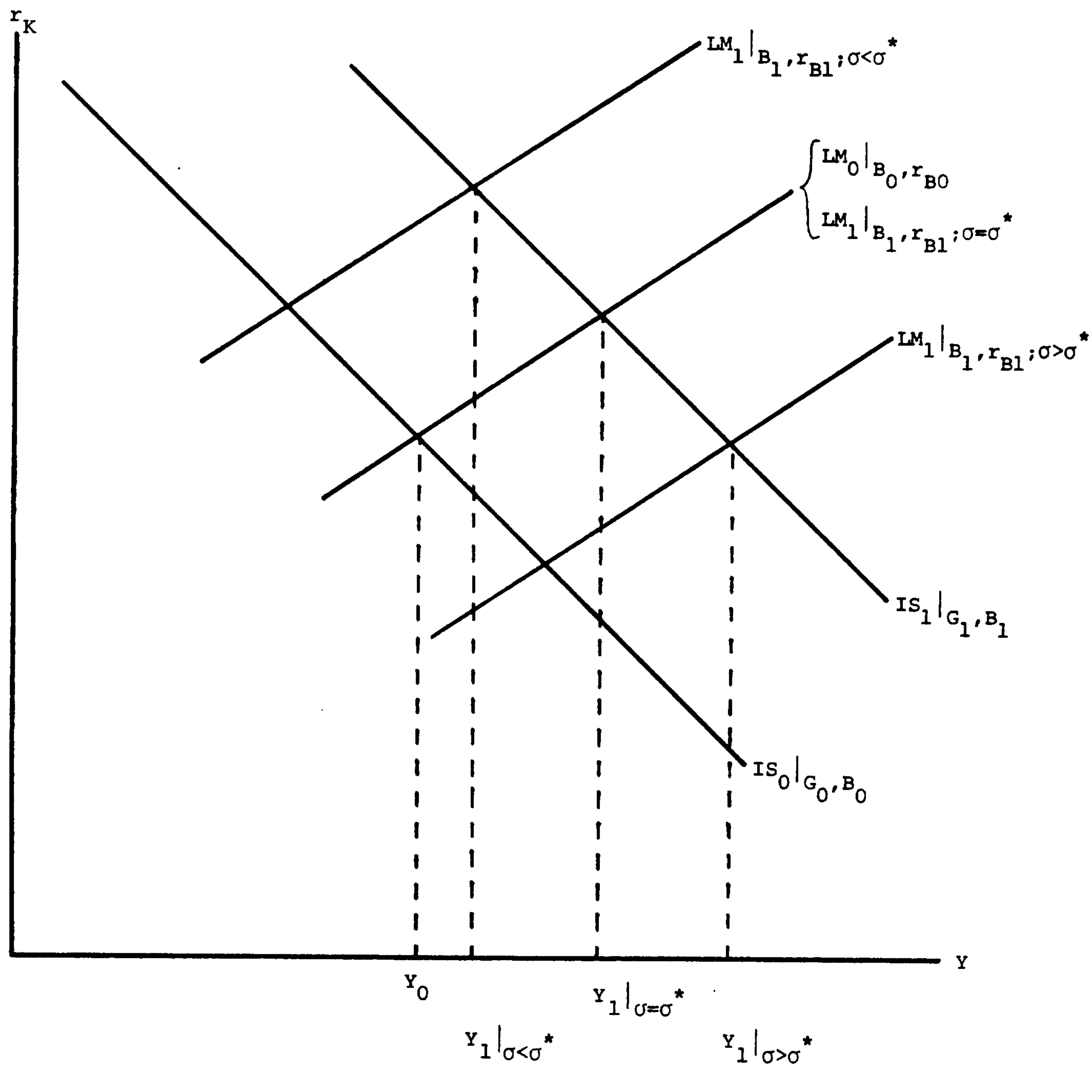

FIGURE 4

TRANSACTIONS CROWDING OUT AND PORTFOLIO CROWDING OUT/IN raise the market-clearing value of r_K for given Y), while the rise in r_B tends to shift LM_1 rightward. Which effect predominates depends on the relative substitutability condition (29).

If $\sigma = \sigma^*$, the two components of the portfolio effect exactly offset one another, so that the conditional LM curve shifts neither rightward nor leftward, and the rightward shift of the conditional IS curve, together with the traditional Hicksian transactions crowding out, is the entire story of bond-financed deficit spending.

If $\sigma < \sigma^*$ — that is, if bonds are more substitutable for capital and less substitutable for money than σ^* — the conditional LM curve shifts leftward, and portfolio crowding out joins transactions crowding out. In contrast to transactions crowding out, however, which can offset only a part of the income effect of fiscal policy, portfolio crowding out can result in $Y_1 < Y_0$ if the conditional LM curve shifts leftward far enough. (Figure 4 shows the Y_1 value conditional on $\sigma < \sigma^*$ as greater than Y_0, but the opposite could just as well be true a priori.)

Finally, if $\sigma > \sigma^*$ — that is, if bonds are more substitutable for money and less substitutable for capital than σ^* — the conditional LM curve shifts rightward, and portfolio crowding in reinforces the income effect of fiscal policy. In this case the resulting Y_1 is not merely greater than Y_0 but greater than the $Y_1 \mid_{\sigma = \sigma^*}$ value corresponding to the traditional IS-LM analysis with transactions crowding out only.

To derive analytically the final outcome for the income effect of bond-financed deficit spending, after allowance for both transactions crowding out and portfolio crowding out/in, it is necessary to solve (21)-(23) for the general equilibrium interaction of the goods market and the asset markets. The total derivatives found by solving the system

$$(31) \qquad \frac{1}{dG}\begin{bmatrix} dY \\ dr_B \\ dr_K \end{bmatrix} = \begin{bmatrix} 1 & 0 & y_2 \\ -m_4 & -m_2 & -m_3 \\ -b_4 & (m_2+m_3) & -b_3 \end{bmatrix}^{-1} \begin{bmatrix} (y_1+y_3) \\ m_5 \\ -(1-b_5) \end{bmatrix}$$

do not readily simplify, however, and they provide no further insights beyond those summarized in the discussion of Figure 4.[37]

Some Special Cases.

Since the previous literature of portfolio crowding out has typically derived rather different results from those presented above, and has done so by using less general models, it is important to show how alternative results emerge as special cases within the model developed above. The two principal issues involved here pertain to the wealth coefficients and the interest rate coefficients of the asset demand equations (16). In both cases the relative substitutability condition (29) serves as a useful tool of analysis.

First, many economists have argued that the only motive for holding money balances is to facilitate transactions, so that the store-of-value role of money attracts no money holding for portfolio purposes. Ando and Shell have formalized the argument for excluding wealth from the money demand function, and Goldfeld and others have provided empirical evidence on this question.[38] If money demand is independent of wealth, then portfolio crowding out cannot occur, and the only possibilities are portfolio crowding in or an unshifting conditional LM curve. If $m_5 = 0$ (and $0 < b_5, k_5 < 1$), then the critical value of the relative substitutability index is $\sigma^* = 0$ and $\sigma < \sigma^*$ is impossible. If bonds are even slightly substitutable for money ($m_2 \neq 0$), then $\sigma > \sigma^*$ and there is automatically portfolio crowding in.

Alternatively, if bonds and money are not substitutes ($m_2 = 0$), then $\sigma = 0$ also and the conditional LM curve does not shift.

Second, it is an unfortunate legacy of Keynes' General Theory that many economists continue to work with a two-asset model in which all non-money claims are by assumption perfect substitutes. If bonds and capital are perfect substitutes, then portfolio crowding in cannot occur, and the only possibilities are portfolio crowding out or an unshifting conditional LM curve. In the limit as b_3 becomes large (in absolute value), $\sigma = 0$ regardless of m_2 (unless m_2 is also infinite, indicating a one-asset model) and $\sigma < \sigma^*$ is impossible. If money demand depends on wealth ($m_5 \neq 0$), then $\sigma < \sigma^*$ and there is automatically portfolio crowding out. Alternatively, if $m_5 = 0$, then $\sigma^* = 0$ also and the conditional LM curve does not shift.

The well known analysis due to Blinder and Solow is an example of this second special case.[39] By assuming that bonds and capital are perfect substitutes ($\sigma = 0$), Blinder and Solow arbitrarily precluded portfolio crowding in (in the stable form of their model). Hence their analysis of "bond finance" — that is, of issuing government bonds that are perfect substitutes for capital — refers to one extreme case. One could just as easily describe "money finance," for which since Hicks there has been no argument that the LM curve shifts rightward, as the polar case of issuing government bonds that are perfect substitutes for money (that is, $\sigma = \infty$) — but there seems little point in doing so. Similarly, it is only misleading to think of the opposite polar case, which Blinder and Solow called "bond finance," as a general description of bond financing of government deficit spending.

Since the potential validity of these special assumptions about both the wealth responses and the interest rate responses of the portfolio demand system is essentially an empirical issue, it is appropriate to examine the available evidence. The remainder of this section introduces evidence on the wealth elasticity of the demand for money. Consideration of the asset substitutability question follows a further generalization of the model in the next section.

Money Demand and Wealth

Whether the demand for money depends on income or wealth, or both, is an old issue in monetary economics. Fisher's transactions version of the quantity equation emphasized the role of money as a means of payment, while the Cambridge cash balance version due to Lavington and Pigou relied on money as a store of value.[40] Keynes accepted both in distinguishing the "transactions" and "speculative" components of money demand.[41] Despite some allegiance to the Fisherian quantity theory, monetarists have typically followed Milton Friedman in accepting both rationales for holding money, although their empirical work has usually favored income over wealth.[42] Although the question of whether money demand depends on income or wealth is usually stated in terms of money as a means of payment versus money as a store of value, in fact the issue is not nearly so clear cut. For example, even in the context of a pure transactions model, money demand will still depend on wealth if wealth levels affect attitudes toward convenience, or if money is used in financial transactions.

In his review of the evidence on the demand for money five years ago, Goldfeld explicitly compared the results of using income and of using wealth (defined as total household net worth) in the money demand function. In brief, he found for 1952:2 - 1972:4 data that the wealth elasticity differed significantly from zero only when income was excluded from the equation, while the income elasticity differed significantly from zero regardless of whether wealth was included or excluded.[43] In his subsequent investigation into the "mystery of the missing money"[44] — that is, the consistent large overprediction of his (and, to that time, everyone else's) money demand equation after 1973 — he found for 1952:2 - 1973:4 data that, with both income and wealth included in the equation, the respective elasticities' t-statistics were 3.0 and 2.3. Extrapolation exercises, however, showed that including wealth did little to clear up the overprediction mystery. On the basis of this evidence, therefore, there seemed to be little basis for rejecting the Ando-Shell special case in which, because of a zero wealth elasticity of money demand, crowding out cannot occur.

Table 4 presents the results of estimating a money demand function comparable to Goldfeld's, including income and wealth alternately, and then including both, using first Goldfeld's original 1952:2-1972:4 sample and then the 1952:2-1977:4 sample.[45] The table reports results for equations based on a real-adjustment specification and then a nominal-adjustment specification, as in Goldfeld's earlier and later work, respectively.

The results shown in the first half of the table, for the 1952:2-1972:4 sample, essentially replicate Goldfeld's earlier findings. Under either the real or the nominal adjustment, the standard error is minimized in the equation including income but not wealth. Adding wealth neither raises nor lowers the standard error. The wealth elasticity differs significantly from zero only if income is excluded. In the equation with a real adjustment and including wealth but not income (II), the implied speed of adjustment is negative. In the equation with a real adjustment

TABLE 4

MONEY DEMAND EQUATIONS WITH AND WITHOUT WEALTH

Real adjustment: $\ln(M/P) = \beta_0 + \beta_1 \ln(Y/P) + \beta_2 \ln(W/P) + \beta_3 \ln r_{CP} + \beta_4 \ln r_{TD} + \beta_5 \ln(M/P)_{-1}$

Nominal adjustment: $\ln(M/P) = \beta_0 + \beta_1 \ln(Y/P) + \beta_2 \ln(W/P) + \beta_3 \ln r_{CP} + \beta_4 \ln r_{TD} + \beta_5 \ln(M_{-1}/P)$

Equation	Sample	Adjustment	β_0	β_1	β_2	β_3	β_4	β_5	$\bar{R}^2$	SE	ρ
I	52-72	Real	-0.962 (-6.1)	0.197 (5.9)	--	-0.018 (5.8)	-0.050 (-4.7)	0.688 (8.9)	0.98	.0041	0.435
II	52-72	Real	-0.303 (-3.1)	--	0.036 (2.8)	-0.014 (4.2)	-0.009 (1.2)	0.981 (30.5)	0.98	0.0047	0.397
III	52-72	Real	-0.981 (-6.1)	0.185 (5.0)	0.010 (0.8)	-0.017 (-5.6)	-0.052 (-4.8)	0.645 (8.9)	0.98	0.0041	0.442
IV	52-72	Nominal	-0.853 (6.2)	0.168 (5.8)	--	-0.016 (5.7)	-0.041 (4.4)	0.740 (11.3)	0.98	0.0035	0.531
V	52-72	Nominal	-0.348 (4.0)	—	0.037 (3.3)	-0.012 (-4.0)	-0.010 (-1.4)	1.032 (32.7)	0.98	0.0039	0.493
VI	52-72	Nominal	-0.875 (6.4)	0.151 (4.7)	0.014 (1.2)	-0.015 (-5.5)	-0.043 (-4.6)	0.752 (11.4)	0.98	0.0035	0.529
I'	52-77	Real	-0.669 (-3.3)	0.162 (4.7)	--	-0.010 (-2.5)	-0.052 (-3.4)	0.550 (6.9)	0.56	0.0051	0.945
II'	52-77	Real	-0.371 (-5.3)	--	0.045 (5.2)	-0.013 (-4.7)	-0.014 (-2.6)	0.961 (40.1)	0.98	0.0048	0.352
III'	52-77	Real	-0.537 (-5.1)	0.027 (2.1)	0.050 (5.4)	-0.012 (-4.0)	-0.027 (-3.4)	0.894 (23.5)	0.98	0.0047	0.417

Equation	Sample	Adjustment	β_0	β_1	β_2	β_3	β_4	β_5	$\bar{R}^2$	SE	ρ
IV'	52-77	Nominal	-0.191 (-3.7)	0.027 (2.6)	--	-0.011 (-4.5)	-0.000 (-0.1)	1.038 (35.5)	0.98	0.0041	0.414
V'	52-77	Nominal	-0.225 (-3.4)	--	0.021 (2.5)	-0.010 (-3.9)	-0.000 (-0.1)	1.058 (42.4)	0.98	0.0041	0.435
VI'	52-77	Nominal	-0.429 (-4.9)	0.035 (3.3)	0.026 (3.2)	-0.009 (-3.8)	-0.017 (-2.5)	0.979 (29.1)	0.98	0.0039	0.424

Note: Numbers in parentheses are t-statistics.

and including wealth but not income (II), the implied speed of adjustment is implausibly slow.

The results shown in the lower half of the table, for the 1952:2-1977:4 sample, differ sharply from the earlier ones in several respects. Under either the real or the nominal adjustment, the standard error is minimized in the equation including both income and wealth, and the elasticities with respect to both variables differ significantly from zero in these two equations. The equations with the nominal adjustment fit the data uniformly better, but always at the expense of negative or implausibly slow adjustment speeds. The rapid adjustment and large ρ value of (I'), the original Goldfeld equation, indicates some further severe problem.

The results for the 1952:2 - 1977:4 sample therefore call into question the notion that one can simply dismiss portfolio crowding out because of the absence of any dependence of money demand on wealth. Since the contrast between these results and those for the earlier sample suggests some change in the underlying behavior, however, it is interesting to test for the presence of a structural shift at the end of 1972. The F-statistics presented in Table 5, for Chow tests of the hypothesis of no structural shift, seem to provide some further support for the dependence of money demand on wealth, although the full set of results is somewhat puzzling. Under either the real or the nominal adjustment, the results warrant rejecting with 99% confidence the stability of the equation relating money demand to income; but they do not warrant rejecting the stability of the equation relating money demand to wealth, even at the weaker 95% confidence level. What is perplexing, however, is that, again under either the real or the nominal adjustment, the results warrant rejecting with 99% confidence the stability

TABLE 5

F-STATISTICS FOR STABILITY TESTS OF MONEY DEMAND EQUATIONS

Equation	Variable (s)	Adjustment	F-Statistic	
I	Income	Real	6.25	(6,91)
IV	Income	Nominal	6.14	(6,91)
II	Wealth	Real	1.68	(6,91)
V	Wealth	Nominal	1.89	(6,91)
III	Income, Wealth	Real	4.82	(7,89)
VI	Income, Wealth	Nominal	3.69	(7,89)

Note: Numbers in parentheses are degrees of freedom.

Critical values of F(6,91): 95% level 2.20
99% level 3.02

Critical values of F(7,89): 95% level 2.11
99% level 2.85

of the equation relating money demand to both income and wealth. Since the question at issue here is whether to include wealth, and not whether to exclude income, the contrast between these results must remain as an object for further research.[46]

These limited empirical results are far from conclusive, and investigating the money demand function per se is not the object of this paper. Nevertheless, on the basis of the results shown in Tables 4 and 5, there appears to be little empirical support for the zero wealth elasticity assumption which would preclude portfolio crowding out.

A Digression on the Missing Money Mystery

The finding that equations relating money demand to income show a significant break after 1972, while equations relating money demand to wealth do not, suggests that the difference between the two specifications may have something to do with the post-1972 overprediction mystery. Since that episode has rightly attracted a great deal of attention, in light of its critical implications for monetary policy, it is worth while to pause to examine whether the income/wealth distinction does in fact provide any light here.

Table 6 presents statistics summarizing the results of simulating, over 1973:1-1977:4, various money demand functions estimated for the 1952:2-1972:4 sample. In each case the simulation is dynamic in that, after 1973:1, it uses the internally generated value for the lagged money stock.

The first six equations simulated are those also considered in Table 5 and shown in full in the upper half of Table 4. The equations relating money demand either to income alone or to both income and wealth, under either the real or the nominal adjustment, show the familiar large overprediction which

TABLE 6

DYNAMIC SIMULATION RESULTS FOR MONEY DEMAND EQUATIONS

Equation	Variable(s)	Adjustment	1973:1-1977:4 Errors Mean	1973:1-1977:4 Errors Root-Mean-Square	1977:4 Error
I	Income	Real	21.4	26.5	46.2
IV	Income	Nominal	18.8	25.4	48.0
II	Wealth	Real	4.5	5.6	5.0
V	Wealth	Nominal	-22.9	27.8	-52.3
III	Income, Wealth	Real	19.2	24.2	42.3
VI	Income, Wealth	Nominal	14.9	21.3	41.2
Hamburger Equation			8.0	9.6	16.1
Hamburger Equation with Wealth			-0.4	1.9	-0.8

Note: Errors in billions of dollars.

continues to worsen throughout the simulation period. The equation relating money demand to wealth alone under the real adjustment (II) also overpredicts, but with far smaller errors that do not tend to increase toward the end of the simulation period. The equation relating money demand to wealth under the nominal adjustment (V), however, consistently underpredicts throughout the simulation period (because of the negative estimated adjustment speed as shown in Table 4) and has the largest absolute mean and root-mean-square errors of the six. Hence relating money demand just to wealth does achieve a marked improvement, but only under the real adjustment.

Even a brief discussion of the missing money mystery would be incomplete without at least some consideration of Hamburger's proposed solution.[47] Hamburger's money demand equation, estimated for the 1955:2 - 1972:4 sample, demonstrably outperforms more standard equations like Goldfeld's in post-1972 simulations. Among the interesting properties of the Hamburger equation, for purposes of the current discussion the most interesting is its inclusion of the dividend/price ratio of common stocks, intended by Hamburger to capture the elasticity of substitution between money and equity securities; the estimated elasticity is significantly less than zero (t-statistic - 2.5).

It is possible, however, to place an altogether different interpretation on the role played by the dividend/price ratio in Hamburger's money demand equation. Since common stock dividends are a fairly stable trend-like series over time, most of the variation of the dividend/price ratio stems from the variation in stock prices. Moreover, the variation of stock prices in turn accounts for most of the measured variation of household wealth (under almost any standard wealth definition), since equities are both the largest and the most volatilely valued component of household assets. To the extent that over time dividends rise roughly like a price index, therefore, the time-series behavior of the dividend/price ratio serves as a close proxy for the time series behavior of (the reciprocal of) the real value of household wealth. It is also important to note in this context that, despite Hamburger's strong appeal to the generalized portfolio concept that money is a substitute for a very broad range of assets, his equation includes no explicit wealth variable.

The question that immediately arises is what happens if household wealth replaces the dividend/price ratio in Hamburger's money demand equation. The answer is that the estimated results differ hardly at all but that, as the bottom two lines of Table 6 show, the wealth form of the equation substantially outperforms Hamburger's own dividend/price form in post-1972 simulations.[48] In fact, the Hamburger equation with wealth substituted for the dividend/price ratio tracks the post-sample data astonishingly well, with only a slight tendency to underpredict on average. A plausible conclusion is that Hamburger's proposed solution for the missing money mystery is simply a disguised story about the role of wealth in the money demand function, and that the solution works better without the disguise.

Summary

Before continuing it is useful to summarize the theoretical and empirical conclusions that emerge from the investigation of portfolio crowding out/in.

First, in a general model including money, bonds and capital, there is no justification for presuming a priori whether the portfolio effect associated with bond-financed government deficit spending offsets or reinforces the familiar income effect of fiscal policy.

Second, whether this portfolio effect is positive or negative depends on a crucial but simple relative substitutability condition: Portfolio crowding out/in results when the ratio of the substitution coefficient between bonds and money to the substitution coefficient between bonds and capital is smaller/greater than the ratio of the respective wealth coefficients of the demands for money and capital. If the two ratios are precisely equal, then there is no portfolio effect, and the traditional IS-LM analysis is the full story of bond-financed government deficit spending.

Third, if portfolio crowding out does occur, in general it can (unlike transactions crowding out) offset more than all of the standard income effect of fiscal policy.

Fourth, particular familiar assumptions give rise to special cases of the general model: If the wealth elasticity of money demand is zero, portfolio crowding out cannot occur. If bonds and capital are perfect substitutes, portfolio crowding in cannot occur.

Fifth, the most recent empirical evidence does not support the contention that the wealth elasticity of money demand is zero. Instead, the role of wealth in the money demand function provides potential clues to the troublesome post-1973 overprediction problem of conventional money demand equations.

PORTFOLIO SUBSTITUTABILITIES AND THE ROLE OF DEBT MANAGEMENT POLICY

The question of what forms of wealth holding are close or distant substitutes for others has long intrigued monetary economists. As the analysis of the previous section has shown, this issue lies at the core of the analysis of fiscal policy involving bond-financed deficit spending.

Two distinct approaches are immediately apparent for dealing with issues pertaining in particular to the substitutability for other assets of government non-money debt claims. The positive approach is to accept as given the terms of these claims and then to investigate the properties of the public's demands for them, bringing to bear whatever empirical evidence is available. Alternatively, since the government is free to set the terms on such claims, just as the public is free to decide at what price (or whether at all) it will accept them, the normative approach is to treat the intended economic effect as given and to ask what terms on government debt claims will best achieve it. Pursuing the normative approach leads directly to the consideration of a subject that economists have now allowed to lie fallow for over a decade — debt management policy.

Composition of the Federal Debt

To begin, it is useful to take note of the basic features of government debt securities. Two characteristics seem especially important to the question, as put in the previous section, of whether government bonds are closer substitutes for money or for bonds.

First, both Tobin and prominent monetarists have emphasized the distinction between nominal and real claims.[49] In the United States, as in most other industrialized countries, interest-bearing government debt instruments have nominal principal amounts and (except for discounted bills) nominal coupons. Tobin has argued, largely on these grounds together with an assumption about the inflation-hedge property of equity returns, that interest-bearing government debt is therefore a better substitute for money than for real capital (or paper claims to real capital). It may or may not be correct to treat this factor as the single most important determinant of relative asset substitutabilities, but in any case the nominal/real distinction itself without doubt mitigates in favor of government debt's being a substitute for money.

Second, Leijonhufvud and others have emphasized the asset's length of extension into the future as a primary determinant of asset-holding preferences in a world of uncertainty and incomplete contingent futures markets, and Stiglitz and others have usefully formalized Hicks' distinction between "income uncertainty" on short-lived claims and "capital uncertainty" on long-lived claims.[50] Table 7 shows the maturity distribution of the U.S. government's outstanding interest-bearing debt as of the end of 1977. The majority of the debt had a maturity of less than one year, and the mean maturity of the total debt was 36.10 months. These data provide no answer to the traditional question of whether government bonds as a whole are closer substitutes for money or capital. Instead, they suggest the implausibility of the assumption that they are a perfect substitute for either one, and therefore they indicate that the multi-asset model developed in the previous section is a more fruitful tool of analysis than the two-asset model which would result from aggregating government bonds with either money or capital. Moreover, by showing the great diversity of maturity of the outstanding government debts, they raise the important question of whether it is appropriate even to treat government bonds as a single aggregate.

TABLE 7

MATURITY DISTRIBUTION OF OUTSTANDING U.S. GOVERNMENT SECURITIES

Maturity	Amount	Percentage
Under 1 year	233.0	50.7
1-5 years	151.3	32.9
5-10 years	45.9	10.0
10-15 years	8.8	1.9
15-20 years	10.9	2.4
Over 20 years	10.0	2.2
Total	459.9	100.0

Note: Amount in billions of dollars, yearend 1977.
Detail may not add to total because of rounding.

Source: U.S. Department of the Treasury

Choosing Between Crowding Out and Crowding In

A four asset equivalent to the symmetric portfolio demand system (19) is

$$(32)\qquad \begin{bmatrix} M^D \\ S^D \\ L^D \\ K^D \end{bmatrix} = \begin{bmatrix} m_0 \\ s_0 \\ \ell_0 \\ -m_0-s_0-\ell_0 \end{bmatrix} + \begin{bmatrix} -m_2-m_3-m_4 & m_2 & m_3 & m_4 \\ m_2 & -m_2-s_3-s_4 & s_3 & s_4 \\ m_3 & s_3 & -m_3-s_3-\ell_4 & \ell_4 \\ m_4 & s_4 & \ell_4 & -m_4-s_4-\ell_4 \end{bmatrix} \begin{bmatrix} r_M \\ r_S \\ r_L \\ r_K \end{bmatrix}$$

$$+ \begin{bmatrix} m_5 \\ s_5 \\ \ell_5 \\ -m_5-s_5-\ell_5 \end{bmatrix} Y + \begin{bmatrix} m_6 \\ s_6 \\ \ell_6 \\ 1-m_6-s_6-\ell_6 \end{bmatrix} W$$

where S^D and L^D are the demands for short-term and long-term government bonds, r_S and r_L are their respective expected returns, and the m_i, s_i and ℓ_i are fixed coefficients as in (19).[51] Here the joint implication of the balance sheet and symmetry constraints is that it is possible to specify completely the 16-element Jacobian with only six independent coefficients. For reasons apparent from the analysis of the previous section, it is convenient to do so in terms of the six substitution coefficients. Using (32) in place of (19), and making the corresponding change in (13) leads to a four-equation analog to (21)-(23), determining now the four variables Y, r_S, r_L and r_K,

$$(33)\qquad Y = y_0 + y_1 G + (1 - y_1)T + y_2 r_K + y_3(M + K + S + L)$$

$$(34)\qquad M = m_0 + m_2 r_S + m_3 r_L + m_4 r_K + m_5 Y + m_6 (M + K + S + L)$$

$$(35)\qquad S = s_0 - (m_2 + s_3 + s_4) r_S + s_3 r_L + s_4 r_K + s_5 Y + s_6 (M + K + S + L)$$

$$(36)\qquad L = \ell_0 + s_3 r_S - (m_3 + s_3 + \ell_4) r_L + \ell_4 r_K + \ell_5 Y + \ell_6 (M + K + S + L).$$

To consider the portfolio effect of the bond financing of a government deficit, it is now necessary to specify whether the bonds issued are short-term ($dS = dG$) or long-term ($dL = dG$). The key asset-markets-only partial derivatives comparable to (25) and (26) follow from the solution of (34)-(36) in the form

$$\text{(37)} \qquad \frac{1}{\partial G}\begin{bmatrix} \partial r_S \\ \partial r_L \\ \partial r_K \end{bmatrix} = \begin{bmatrix} -m_2 & -m_3 & -m_4 \\ (m_2+s_3+s_4) & -s_3 & -s_4 \\ -s_3 & (m_3+s_3+\ell_4) & -\ell_4 \end{bmatrix}^{-1} \begin{bmatrix} m_6 \\ -(1-s_6) \\ \ell_6 \end{bmatrix}$$

for short-term financing or

$$\text{(38)} \qquad \frac{1}{\partial G}\begin{bmatrix} \partial r_S \\ \partial r_L \\ \partial r_K \end{bmatrix} = \begin{bmatrix} -m_2 & -m_3 & -m_4 \\ (m_2+s_3+s_4) & -s_3 & -s_4 \\ -s_3 & (m_3+s_3+\ell_4) & -\ell_4 \end{bmatrix}^{-1} \begin{bmatrix} m_6 \\ s_6 \\ -(1-\ell_6) \end{bmatrix}$$

for long-term financing.

In the absence of any further restrictions, the results of solving (37) and (38) show only that under short-term financing $\frac{\partial r_S}{\partial G} > 0$ while $\frac{\partial r_L}{\partial G}$ and $\frac{\partial r_K}{\partial G}$ are both of indeterminate sign, and under long-term financing $\frac{\partial r_L}{\partial G} > 0$ while $\frac{\partial r_K}{\partial G}$ and $\frac{\partial r_S}{\partial G}$ are of indeterminate sign. Either portfolio crowding out or crowding in is possible under either short- or long-term financing. Any stronger result would be surprising, since so far there is no restriction on how short is "short" and how long is "long." The securities indicated by S and L, respectively, could be 3-month and 6-month bills, or they could be 20-year and 30-year bonds.

The analysis of the previous section provides a useful break-point for distinguishing "short-term" from "long-term" financing of the deficit.

In particular, under further relative substitutability conditions that imply[52]

(39) $$\sigma_S > \sigma^* > \sigma_L$$

where σ_S and σ_L are the relative substitutability indices of the short- and long-term bonds, defined analogously to (28) as

(40) $$\sigma_S \equiv \frac{m_2}{s_4} \quad , \quad \sigma_L \equiv \frac{m_3}{\ell_4}$$

and σ^* is again the critical value now defined analogously to (30) as

(41) $$\sigma^* \equiv \frac{m_6}{1 - m_6 - s_6 - \ell_6} \qquad \left(= \frac{m_6}{k_6} \right)$$

the results of solving (37) and (38) show in addition that under short-term financing $\frac{\partial r_K}{\partial G} < 0$, and under long-term financing $\frac{\partial r_K}{\partial G} > 0$. Financing the deficit with a bond characterized by a relative substitutability index <u>greater</u> than σ^* causes portfolio crowding <u>in</u>, while financing the deficit with a bond characterized by a relative substitutability index <u>smaller</u> than σ^* causes portfolio crowding <u>out</u>. (In addition, it is possible to achieve similar effects via a pure debt management operation without any change in spending ($dS = -dL$; $dG = 0$). Given (39), replacing <u>long- by short-term</u> bonds causes portfolio crowding <u>in</u>, while replacing <u>short- by long-term</u> bonds causes portfolio crowding <u>out</u>.)

If there existed only one kind of government bond, then the conclusion that there is portfolio crowding in/out according to whether that bond's relative substitutability index is greater/smaller than σ^* would be no more than a restatement of the relative substitutability condition (29). Given the existence of different kinds of government bonds with differing substitution properties, however, these conclusions reveal the crucial importance of debt management policy in determining the effects of fiscal policy. As long as there exists — or could be created — at least one kind of interest-bearing government debt instrument characterized by $\sigma_S > \sigma^*$ and at least one kind characterized by $\sigma_L < \sigma^*$, the government can choose whether to have portfolio crowding in or crowding out accompany its deficit spending. Under Leijonhufvud's view that the relevant substitutabilities depend primarily on the asset's length of life, the current range of maturities is probably sufficient for this purpose.[53] Alternatively, under Tobin's view that the nominal/real distinction is of prime importance, it is possible that there now exists in the United States no government debt instrument capable of producing portfolio crowding out. If such an instrument did not exist, and if for some reason the object of policy were to achieve portfolio crowding out, the means of doing so would be to issue an indexed security.

Under what circumstances would the government want to use debt management to influence which (and how much) of portfolio crowding out/in its deficit financing produced? The most straightforward (though unlikely) such situation would occur if the relevant empirical magnitudes indicated that portfolio crowding out would offset more than all of the intended effect of fiscal policy on income — in terms of Figure 4, if the conditional LM curve would shift so far leftward as to result in $Y_1 \big|_{\sigma < \sigma^*} < Y_0$. By contrast, as long as crowding out is less than total, and especially if there is not crowding out but crowding in, debt management policy would be irrelevant if the sole object of policy were the <u>level</u> of income. The more powerful was crowding out in that case, the more the government would spend to achieve a given desired income. Debt management would not matter.

When policy is concerned with both the level and the composition of income, however, then debt management policy has a major role to play along with fiscal policy. While fiscal policy alone can raise the level of income, it does so at the expense of private investment. Under either transactions crowding out or portfolio crowding out, income increases because each dollar of government spending replaces a smaller — though still strictly positive — amount of private investment. When the long-term benefits of growth and productivity associated with capital formation are also criteria for policy,[54] then debt management policy can serve to minimize the crowding out (or maximize the crowding in) of investment that accompanies any given level of income. In sum, the effect of debt management policy is to shift the income level/composition trade-off that fiscal policy faces under an unaccommodative monetary policy.

Especially in the context of the widespread concern recently voiced over the poor performance of capital formation in the United States, it is interesting to consider the debt management policy now being used to finance the continuing large deficits shown in Table 1. Table 8 presents data for the mean maturity of the U.S. Treasury's outstanding debt during the post World War II era. Subject to modest fluctuation, the dominant trend for three decades was toward a shorter mean maturity. During the late 1960's, for example — a period characterized by a substantial surge in U.S. investment in plant and equipment, both absolutely and as a share of total spending — the mean maturity fell especially rapidly. Since January, 1976, however, debt management policy has shifted toward sharply lengthening rather than shortening the debt. Although the quantitative magnitudes involved are impossible to estimate on the basis of current knowledge, it is qualitatively clear that post-1975 U.S. debt management policy has been (and to date continues to be) counterproductive from the standpoint of promoting capital formation.

TABLE 8

MEAN MATURITY OF U.S. TREASURY MARKETABLE SECURITIES OUTSTANDING

Yearend (or other as noted)	Total Debt	Privately Held Debt
1946	112.75	124.17
1950	97.11	99.99
1955	65.51	71.24
1960	54.84	58.35
1965	59.54	63.31
1970	40.43	40.99
1975	33.30	28.90
January, 1976	32.90	28.50
June, 1976	34.68	31.05
December, 1976	36.10	33.28
June, 1977	38.02	34.48
December, 1977	38.39	35.40
May, 1978	41.05	37.14

Note: Mean maturity in months.

Source: U.S. Department of the Treasury.

Econometric Evidence on Portfolio Substitutabilities

A fundamental implication of the models used to analyze portfolio crowding out/in, both here and in the previous section, is that different non-money assets are not perfect substitutes. Hence the structure of relative asset yields depends upon (among other factors) relative asset supplies.

At the theoretical level, the dependence of asset yields on asset supplies has long been familiar, in a comparative statics context from Keynes and Hicks, and in a dynamic context from Tobin.[55] Culbertson and Modigliani and Sutch have expanded on this notion, under the respective labels "market segmentation" and "preferred habitats," and Stiglitz has clarified how such effects follow directly from investors' risk aversion (except under highly restrictive conditions on the covariance structure of the individual assets' returns).[56] At the empirical level, however, for many years economists' efforts to test for the effect of asset supplies on yield relationships produced meager results at best. The standard time-series test, which consisted of regressing the observed long-short yield spread directly on variables indicating the relative amounts of outstanding long- versus short-term Treasury securities, or regressing the long-term yield directly on the short-term yield and the relative supply variables, rarely showed significant supply effects.[57] In large part as a consequence of the accumulating evidence from such tests, economists' interest in multi-asset models in general, and debt management policy in particular, waned considerably.

In retrospect it is possible to identify at least three reasons, all related to the unrestricted reduced-form methodology which they employed, why such tests failed to find evidence for effects of asset supplies on asset yields. First, these tests typically focused on "outside" assets only, implicitly relying on the assumption that intermediation is irrelevant for the structure of relative yields, so that "inside" assets (that is, debt securities issued by private borrowers) simply netted out. Second, these tests typically dealt only with aggregative data (for example, the total amounts of outside assets held by all private investors), thereby relying on the assumption that heterogeneity in portfolio behavior among different groups of investors facing different legal and institutional constraints is also irrelevant for market-determined yield relationships. Third, by using the direct reduced-form approach these tests forewent the opportunity to impose restrictions (even on aggregate behavior) from the richly developed theory of portfolio choice.

More recently, the seminal contribution of Brainard and Tobin has generated renewed empirical attempts to investigate the asset-substitution and other properties of portfolio behavior by estimating asset demand (and, in the context of intermediation, liability supply) relationships analogous to systems (19) and (32).[58] To date, the most successful such attempts have focused on single well-defined categories of investors, such as life insurance companies or commercial banks or the "household" sector of the flow-of-funds accounts. In order to bring evidence from such models to bear on issues like those under discussion here, however, it is necessary to have a fully simultaneous model for all categories of asset holders in the economy. Alternatively, one could estimate a single system like (19) or (32) for the asset holding behavior of the entire private sector.

An attempt to estimate a five-asset econometric model for the aggregate U.S. non-bank private sector (the five assets were money, time deposits, short-term Treasury securities, long-term Treasury securities, and equities), to provide for this paper some empirical estimates of the key substitution coefficients that determine the distinction between portfolio crowding out and crowding in, met with only limited success. The estimated own-yield elasticities were typically positive and significant, and the estimated cross-yield elasticities were (with one exception) either negative and significant or else insignificantly different from zero. But the results as a whole did not appear to warrant even the limited confidence that a cautious observer would have in the money demand functions used for an analogous purpose in the first section of the paper. Given the likely importance of intermediation and investor heterogeneity, modest results for such a fully aggregated no-intermediation model are hardly surprising.[59]

In the absence of such a model, one is entitled to ask whether there exists any evidence that different non-money assets are indeed only imperfect substitutes in private investors' portfolios, so that relative asset supplies do matter for relative asset yields as in the analytical models used above. The answer is that research using structural models of portfolio behavior and interest rate determination has provided such evidence in two forms, corresponding to the two elements of the key proposition in question. First, on the question of the elasticities of portfolio substitution per se, this research has found strong evidence of cross-yield elasticities small enough to indicate highly imperfect substitution among non-money assets.[60] Second, on the question of asset supply effects on relative asset yields, this research has found strong evidence of such effects for several specific markets.[61]

In sum, although gaining satisfactory estimates of the key substitution parameters that determine conditions like (29) and (39) remains as an object for future research, even the limited evidence now available appears to deny the assumption of perfect (or nearly perfect) substitutability of non-money assets which would preclude portfolio crowding in and render debt management policy irrelevant.

Summary

Several useful conclusions about the effects of debt-financed government deficit spending emerge on extending the analysis to take account of the observed heterogeneity within the single asset category of "government bonds."

First, the nominal returns on government debt instruments, together with their relatively short average maturity, render highly suspect any attempt to argue that they are perfect substitutes for real capital. They hardly appear to be perfect substitutes for money either, however.

Second, the range of different maturities actually or potentially available strongly suggests that all government debt instruments are not even perfect substitutes for one another. It is the government's prerogative of choosing among them that facilitates debt management policy.

Third, as long as there exist (or could be created) at least one government debt instrument (a "short-term" bond) with a relative substitutability index greater than, and one (a "long-term" bond) less than, the key ratio of the respective wealth responses of money and capital, debt management policy can determine which (and how much) of portfolio crowding out or crowding in results from financing deficit spending. *Long*-term financing leads to crowding *out*, while *short*-term financing leads to crowding *in*.

Fourth, the most important role for debt management policy is to shift the trade-off, between raising total income and reducing private investment, faced by fiscal policy under an unaccommodative monetary policy. Viewed in this context, the change in U.S. debt management policy that began after 1975 has been counterproductive from the standpoint of promoting capital formation.

Fifth, the available empirical evidence does not support the contention that familiar non-money assets — like bonds and equities, or short- and long-term bonds — are perfect substitutes. Hence portfolio crowding in can occur, and debt management policy matters.

CONCLUSIONS FOR FISCAL, DEBT MANAGEMENT, AND MONETARY POLICIES

Since the preceding sections include individual summaries, there is no need to restate in detail each of this paper's specific results. It is more useful, instead, briefly to relate these conclusions to some of the broader issues excluded from the paper's focus on the financial crowding out/in associated with debt-financed fiscal policy.

To begin, the paper's principal conclusion — that the consequences of bond financing (and of transactions crowding out, too) do not appear so damaging for expansionary fiscal policy as previous analysis has indicated — suggests that the assessment of fiscal policy actions should rest in the first instance with real-sector rather than financial-sector behavior. Offsets from the LM curve shift or slope need not vitiate the efficacy of fiscal policy. Instead, both the availability of real resources to meet additional demand for real spending, and the likelihood of an induced expansion of productive capacity itself, constitute the potentially more restrictive conditions for effective fiscal stimulation. Practical analysis for policy making purposes is all the more difficult since most of the available evidence indicates that both the response of price inflation to aggregate demand pressure and the response of fixed investment to changing rate-of-return anticipations involve substantial time lags. Resting the case for or against fiscal stimulation on a race between inflation and the accelerator is a crude, but not altogether inaccurate, conceptualization of the problem. If fiscal policy is necessarily ineffective in a given situation, it is likely to be as a result of those effects in the goods market and not because of problems caused in the financial markets by an excess supply of bonds.

Next, debt management, despite the lack of attention paid to it in almost any recent discussion of macroeconomic policy, is an essential part of the story. The portfolio behavior consequent upon issuing government bonds need not vitiate the intended effect of fiscal policy, but — under improper debt management policy — it almost certainly can do so. The case for or against lengthening the average maturity of the U.S. public debt, as the Treasury has done since its policy shift in early 1976, rests on arguments that lie well beyond the scope of this paper. What does seem clear, however, is that the period since then, which has witnessed extraordinarily large federal deficits and a sluggish recovery of capital spending, has been a particularly unpropitious time to choose for embarking on such a debt restructuring program. The Treasury should be meeting its financing requirements during this period in such a way as to deny, not satisfy, investors' demand for long-term securities, thereby forcing the public to turn to the corporate business sector for more new issues. The fact that the Treasury has been able to issue its long-term bonds without causing "indigestion" in the debt markets is beside the point. In the context of the usual alimentary analogy, the objective of debt management policy should have been to keep the market hungry for long-term assets, not merely to avoid overfeeding it.

Finally, it is useful to recall that the entire analysis of this paper has proceeded on the assumption of a strictly non-accommodative monetary policy. Not only need this not be the case; in practice also, more often than not the Federal Reserve System has adopted at least a partially accommodative stance in the face of a decision by Congress and the Executive to pursue a policy of fiscal stimulation. A responsive monetary policy would have a major impact on the issues analyzed here in two ways. The most familiar is simply the LM curve shift due to increasing the money stock. Even with no change in monetary growth, however, the Federal Reserve can still influence the economic consequences of debt-financed fiscal policy by the simultaneous purchase and sale of Treasury securities through its open market operations. Only the Treasury, of course, can design and issue a new security (such as an indexed bond or a perpetuity, designed to achieve maximum crowding out). With respect to the composition of the outstanding securities that the Treasury has already issued, however, the Federal Reserve's portfolio is large enough to exert substantial impact. If debt management policy fails to follow a path consistent with enhancing the objectives of fiscal policy, monetary policy can provide a satisfactory surrogate.

Footnotes

*I am grateful to David Jones, Angelo Melino and Chris Piros for research assistance; to them as well as Alan Blinder, James Duesenberry, Zvi Griliches, Michael Hamburger, Mervyn King, John Lintner, Vance Roley, Robert Solow, Stephen Taylor, the editors and my discussants for helpful comments on an earlier draft; and to the National Science Foundation (grant APR77-14160) and the Alfred P. Sloan Foundation for research support. I also want to acknowledge at the outset the general guidance provided by James Tobin, "Money, Capital, and Other Stores of Value," American Economic Review, Vol. 51 (May 1961), pp. 26-37, and "An Essay on the Principles of Debt Management," in Commission on Money and Credit, Fiscal and Debt Management Policies (Prentice-Hall, 1963), pp. 143-218.

[1] See, for example, James S. Duesenberry, "The Portfolio Approach to the Demand for Money and Other Assets," Review of Economics and Statistics, Vol. 45 (February 1963, Supplement) pp. 3-24.

[2] For example, the growth of the narrowly defined money stock (currency plus demand deposits, M-1) has increased from 4.1 percent in 1975 to 7.9 percent during 1977, in comparison to 6.3 percent average growth for the preceding five years. By contrast, the stock of money plus outstanding U.S. Treasury bills grew by 12.2 percent in 1974 but only 4.6 percent in 1977, in comparison to its previous five-year average annual growth rate of 7.5 percent. Hence inferences drawn from a policy prescription of controlling money plus Treasury bills would have diverged widely from inferences drawn from a policy of controlling money.

[3] "Inflation and Unemployment: A Report on the Economy." (Congressional Budget Office, June 30, 1975; processed), pp. 57-58.

[4] J.R. Hicks, "Mr. Keynes and the 'Classics'; A Suggested Interpretation," Econometrica, Vol. 5 (April 1937), pp. 147-59.

[5] See Friedman's response to Tobin in, "Comments on the Critics," Journal of Political Economy, Vol. 80 (September/October 1972), pp. 906-50.

[6] Alan S. Blinder and Robert M. Solow, "Does Fiscal Policy Matter?" Journal of Public Economics, Vol. 2 (November 1973), pp. 319-37; James Tobin and Willem Buiter, "Long-Run Effects of Fiscal and Monetary Policy on Aggregate Demand," in Monetarism, edited by Jerome Stein (North-Holland, 1976), pp. 273-309.

[7] Stephen M. Goldfeld, "The Case of the Missing Money," BPEA, 3: 1976, pp. 683-730; Michael J. Hamburger, "Behavior of the Money Stock: Is There a Puzzle?" Journal of Monetary Economics, Vol. 3 (July, 1977), pp. 265-88.

[8] William J. Baumol, "The Transactions Demand for Cash: An Inventory Theoretic Approach," Quarterly Journal of Economics, Vol. 66 (November 1952), pp. 545-56; James Tobin, "The Interest Elasticity of Transactions Demand for Cash," Review of Economics and Statistics, Vol. 38 (August 1956), pp. 241-47.

[9] Here, as well as elsewhere in this paper, subscripted lower-case letters are fixed coefficients in equations for economic variables indicated by the corresponding upper-case letter. For example, c_0 and c_1 are coefficients in the consumption function, i_0 and i_1 in the investment function, etc. This convention is especially handy in keeping straight the notation for the more complicated asset demand systems used in several following sections.

[10] Alternative, but also less transparent, ways of calculating this magnitude include simulating large nonlinear econometric models and estimating direct reduced forms. See, for example, Franco Modigliani and Albert Ando, "Impacts of Fiscal Actions on Aggregate Income and the Monetarist Controversy: Theory and Evidence," in Monetarism, edited by Jerome Stein (North-Holland, 1976), pp. 17-42; and Leonall C. Anderson and Jerry L. Jordan, "Monetary and Fiscal Actions: A Test of Their Relative Importance in Economic Stabilization," Federal Reserve Bank of St. Louis, Review (November 1968), pp. 11-24.

[11] Benjamin M. Friedman, "The Inefficiency of Short-Run Monetary Targets for Monetary Policy," BPEA, 2: 1977, pp. 293-335. In estimating this model I used an instrumental-variables procedure to derive consistent estimators given the endogeneity of both Y and r. It is interesting to note that these short- and long-run elasticities are very similar to those found for a rational-expectations model in Olivier J. Blanchard and Charles Wyplosz, "An Empirical Structural Macroeconomic Model Which Can Be Used for Policy Simulations" (Harvard University, August 1978; processed).

[12] Friedman, op. cit.; Stephen M. Goldfeld, "The Demand for Money Revisited," BPEA, 3: 1973, pp. 577-638; and Hamburger, "Behavior of the Money Stock."

[13] Analogously, if there were some shift in the relationship between income and transactions, the IS and LM curves would also refer to different horizontal axes.

[14] The usual argument for relating real spending to long-term interest rates is that, for reasons related to risk aversion, businesses tend to

finance plant and equipment investment with long-term liabilities, and households almost always finance residential construction with long-term liabilities. For an argument that investment instead depends on a kind of short-term yield (though not on the measured yield on short-term assets like deposits on commercial paper), see Robert E. Hall, "Investment, Interest Rates, and the Effects of Stabilization Policies," BPEA, 1: 1977, pp. 61-103.

[15] The equation plausibly indicates a 0.265 elasticity of the long-term interest rate with respect to the short-term rate.

[16] Without the term-structure correction the short-run estimates in Table 3 would be 0.778 for Goldfeld's equation and 0.599 for the Pirandello Model's equation.

[17] Since writing this paper I have seen a paper by Cohen and McMenamin which overlaps some of the analysis of this section; see Darrel Cohen and Stuart McMenamin, "The Role of Fiscal Policy in a Financially Disaggregated Macroeconomic Model," Journal of Money, Credit and Banking, Vol. 10 (August 1978), pp. 322-36.

[18] Money, of course, (actually the monetary base in a model that distinguishes the two) also constitutes a part of the government's debt. Unless specified to the contrary, however, the term "debt" in this paper means interest-bearing debt.

[19] A.C. Pigou, "The Value of Money," Quarterly Journal of Economics, Vol. 32 (November, 1917), pp. 38-65; J.M. Keynes, The General Theory of Employment, Interest and Money (Harcourt, Brace & World, 1936).

[20]Franco Modigliani, "Monetary Policy and Consumption: Linkages via Interest Rate and Wealth Effects in the FMP Model," and James Tobin and Walter Dolde, "Wealth, Liquidity and Consumption," both in Consumer Spending and Monetary Policy: The Linkages (Federal Reserve Bank of Boston, 1971), pp. 9-85 and 99-146, respectively.

[21]Like (6), (13) exhibits a unit balanced budget multiplier; this result follows from the partial-equilibrium, goods-market-only nature of both (6) and (13).

[22]The analysis in this paper assumes that the public regards all of the increase in the stock of outstanding government bonds as an increase in wealth. Assuming instead that the public regarded as wealth only some positive fraction δ of the additional amount of bonds, and replacing B in (14) by δB, would change none of the paper's substantive conclusions. By contrast, Barro has argued that the public regards no government bonds as wealth; see Robert J. Barro, "Are Government Bonds Net Wealth?" Journal of Political Economy, Vol. 82 (November/December 1974), pp. 1095-1117. The standard arguments against this view appeal to the credit market imperfections faced by nearly all taxpayers, as well as intergenerational nonneutralities. Another generalization would be to allow for bond valuation changes by writing B itself as a function of the yield on bonds.

[23]See Carl Christ, "A Simple Macroeconomic Model with a Government Budget Constraint," Journal of Political Economy, Vol. 76 (January/February 1968), pp. 53-67; and William L. Silber, "Fiscal Policy in IS-LM Analysis: A Correction," Journal of Money, Credit and Banking, Vol. 2 (November 1970), pp. 461-72. In a dynamic context, it is necessary to be precise about the passage of time, as well as about problems of stability associated with

interest payments on the government debt; see, for example, Blinder and Solow, "Does Fiscal Policy Matter?" As written, (15) strictly applies only to a single time period, where the time unit is identical to that used to define the model's flow variables (Y, G, etc.).

[24]Making taxes depend on income would only complicate the algebra without changing any substantive conclusions.

[25]Since the capital stock is fixed for the period of this analysis, an appealing generalization would be to follow Tobin by letting the real price of capital q vary; see James Tobin, "A General Equilibrium Approach to Monetary Theory," Journal of Money, Credit and Banking, Vol. 1 (February 1969), pp. 15-29. Replacing K in (14) by qK, and adding an equation relating q inversely to the yield on capital, however, would change none of the substantive conclusions derived here. An alternative approach would be to rely on a long-run steady-state growth model as in James Tobin, "Money and Economic Growth," Econometrica, Vol. 33 (October 1965), pp. 671-84; part of Blinder and Solow, "Does Fiscal Policy Matter?"; or Martin Feldstein, "Fiscal Policies, Inflation and Capital Formation" (National Bureau of Economic Research, August 1978; processed).

[26]William C. Brainard and James Tobin, "Pitfalls in Financial Model Building," American Economic Review, Vol. 57 (May 1968), pp. 99-122.

[27]For example, the Keynesian "speculative" demand for money, which depends fundamentally on interest rate expectations, is simply the negative of the demand for assets subject to capital gains and losses. In the absence of any appeal to expectations, the observed negative interest elasticity of money demand is evidence for the inventory-theoretic interest sensitivity of

"transactions" demand, and (contrary to a frequent misinterpretation) has nothing to do with "speculative" demand.

[28] Friedman and de Leeuw in particular provided the rationale for the wealth homogeneity constraint. See Milton Friedman, "The Quantity Theory of Money: A Restatement," in Studies in the Quantity Theory of Money (Chicago, 1956), pp. 3-21; and Frank de Leeuw, "A Model of Financial Behavior," in The Brookings Quarterly Econometric Model of the United States, edited by James S. Duesenberry et al. (Rand McNally, 1965), pp. 465-530. In "The Effect of Shifting Wealth Ownership on the Term Structure of Interest Rates" (National Bureau of Economic Research, February 1978; processed), I have shown that constant relative risk aversion and joint normally distributed asset return assessments are sufficient to generate asset demand functions that are homogeneous in wealth and linear in expected returns, either exactly in a continuous-time model or as an approximation in a discrete-time model.

[29] See again footnote 9.

[30] Despite the frequent immediate resort to symmetry constraints by researchers who apparently assume that the properties of consumer demand theory necessarily carry over to portfolio theory, symmetry in derived asset demand systems implies strong restrictions on the underlying utility function. For a careful treatment of this question, see V. Vance Roley, A Structural Model of the U.S. Government Securities Market (Ph.D. dissertation, Harvard Unitersity, 1977).

[31] The elements of the Jacobian are themselves functions of the variance-covariance matrix of the asset return assessments. Blanchard and

Plantes have shown that gross substitution requires a positive covariance between each pair of uncertain returns; see Olivier-Jean Blanchard and Mary Kay Plantes, "A Note on Gross Substitutability of Financial Assets," Econometrica, Vol. 45 (April 1977), pp. 769-71.

[32]Instead of relating Y negatively to r_K, (13) could just as well relate Y positively to q (with q related inversely to r_K); see again footnote 25.

[33]Allowing for the dependence of B on r_B would further complicate the sense in which the LM curve is conditional on r_B, and would also render the IS curve conditional on r_B.

[34]The portfolio effect is the more likely to outweigh the transactions effect as more than the single time period elapses, since the stock of bonds continues to grow if the deficit continues.

[35]See, for example, Tobin, "Money, Capital, and Other Stores of Value," "Principles of Debt Management," and "A General Equilibrium Approach;" and Karl Brunner and Allan H. Meltzer, "Money, Debt and Economic Activity," Journal of Political Economy, Vol. 80 (September/October 1972), pp. 951-77.

[36]It is interesting to note that this result is independent of m_3 (= k_1), the elasticity of substitution between money and capital.

[37]The asset-markets-only expressions in (25) and (26), which follow from (22) and (23) alone, are simply the solution to (31) excluding the first row of the system and the first column of the inverted matrix.

[38]Albert Ando and Karl Shell, "Appendix: Demand for Money in a General Portfolio Model in the Presence of an Asset That Dominates Money," in

The Brookings Model: Perspective and Recent Developments, edited by Gary Fromm and Lawrence R. Klein (North-Holland, 1975), pp. 560-63; Goldfeld, "The Demand for Money Revisited."

[39]Blinder and Solow, "Does Fiscal Policy Matter?"

[40]Irving Fisher, The Purchasing Power of Money (Macmillan, 1911); F. Lavington, The English Capital Market (Methuen, 1921); Pigou, "The Value of Money." Marshall had also acknowledged the dependence of money demand on wealth; see Alfred Marshall, Money, Credit and Commerce (Macmillan, 1923).

[41]Keynes, The General Theory.

[42]Milton Friedman, "The Demand for Money: Some Theoretical and Empirical Results," Journal of Political Economy, Vol. 67 (August 1959), pp. 327-51. An important exception is Meltzer's work; see, for example, Allan H. Meltzer, "The Demand for Money: The Evidence from the Time Series," Journal of Political Economy, Vol. 71 (June 1963), pp. 219-46.

[43]Goldfeld did find a significant elasticity with respect to the change in wealth; but it is difficult to interpret this result, and he did not emphasize it.

[44]Goldfeld, "Missing Money."

[45]In the results as shown in the table, the wealth variable is household financial asset holdings. The results do not change much if any of three other definitions of wealth is used instead: household financial net worth, household total asset holdings, or household total net worth; these alternate results are available from the author on request.

[46]Two recent papers have usefully set forth the case for a shift in the relationship between money demand and income, due to changes in banking technology. See Gillian Garcia and Simon Pak, "Some Clues in the Case of the Missing Money" (University of California at Berkeley, February 1978; processed); and Richard D. Porter and Eileen Mauskopf, "Some Notes on the Apparent Shift in the Demand for Demand Deposits Function" (Federal Reserve Board, May 1978; processed).

[47]Hamburger, "Behavior of the Money Stock."

[48]The results shown at the bottom of Table 6 follow Hamburger in using as the money stock variable a two-month average centered on the end of the quarter. The other results use Goldfeld's three-month average centered on the middle of the quarter.

[49]See in particular Tobin, "Money, Capital and Other Stores of Value," and "Principles of Debt Management."

[50]Axel Leijonhufvud, Keynesian Economics and the Economics of Keynes (Oxford, 1968); Joseph E. Stiglitz, "A Consumption-Oriented Theory of the Demand for Financial Assets and the Term Structure of Interest Rates," Review of Economic Studies, Vol. 25 (February 1968), pp. 65-86; and J.R. Hicks, Value and Capital (Oxford, 1939).

[51]Note that coefficients m_4 and m_5 now have different meanings than in (19), however.

[52]The jointly sufficient conditions for the results stated below are $\frac{m_2}{s_3} > \frac{m_6}{\ell_6}$ and $\frac{s_3}{s_4} > \frac{\ell_6}{k_6}$ which together imply $\sigma_S > \sigma^*$, and $\frac{m_3}{s_3} < \frac{m_6}{s_6}$ and $\frac{s_3}{\ell_4} < \frac{s_6}{k_6}$ which together imply $\sigma_L < \sigma^*$.

[53] If necessary, the government could introduce perpetuities, although real capital (except for land) is not infinite-lived either. It is also worth noting that the relevant concept here is not the asset's maturity but its duration; see Michael H. Hopewell and George G. Kaufman, "Bond Price Volatility and Term to Maturity: A Generalized Respecification," American Economic Review, Vol. 63 (September 1973), pp. 749-53. At a yield of 6% per annum, for example, a perpetuity has duration of about 17 years.

[54] Such effects, including also implications for price inflation, lie outside the fixed-capital, fixed-price model used in this paper's formal analysis.

[55] Keynes, The General Theory; Hicks, "Mr. Keynes and the Classics"; Tobin, "Money and Economic Growth."

[56] J.M. Culbertson, "The Term Structure of Interest Rates." Quarterly Journal of Economics, Vol. 71 (November, 1957), pp. 485-517; Franco Modigliani and Richard Sutch, "Innovations in Interest Rate Policy," American Economic Review, Vol. 56 (May 1966), pp. 178-97; and Stiglitz, "A Consumption-Oriented Theory."

[57] See, for example, Modigliani and Sutch, op. cit., and "Debt Management and the Term Structure of Interest Rates," Journal of Political Economy, Vol. 75 (August 1967), pp. 569-89. One study which was exceptional, in that it did find some evidence of asset supply effects, was Arthur M. Okun, "Monetary Policy, Debt Management, and Interest Rates: A Quantitative Appraisal." In Commission on Money and Credit, Stabilization Policies (Prentice-Hall), pp. 331-80.

[58] Brainard and Tobin, "Pitfalls."

[59] The complete estimates, together with a description of the estimation methodology, are available from the author on request.

[60] See Benjamin M. Friedman, "Financial Flow Variables and the Short-Run Determination of Long-Term Interest Rates," Journal of Political Economy, Vol. 85 (August 1977), pp. 668-89; and V. Vance Roley, A Structural Model. Other researchers have found similar evidence for imperfect substitutability among liquid assets (although this is less to the point here); see, for example, Richard W. Kopcke, "U.S. Household Sector Demand for Liquid Financial Assets, 1959-1970," Journal of Monetary Economics, Vol. 3 (October 1977).

[61] See Friedman, op. cit., for evidence along these lines for the corporate bond market, and Roley, op. cit., for similar evidence for the markets for short-intermediate-term Treasury notes and long-term Treasury bonds. Other researchers have found evidence for asset supply effects in models that encompass more asset markets but are less specific about the nature of the asset substitutions involved; see, for example, Barry Bosworth and James S. Duesenberry, "A Flow of Funds Model and Its Implications," in Issues in Federal Debt Management (Federal Reserve Bank of Boston, 1973), pp. 39-147; and Patric H. Hendershott, Understanding Capital Markets, Volume II: A Flow-of-Funds Model (Heath, 1977).