6. Monetary Base Control III

The British Banking System's Demand for Cash Reserves

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FEU 2/6/03 G

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October 1980

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There has been considerable controversy in the United Kingdom about the most appropriate method of conducting monetary policy. This controversy has focused on the concept of the monetary base and its present and potential usefulness as an instrument of monetary policy.[1/] This paper is intended to help resolve this controversy by analyzing an important part of the monetary system in existence in the United Kingdom during the years 1973-1978 and referred to as the "present" system in this paper. First, a brief description of the relevant aspects of the British monetary system is presented. Next, a theoretical model of the banking system's demand for cash reserves (i.e., vault cash plus cash deposits at the Bank of England) is developed. This model is estimated and conclusions are drawn based on the empirical results. It is found that in the present British monetary system, banks' demand for cash reserves is a well-defined and well-behaved function of bank deposit liabilities and a few other observable variables. Thus a policy of achieving monetary growth targets by means of conventional open-market operations by the Bank of England -- that is, by manipulating the supply of monetary base -- appears to be feasible under present circumstances, assuming that the demand for the monetary base by nonbanks is also well defined.

I. The British Monetary System

British banks have long been subject to two required reserve ratios: a cash ratio and a liquid-asset ratio. The former stipulates a minimum proportion of eligible bank liabilities which must be matched by holdings of non-interest-bearing balances at the Bank of England and the latter a minimum proportion of liabilities which must be matched by certain defined liquid assets. There has been a longstanding disagreement about which of the two types of reserves is relevant for the determination of the U.K.'s money supply. (See, for example, the papers in part 3 of the book edited by Harry Johnson.) In 1971 a change in the British financial system (see Bank of England) reduced the size of the cash ratio, but not necessarily its importance. During the period studied in this paper -- 1973 through 1978 -- the required liquid-asset reserve ratio was 12-1/2 percent of eligible liabilities while the cash ratio was 1-1/2 percent for London clearing banks and zero for all other banks.[2/] The liquid-asset requirement pertains to eligible liabilities in the current month, while the cash-balance requirement pertains to eligible liabilities in the preceding month. Eligible liabilities essentially are sterling deposit liabilities. Liquid-asset reserves include balances at the Bank of England other than special deposits and supplementary special deposits (see below), U.K. Treasury bills, call money in the London discount market, certain commercial bills, and some other assets. Cash reserves comprise the first item only, i.e., balances at the Bank of England, and do not include currency held by the banks. The cash balances at the Bank of England do not bear interest. In addition, the Bank of England can call for special deposits to be placed by the banks in the Bank. These special deposits are a certain percentage -- stipulated by the Bank -- of eligible liabilities and pay a rate of interest equal to the Treasury bill rate. Finally, the Bank can set a limit to the growth of the interest-bearing component of eligible liabilities and require non-interest-bearing deposits to be placed with the Bank if the limits are violated. (This supplementary special deposit scheme is often referred to as the "corset.")

An important component of banks' liquid-asset reserves is call money at the discount houses. The discount houses play an important role as financial intermediaries, particularly with respect to the relationship between the Bank of England and the banks. When banks are short of cash, i.e., balances at the Bank of England, they call in money deposited with the discount houses. The discount houses, in turn, obtain the cash from the Bank either by selling it bills or by borrowing at a penal rate (the Bank's Minimum Lending Rate) at the Bank's discretion. The discount houses are particularly active in the market for U.K. Treasury bills and by agreement with the authorities are obligated to bid for the entire amount of new Treasury bills offered each week. Most, and perhaps all, of the functions of the discount houses could be performed by the banks themselves in a more integrated financial system, and in this paper the discount houses are treated as part of the banks. Although some aspects of the British financial system are obscured by this treatment, the consolidation allows one to focus on a central issue of this paper -- the reserves of the banking system. When the banks and discount houses are combined it becomes clear that call money is not a true reserve of the banking system. Indeed in the consolidated balance sheet it does not even appear; it is merely an internal accounting item. Nevertheless, because the reserve requirements refer to banks' accounts that are not consolidated with the discount houses, call money still qualifies as a liquid-asset reserve for the purpose of complying with the liquid-asset reserve requirement.

On the other hand, Treasury bills and the other bills eligible for use as liquid-asset reserves do constitute at least potential reserves of the banking system because the Bank of England often stands ready to purchase such assets at market prices. However, because in some cases nonbanks issue these bills, the supply of these assets is not directly under the control of the monetary authorities. Therefore, because liquid-asset reserves can be either created by the banking system -- as in the case of call money -- or fairly readily produced by and obtained from nonbanks -- as in the case of bills -- the liquid-asset reserve requirement would appear not to be much of a constraint on the banking system. In addition, if such liquid-asset reserves constitute at least part of the monetary base, the ability of the authorities to control the base is called into question.

One of the methods by which the Bank of England tries to control the money supply is by altering the supply of Treasury bills (liquid assets) through funding operations. This method would seem to indicate that the Bank considers the liquid-asset ratio to be relevant to the determination of the money stock. However, in its day-to-day activities in the London money market the Bank usually operates so as to make the banking system short of balances at the Bank, thereby ensuring that the discount houses have to go to the Bank for cash. The form of assistance chosen by the Bank -- i.e., purchases of bills or lending at a penal rate -- then exerts an influence on interest rates and market conditions. This type of activity would seem to indicate that the cash ratio might be the relevant ratio because of its role in determining interest rates and hence the money stock.

In this study the conventional definition of the monetary base -- that is, cash held by banks and nonbanks including banks' cash deposits (but not special and supplementary special deposits) at the central bank -- is used. The role of liquid-asset reserves in the banking system's demand for this monetary-base variable is investigated empirically. Even though there is no mandatory requirement that banks hold vault cash, banks will hold a certain amount for prudential reasons and for normal business transactions with their customers. Similarly, the banking system may want to hold more cash balances at the Bank of England than are needed to meet the mandatory cash requirement in order to facilitate interbank clearing. Thus it is to be expected that there will be a well-defined demand for central bank liabilities despite the lack of any mandatory requirement for the banks to hold more than a small amount of such liabilities. This study treats the demand for bank cash reserves as being derived from the needs of the banking business as well as from the reserve requirement imposed by the authorities.

II. The Model

A. The Monetary Base

The monetary base (B) is defined to be the sum of banks' cash reserves (R) and the nonbank public's holdings of cash (PC). Therefore the monetary base usually consists of the stock of central bank liabilities held by the banks and the nonbank public. In the standard monetary-base approach to monetary theory, certain definitions are presented and manipulated until the money stock (M) is shown to be related to the monetary base by a multiple involving various ratios. These ratios are then postulated to be functions of a few variables and therefore the "money multiplier", i.e., the ratio of the stock of money to the base, is also postulated to be a function of those same variables.[3/] That is,

$$(1)\quad M = \left[\frac{\frac{PC}{D} + 1}{\frac{R}{D} + \frac{PC}{D}}\right] B.$$

where D represents the nonbank public's holdings of bank deposits, and M=PC+D. In the present paper the behavior of the reserve ratio -- R/D -- is investigated. The behavior of the currency ratio -- PC/D -- is beyond the scope of the present paper.

B. The Demand for Reserves

Before discussing the banks' demand-for-reserves function, it is necessary to define the following terms:

R = banks' holdings of vault cash and deposits at the Bank of England exclusive of special deposits and supplementary special deposits;[4/]

RR = quantity of R which the banks are required by "law" to hold;[5/]

CTB = banks' holdings of commercial and U.K. Treasury bills eligible for sale to the Bank of England and qualifying as liquid-asset reserves;

D = sterling deposit liabilities of the banks, including certificates of deposit;

DD = sterling demand-deposit liabilities of the banks;

TD = sterling deposit liabilities of the banks other than demand deposits, i.e., $TD \equiv D-DD$;

λ = ratio of demand deposits to total deposits, i.e., $\lambda \equiv DD/D$;

P = price level;

r_{TB} = interest rate on U.K. Treasury bills, i.e., the interest rate on a close substitute for R;

r_{LD} = the cost to the banks of raising additional funds by borrowing from the nonbank public;

PBMLR = the expected cost to the banks of obtaining funds from the Bank of England -- represented by the product of the Bank's Minimum Lending Rate (MLR) times a proxy for the probability that the banks will have to borrow at MLR;

SSD = binary variable reflecting the operation of the supplementary special deposits scheme.

The demand-for-reserves function -- in general form -- is:

$$(2)\quad R=f(\overset{-}{r_{TB}},\overset{-}{r_{LD}},\overset{-}{PBMLR},\overset{-}{SSD},\overset{+}{D},\overset{+}{P},\overset{+}{\lambda},\overset{+}{RR},\overset{-}{CTB}),$$

where the signs indicate the predicted signs of the partial derivatives. In equation (2) there is no variable representing the yield on reserve assets because in this paper a maintained hypothesis is that bank reserves consist solely of vault cash and cash balances at the Bank of England, and these assets do not bear interest. The predicted signs of the partial derivatives are readily explained. An increase (decrease) in r_{TB} increases (decreases) the opportunity cost to the bank of holding a cash-reserve asset and thus it is predicted that such increases (decreases) will decrease (increase) the demand for reserves; hence the predicted sign for r_{TB}. Similarly, an increase, for example, in r_{LD} increases the cost to the bank of obtaining funds and thus leads the bank to economize on its holdings of non-interest-bearing assets; thus the predicted negative sign. The effect of a change in PBMLR is negative because an increase, for example, in PBMLR increases the cost of obtaining reserves, which would tend to reduce the demand for R.[6/] The imposition of the corset raises the cost to the banks of increasing liabilities above a specified amount; the increase in cost may tend to induce the banks to economize on reserves, as in the case of an increase in r_{LD}. Thus, the predicted sign of SSD is negative. An increase (decrease) in the nominal quantity of deposits, D, can be expected to increase (decrease) the demand for reserves, hence the predicted positive sign. The price level, P, is included in equation (2) because an increase, for example, in the level of real deposits would not lead necessarily to a proportionate increase in the demand for reserves; there may well be economies of scale in the holding of reserves in that as the quantity of real deposits increases the ratio of reserves to deposits can decline without increasing risk, hence the predicted positive sign for P. On the other hand, in the absence of money illusion on the part of both banks and depositors it would be expected that proportional increases in the price level and other nominal variables (i.e., D, RR, and CTB) would lead to a proportionate increase in the demand for (nominal) reserves. One might expect that demand deposits require more reserves than do other deposits because they are more likely to be withdrawn. If so, an increase (decrease) in the ratio of demand deposits to total deposits will increase (decrease) the demand for reserves, holding the total level of deposits constant. Therefore the predicted sign of λ is positive. An increase, for example, in required reserves can be expected to increase the demand for reserves by approximately the same amount; hence the positive sign for RR. As mentioned in the preceding section, it is possible that certain liquid assets other than cash also function as bank reserves in the United Kingdom in that legal reserve requirements are stated in terms of such assets and because the assets are fairly readily sold to the Bank of England for cash balances at the Bank. These liquid assets are denoted as CTB in this study and to the extent that they are substitutes for R, the predicted sign of the partial derivative with respect to CTB will be negative: the more CTB is held, the less cash is necessary as a reserve.[7/] The CTB variable itself as well as its interest rate -- r_{TB} -- is included in equation (2) in order to represent the effect on the banks' demand for cash of the Bank of England's policy of often standing ready to exchange cash for CTB at prevailing market rates. Thus the quantity held as well as the price of CTB can be expected to affect the demand for R.

C. Functional Form

The demand-for-reserves function is specified to be:

$$(3)\quad R/P=\alpha+(\beta_0+\beta_1 r_{TB}+\beta_2 r_{LD}+\beta_3 PBMLR+\beta_4 SSD)(DD/P)$$
$$+(\delta_0+\delta_1 r_{TB}+\delta_2 r_{LD}+\delta_3 PBMLR+\delta_4 SSD)(TD/P)$$
$$+\theta(RR/P)+\phi(CTB/P)+\eta\ ,$$

where η is an error term and the absence of money illusion has been imposed by expressing the equation in real terms. The additional constraint that reserves change by the same amount as required reserves can be imposed by setting $\theta=1$. Subtraction of (RR/P) from both sides of the equation then yields an equation that represents a demand for excess reserves and is the behavioral function that relates the banks' demand for prudential and transactions cash reserves to certain economic variables.[8/] It is this equation that is central to the question of the feasibility and desirability of a monetary policy based on the central bank's manipulation of the outstanding supply of its liabilities, both with and without mandatory reserve requirements.

Equation (3) has some useful properties: (1) the constant term, α, allows the average reserve ratio to vary as the level of real deposits varies while the ratio is unchanged with respect to proportional changes in nominal quantities and the price level; (2) the response to changes in DD and TD can differ and these differing responses are functions of a few key variables; and (3) the (RR/P) and (CTB/P) variables enter additively so that the equation is readily transformed into an excess-reserves equation (as mentioned above) and the relationship between R and CTB can be inferred directly from the coefficient of (CTB/P). If R and CTB are interchangeable as bank reserves, $\phi=-1$ and equation (3) can be transformed into a demand function for cash reserves plus liquid-asset reserves by adding (CTB/P) to both sides of the equation.[9/]

The error term, η, can be expected to be heteroscedastic and, in particular, it can be expected to vary with the real size of the banks' deposit liabilities, i.e.,

$$\eta=\varepsilon(D/P);\ \ \varepsilon \sim N(0,\sigma^2).$$

In order to remove the heteroscedasticity, equation (3) must be divided through by (D/P) to obtain:

$$(4)\quad XR/D=\alpha(D/P)^{-1}+(\beta_o-\delta_o)\lambda+(\beta_1-\delta_1)\lambda r_{TB}+(\beta_2-\delta_2)\lambda r_{LD}$$
$$+(\beta_3-\delta_3)\lambda PBMLR+(\beta_4-\delta_4)\lambda SSD$$
$$+\delta_o+\delta_1 r_{TB}+\delta_2 r_{LD}+\delta_3 PBMLR+\delta_4 SSD$$
$$+\phi(CTB/D)+\varepsilon\ ,$$

where XR≡R-RR. Equation (4) is the equation that is estimated in this paper. In addition to the right-hand-side variables shown, the equation also includes a binary variable (DUM) equal to unity in July 1978 and zero elsewhere, a linear time trend, and seasonal binary variables. DUM removes an outlier -- in July 1978, banks' cash balances at the Bank of England were at an extraordinarily high level: £616 million compared to £399 million in June and £402 million in August. The trend term is meant to reflect such things as the effects of technological advances in information processing during the period as well as increasing familiarity with the new financial system instituted in 1971. The seasonal variables are required because the data used are not seasonally adjusted.

D. Predicted Signs

The signs of the partial derivatives of equation (4) can be predicted based on the above discussion of equation (2). They are:

$$\partial(XR/D)/\partial r_{TB} = (\beta_1-\delta_1)\lambda+\delta_1 <0;$$

$$\partial(XR/D)/\partial r_{LD} = (\beta_2-\delta_2)\lambda+\delta_2 <0;$$

$$\partial(XR/D)/\partial PBMLR = (\beta_3-\delta_3)\lambda+\delta_3 <0;$$

$$\partial(XR/D)/\partial SSD = (\beta_4-\delta_4)\lambda+\delta_4 <0;$$

$$\partial(XR/D)/\partial(D/P) = -\alpha(D/P)^{-2} \leq 0;$$

$$\partial(XR/D)/\partial P = \alpha/D \geq 0;$$

$$\partial(XR/D)/\partial\lambda = (\beta_o-\delta_o)+(\beta_1-\delta_1)r_{TB}+(\beta_2-\delta_2)r_{LD}+(\beta_3-\delta_3)PBMLR+(\beta_4-\delta_4)SSD >0;$$

$$\partial(XR/D)/\partial(CTB/D) = \phi < 0.$$

III. Estimation

Most, if not all, of the right-hand-side variables in equation (4) are likely to be correlated with the disturbance term, ε. Thus ordinary-least-squares estimation of equation (4) will not yield consistent estimates. In order to obtain consistent estimates, this paper utilizes the two-stage-least-squares (2SLS) technique. Two types of relationships are used to generate the exogenous and predetermined variables needed to compute the instruments used in the 2SLS regression: the demand-for-money function and the monetary authorities' policy-reaction functions.

The general demand-for-money function used in this paper is:

$$\ln M^* = \mu_0+\mu_1 r+\mu_2 \ln y+\mu_3 \ln P,$$

where the asterisk indicates long-run demand, r is a vector of interest rates, y is real income, and the error term in the equation is ignored. Assuming partial adjustment one obtains:[10/]

$$\ln M-\ln M_{-1} = \gamma(\ln M^*-\ln M_{-1}),$$

or,

$$\ln M = \gamma\mu_0+\gamma\mu_1 r+\gamma\mu_2 \ln y+\gamma\mu_3 \ln P+(1-\gamma)\ln M_{-1},$$

where γ is the adjustment parameter. In this paper the relevant demand for money is taken to be the demand for sterling M3. Monthly data are used in this study and in a monthly model it is reasonable to treat real income and the price level as predetermined. However, the r variable must be taken to be a vector of endogenous variables.[11/] Therefore the demand-for-money function supplies the following predetermined variables for use in estimating equation (4): $\ln y$, $\ln P$, and $\ln M3_{-1}$, where M3 denotes sterling M3.

During the period examined in this paper (1973-1978), the monetary authorities were mainly concerned with setting interest rates and did so primarily by manipulating the U.K. Treasury bill rate.[12/] In this paper it is assumed that the authorities had implicit or explicit targets for the rates of growth of real income, prices, the money stock, and the dollar-sterling exchange rate, and changed the Treasury bill rate according to how actual performance compared to the targets. In addition, it is assumed that the authorities took into account the level of the U.S. Treasury bill rate and the prevailing values of the authorities' other policy instruments when setting the U.K. Treasury bill rate. Thus the monetary authorities' reaction function can be represented as:

$$(5)\quad r_{TB}-r_{TB_{-1}} = \pi_0+\pi_1(\ln y-\ln y_{-1}-\tau_1)+\pi_2(\ln P-\ln P_{-1}-\tau_2)$$
$$+\pi_3(\ln M3-\ln M3_{-1}-\tau_3)+\pi_4(\ln EX-\ln EX_{-1}-\tau_4)$$
$$+\pi_5 r_{USTB}+\pi_6\rho_{SD}+\pi_7 SSD+\pi_8 BOR,$$

where the τ_i represent the authorities' targets, EX is the dollar-sterling exchange rate, r_{USTB} is the interest rate on U.S. Treasury bills, ρ_{SD} is the rate of call for special deposits, and BOR denotes discount-house borrowing from the Bank of England. The last three variables in equation (5) are other policy instruments available to the monetary authorities -- recall that in the United Kingdom the quantity of borrowing from the central bank is determined by the monetary authorities. (The Bank's MLR is set in accordance with the r_{TB} target.) The lagged variables in equation (5) are predetermined; it has been argued in the above discussion that lny and lnP can be treated as predetermined also. In addition r_{USTB} can be taken safely to be exogenous to British monetary events. On the other hand, current values of M3 and EX are likely to be correlated with contemporaneous monetary disturbances and must be treated as endogenous variables. The status of the three policy variables -- ρ_{SD}, SSD, and BOR -- must now be determined. In principle each of these variables is subject to a reaction function similar to equation (5), which would make them all endogenous variables. However, only ρ_{SD} and BOR are similar to r_{TB} in their flexibility and the ease with which they can be altered in order to react to approximately contemporaneous events. The corset is a much less flexible policy instrument which cannot be altered effectively from month to month. Thus it is better to consider SSD to be determined by the past history of money growth (or inflation) and not by current variables. Therefore the SSD variable can be taken to be predetermined while the other two policy variables on the right-hand-side of equation (5) -- ρ_{SD} and BOR -- are assumed to be endogenous.

In summary, the policy reaction function -- equation (5) -- provides the following exogenous and predetermined variables: $r_{TB_{-1}}$, lny, lny_{-1}, lnP, lnP_{-1}, $lnM3_{-1}$, $lnEX_{-1}$, r_{USTB}, and SSD, of which some have constrained coefficients. The variables suggested by the demand-for-money function are: lny, lnP, and $lnM3_{-1}$. Combining the two sets of variables in order to run linear unconstrained regressions yields the following list of exogenous and predetermined variables: $r_{TB_{-1}}$, lny, lny_{-1}, lnP, lnP_{-1}, $lnM3_{-1}$, $lnEX_{-1}$, r_{USTB}, and SSD, none of which has a constrained coefficient. These variables are used to obtain instruments for the endogenous variables on the right-hand-side of equation (4) which are then used to estimate equation (4). The 2SLS estimates are reported in section IV. In the Appendix to this paper, the data used in this study are discussed. [13/]

IV. Empirical Results

Preliminary work not reported here indicates that the r_{LD}, PBMLR, and SSD variables may not be statistically significant in equation (4). A simplified version of equation (4) which excludes the r_{LD}, PBMLR, and SSD variables can be obtained by provisionally setting β_2, β_3, β_4, δ_2, δ_3, and δ_4 equal to zero. The resulting equation is:

$$(6)\quad XR/D = \alpha(D/P)^{-1}+(\beta_0-\delta_0)\lambda+(\beta_1-\delta_1)\lambda r_{TB} +\delta_0+\delta_1 r_{TB}+\phi(CTB/D)+\varepsilon .$$

The 2SLS estimate of equation (6) is presented in Table 1. Next the hypotheses that β_2, β_3, β_4, δ_2, δ_3, and δ_4 equal zero are investigated. The procedure for testing these hypotheses is best explained by example. If the variable r_{LD} is a significant explanatory variable in the demand-for-reserves equation, then β_2, δ_2, or both will be statistically significant in equation (4).[14/] Equation (6) augmented by the inclusion of r_{LD} is:

$$(7)\quad XR/D = \alpha(D/P)^{-1}+(\beta_0-\delta_0)\lambda+(\beta_1-\delta_1)\lambda r_{TB}+(\beta_2-\delta_2)\lambda r_{LD} +\delta_0+\delta_1 r_{TB}+\delta_2 r_{LD}+\phi(CTB/D)+\varepsilon .$$

The significance of δ_2 can be determined by examining its t-ratio. If it is found that the hypothesis δ_2=0 cannot be rejected, then the following equation can be estimated:

$$(8)\quad XR/D = \alpha(D/P)^{-1} + (\beta_0-\delta_0)\lambda+(\beta_1-\delta_1)\lambda r_{TB}+\beta_2\lambda r_{LD} + \delta_0+\delta_1 r_{TB}+\phi(CTB/D)+\varepsilon ,$$

and the significance of β_2 is determined by examining the t-ratio of β_2. The t-ratios of δ_2 and β_2 in 2SLS regressions of equations (7) and (8), respectively, are reported in Table 2; analogous information on β_3, β_4, δ_3, and δ_4 is reported in Table 2 as well.[15/]

TABLE 1

2SLS Estimates of Equation (6)

Variable	Estimated Coefficient	t-ratio
Constant	0.0690	3.615
r_{TB}	-0.3488	2.241
λ	-0.0969	1.988
λr_{TB}	0.8796	2.210
$(D/P)^{-1}$	421.40	2.978
(CTB/D)	-0.0336	2.141
DUM	0.0065	3.808
T	-0.00018	8.214
JAN	-0.0036	4.010
FEB	-0.0062	5.906
MAR	-0.0056	5.391
APR	-0.0037	3.764
MAY	-0.0043	4.349
JUN	-0.0032	3.217
JUL	-0.0020	1.980
AUG	-0.0037	4.203
SEP	-0.0034	3.889
OCT	-0.0039	4.538
NOV	-0.0032	3.738
R^2	0.84	
SE	0.0015	
DW	2.363	
n	72	

Notes: DUM is a binary variable equal to unity in July 1978 and zero elsewhere; T is a linear trend term; JAN, ..., NOV are seasonal binary variables; SE is the standard error of the regression; n is the sample size.

TABLE 2

Significance of Additional Explanatory Variables

Variable	Parameter	t-ratio
r_{LD}	β_2	1.444
	δ_2	0.023
PBMLR	β_3	0.073
	δ_3	0.214
SSD1	β_{41}	0.089
	δ_{41}	0.755
SSD2	β_{42}	0.658
	δ_{42}	1.163
SSD3	β_{43}	0.066
	δ_{43}	0.258

Note: See footnote 15.

The results reported in Table 1 indicate that equation (6) performs very well as an explanatory equation for the excess-reserves-to-deposits ratio: all of the coefficients are statistically significant, the R^2 is quite high, particularly considering that the dependent variable is a ratio, the standard error of the regression is about 4 percent of the average XR/D, and there is no evidence of first-order serial correlation. As the results in Table 2 indicate, the additional explanatory variables investigated -- i.e., r_{LD}, PBLMR, and SSD -- are not statistically significant and therefore will be ignored in the rest of this paper.[16/]

In order to test the behavioral model presented in section II, the statistical significance of the various parameters underlying the estimates reported in Table 1 must be ascertained. Table 3 reports the t-ratios of the parameters of greatest interest. As is readily seen, only one of the parameters -- β_0 -- is not statistically significant. Setting β_0 equal to zero yields the following equation:

$$(9)\quad XR/D = \alpha(D/P)^{-1}+\delta_0(1-\lambda)+(\beta_1-\delta_1)\lambda r_{TB}+\delta_1 r_{TB}+\phi(CTB/D)+\varepsilon\ .$$

The 2SLS estimate of equation (9) is reported in Table 4 and the estimates of the parameters of greatest interest are reported separately in Table 5. The Table 5 estimates can be used to evaluate certain partial derivatives of equation (4), which, in turn, can be compared to the predictions presented at the end of section II; Table 6 reports these partial derivatives.

TABLE 3

Estimates of Individual Parameters in Equation (6)

Parameter	Estimate	t-ratio
α	421.40	2.978
β_o	-0.0279	0.910
β_1	0.5308	2.183
δ_o	0.0690	3.615
δ_1	-0.3488	2.241
ϕ	-0.0336	2.141