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More on Substitutability Between Money and Near-Monies

I. INTRODUCTION

FEW SUBJECTS HAVE RECEIVED MORE EARNEST ATTENTION in recent years than the problem of substitutability between money and other financial assets. More than fifteen years ago the pioneering work of Gurley and Shaw (15) (16) (17) rekindled the debate over the theoretical relevance of money substitutability. Their work also initiated a long series of attempts to measure the magnitude of this substitutability (4) (12) (18) (25) (26) (27) (28) (29) (33). Although now most economists accept substitutability as a theoretically important monetary issue (although not always for the same reasons), the same happy state of unanimity does not exist with respect to the empirical side of the debate. Recent empirical studies by Feige (12), Lee (27) (28), Hamburger (18) (19) (20), and Chetty (4) are not in agreement about the importance of substitutability between money and other liquid assets. In dispute is whether money is substitutable for other liquid assets, and if it is, exactly which other assets and to what extent.

Difficulty in interpreting past results stems from a variety of sources. Some researchers use time series data (4) (18) (19) (28) (29), others look at cross-section data (12) (27). Some use micro data (27), while others employ aggregate data (12). Finally, researchers frequently estimate quite different models. It is not surprising, for example, to find one study estimating multiplicative demand equations (18) (28) and another estimating linear equations (12) (27); or to find one using interest

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rate differentials (27), (28) but another using absolute yields (4) (12) (20). In addition, some economists incorporate variables which others do not even mention. For all of these reasons, prior studies have not yielded an unambiguous body of information upon which to base general conclusions about asset substitutability.

This study is another attempt to estimate the degree of money substitutability. Its focus, however, is on "near-money" assets rather than on the entire spectrum of liquid assets. Specifically, we estimate the degree of substitutability between three assets: money, bank savings and time deposits, and nonbank savings institutions' savings deposits. Our conclusions are that there exists little or no substitutability between money and these near-money assets, but that the two kinds of savings assets are highly substitutable with each other.

The present study differs from past studies in that it uses cross-section metropolitan area data. Other studies have used either time series data or more aggregative state cross-section data. Metropolitan area data are superior to both of these alternative data sets. They are preferable to time series data because they largely avoid the serious simultaneity problem associated with time series. An implicit assumption underlying the usual single-equation, time series, demand study which attempts to estimate substitutability (18) (19) (28) (29) is that the supply of money (and near-monies) is independent of the variables in the demand equations. Although this simultaneity problem is well-known in "money" time series work (and commonly dismissed with a footnote), it is likely to be more important for money substitutability studies than for most other kinds of studies. At the very least, the supply of money is not independent of the yield on bank savings deposits. The volume of savings deposits banks hold will affect the volume of demand deposits they can supply because required reserves must be held against savings deposits. Put another way, changes in the savings-to-demand deposit ratio must change the money multiplier.[1] Consequently, it can be shown that since single-equation demand for money studies do not take account of the endogeneous nature of the money supply, they overestimate the cross-interest elasticity between money and bank savings deposits and underestimate the interest elasticity between money and nonbank savings deposits.[2] A second disadvantage of time series data is the high correlation which exists among the variables that explain the demand for money and near-moneys, such as the yields on alternative financial assets. Further, since the relative "qualities" of money and near-moneys have changed substantially over time, it is probably safe to assume that past time-series studies (none of which take quality changes into account) overestimate the effect of interest rates on the demand for these assets. Finally, our data are also superior to state area cross-section data because metropolitan areas are more homogeneous observations and therefore permit more exact measures of the critical yield and quality variables.[3]

[1] See Brunner and Meltzer [2, 11].
[2] A proof of this effect will be provided upon request.
[3] This point is elaborated in section V where we compare our results with those of other cross-section studies.

II. THE MODEL AND THE ESTIMATING EQUATIONS

A. The General Demand Model

The most frequently used approach to measuring the degree of substitutability between money and near-moneys is to estimate a demand for money function that is derived from traditional consumer theory (12) (18) (27) (28). Financial assets are assumed to yield a service stream (liquidity, safety, convenience, etc.) which has a value directly related to the stock of the asset. The stock quantity, therefore, is a proxy for the size of the service stream. Following the traditional demand framework, the demand for this service stream (or financial stock) depends on the price of the asset, prices of related assets, income, and tastes. The demand for money function becomes

$$M = f(Y, r)$$

where M is real money balances, Y is real income, and r is a vector of yields on substitute assets as well as on money itself.

There have basically been two approaches to specifying asset yields. One is simply to define the yield on money as the "direct" cost of maintaining and using demand deposit balances, which is considered to be the negative of the ratio of service charges to demand deposit balances (28). Those using this approach do not introduce the yield on money as a separate argument but rather define the yields on substitute assets to be the yield of a substitute asset minus the "direct" cost of holding money, or the yield on that asset plus the service charge rate (see equation (1)′ below). The second approach is to treat the yield on money as the opportunity cost or income foregone by holding money (12) (27). Here the yield on money (or cost of holding it) is defined as the yield on a substitute asset from which little or no nonpecuniary service is derived, such as long-term Government bonds, plus the service charge on demand deposits. The yield on a substitute asset (or the opportunity cost of holding it) is then defined as the differential between a particular substitute asset's yield and the yield on long-term Government bonds. Here the yield on money is introduced as a separate argument (see equation (1) below). Both approaches, of course, implicitly assume that the flow of services received from holding money or substitute assets (or the "quality" of these assets) does not vary in an important way.

If the form of the estimating demand function is linear, the two approaches are equivalent. Equation (1) represents the opportunity cost approach, equation (1)′ represents the approach I have labelled the direct cost approach, and equation (1)″ is another way of writing either equation (1) or (1)′.

$$DD = k_0' + a_0(BR_L - DDR) + b_0(BR_L - BTSR) + c_0(BR_L - SLMR) + e_0(BR_L - BR_S) + d_0(Y_p) + E_0' \qquad (1)$$

$$DD = k_0' - b_0(BTSR - DDR) - c_0(SLMR - DDR) - e_0(BR_s - DDR)$$
$$+ h\,(BR_L - DDR) + d_0 Y_p + E_0' \quad (1)'$$

$$DD = k_0' - a_0 DDR - b_0 BTSR - c_0 SLMR - e_0 BR_s + hBR_L + d_0 Y_p + E_0' \quad (1)''$$

where $h = (a_0 + b_0 + c_0 + e_0)$, or alternatively, $-a_0 = (b_0 + c_0 + e_0 - h)$, and where:

DD = demand deposits of commercial banks plus currency held by the public (this symbol is also used to represent only demand deposits later in the paper);
Y_p = permanent income;
DDR = yield on bank demand deposits: the negative of the service charge rate on demand deposits;
$BTSR$ = yield on bank time and savings deposits;
$SLMR$ = yield on deposits in nonbank savings institutions;
BR_s = yield on short-term market securities (commercial paper, Treasury bills, etc.);
BR_L = yield on long-term market securities which are assumed to yield no non-pecuniary services (Government bonds, corporate equity, etc.);
E_0' = random error term with the usual characteristics.[4]

Although researchers have commonly used one of the three foregoing specifications of asset yields, they have not all assumed linear demand functions. For example, time series studies generally employ multiplicative (log-linear) demand equations, while cross-section studies usually assume linear functions. If linearity is not assumed, equations (1) and (1)′ can no longer be considered equivalent estimating procedures, and it becomes necessary to choose between them. This problem, unfortunately, is at present unresolved.

Given the difficulty of determining which is the theoretically superior demand function, this author settled for an easier and more practicable solution. First, I estimated both linear and log-linear versions of the demand functions and found the results to be very similar. Since my data (cross-section) have limited variability, this result is not surprising. Second, I chose to adopt the linear rather than the multiplicative equation form because it permitted the use of equation (1)″, which exhibited considerably less multicollinearity than either equations (1) or (1)′. Contrary to what some researchers have argued, using interest rate differentials substantially increased the problem of multicollinearity. Thus, the remainder of this paper assumes that the theoretically correct demand function is linear and homogeneous of degree one.[5]

B. The Cross-Section Equations

The basic demand functions used to estimate substitutability in this study follow directly from equation (1).″ First, on the assumption that the supplies of money

[4] See Johnston [22], p. 107.

[5] For support of this homogeneity assumption, see Patinkin [32, pp. 70–71, 82–88, 89–110], and Motley [30]. For a discussion of the limitations of linear models, see Houthakker [21].

and near-moneys are exogeneous in the cross-section, we can ignore the respective supply functions.[6] Second, in the cross-section market variables such as BR_s and BR_L are constant, and can consequently be excluded from the estimating equations. The three basic equations to be estimated are:

$$DD = S_0 + a_0 DDR + b_0 BTSR + c_0 SLMR + d_0 Y_p + E_0 \tag{I}$$

$$BTM = S_1 + a_1 DDR + b_1 BTSR + c_1 SLMR + d_1 Y_p + E_1 \tag{II}$$

$$SLM = S_2 + a_2 DDR + b_2 BTSR + c_2 SLMR + d_2 Y_p + E_2 \tag{III}$$

The asset yields in these three equations are "effective" yields and therefore implicitly account for variations in both asset quality and nominal yields. If, for example, some individuals must expend a great deal of their time acquiring information and in actually transferring their funds from one asset form to another, their "effective" return (yield) will obviously be lower than it is for individuals who do not have to expend their time in this way (assuming all individuals earn identical nominal yields). Thus, in order to estimate equations (I), (II), and (III) correctly, we include not only the nominal asset yields in the estimating equations but also several proxy variables to represent differences in asset quality due to variations in transaction costs.[7]

III. THE DATA AND VARIABLES

Metropolitan areas (SMSA) are our units of observation. Both published SMSA data and individual bank data are used to construct the required SMSA variables. Specifically, the data consist of thirty-seven areas which have populations ranging from about 300 thousand to over six million and for which mean family income varies between \$4,500 and \$7,400.[8] Metropolitan areas are defined to be self-

[6] This assumption appears considerably more valid for cross-section than for time series. Two forces which work to make the supply of money endogenous in time series are: (1) the relationship between discretionary monetary policy and the yield variables in the demand functions (e.g., yields on savings deposits), and (2) the previously discussed endogeneous nature of the money multiplier. Since cross-section studies compare different regions of the country at a moment in time, and since monetary authorities do not respond in a selective manner to regional interest rate differences, discretionary monetary policy is not a problem. The effect of an endogenous money multiplier is less certain, although it too seems unimportant. The market for bank reserves is national rather than local so that banks in a particular region need not necessarily curtail their supplies of demand deposits if, for example, they happen to hold large volumes of savings and time deposits. Further, the data used in this study are for 1962, when the supply of bank reserves was plentiful. It should be recognized, however, that a simultaneity problem may exist even in cross-section data, since the savings rates paid by banks and savings institutions are surely influenced to some extent by locally determined asset yields.

[7] For those interested in a more detailed treatment of the differences between effective and nominal yields, as well as a theoretical justification of why transaction cost variables enter our estimating equation in a linear manner, see Appendix 1.

[8] These data are essentially the same as those used in my previous study and are described fully there. See [9], pages 1 and 26–27. One change requires discussion, however. This study excludes the San Francisco metropolitan area on the rationale that it is a poor observation. Specifically, the level of bank savings deposits per capita in San Francisco was \$1,480, com-

sufficient, highly integrated economic areas. Further, several empirical studies of banking markets have either directly or indirectly supported the contention that these areas are reasonably separate and distinct deposit markets (8) (9) (23) (37).

Most variables used in the regression equations are mid-year values for each metropolitan area during the year 1962. For example, the volume of demand deposits, etc., is the amount outstanding on June 30, 1962. Interest rates on each kind of asset are calculated by dividing total annual interest expenses of all banks in the metropolitan area by the mean value of total deposits (such as total savings deposits).[9] A few variables, however, such as the income and population per office variables are calculated somewhat differently and are described below.[10]

The specific variables used in the estimated demand equations are defined as follows:

DD	= Per capita demand deposits held by individuals, partnerships, and corporations, excluding deposits held by nonbank savings institutions.
BTS	= Per capita commercial bank time and savings deposits held by individuals, partnerships, and corporations
SLM	= Per capita nonbank savings liabilities held in mutual savings banks and savings and loan associations.
Y_{59}	= Per capita personal income, 1959.
Y_{62}	= Per capita personal income, 1962.
Y_a	= Average per capita personal income $(Y_{59} + Y_{62}/2)$
Y_f	= Average personal income per family
DDR	= Actual interest rate charged on commercial bank demand deposits, or the negative of service charge rate on demand deposits.
BTSR	= Actual interest rate paid on commercial bank time and savings deposits.
SLMR	= Actual interest rate paid on nonbank savings deposits: weighted average of yields on savings and loan association deposits and mutual savings bank deposits, the weights being the respective deposit balances in each *SMSA* at mid-year.
N_b	= Population per bank office.
N_s	= Population per nonbank savings office: savings and loan offices plus mutual savings bank offices.

pared to a mean level for all observations of $451. In addition, the average interest rate paid by savings and loan associations on savings deposits in San Francisco was 5 percent compared to a mean for all observations of slightly under 4 percent. These deviations suggest that an implicit assumption of this study is inappropriate for the San Francisco area: that is the assumption that metropolitan areas are separate deposit markets. Besides the individual bank data, the main data sources are: *Annual Report of the Federal Deposit Insurance Corporation, 1962; Bank Deposits by State and Country*, 1962, Federal Reserve Board; *Combined Financial Statements*, 1962, Federal Home Loan Bank Board; and *Annual Report of the National Association of Mutual Savings Banks, 1963.*

9 For statewide banking areas, the assumption is that all of a bank's branch offices pay the same interest rate. This is the customary bank policy.

10 Although it would have been desirable to use observations for more than one year, this was impossible. The data on individual banks used in this study were available for only 1962.

MSB	= Dummy variable for presence of mutual savings banks in $SMSA$ (1 if mutual savings banks operate, otherwise zero)
A_s	= Advertising expenditures per capita by nonbank savings institutions.
FS	= Family size: average number of people in family in 1960.
TP	= Total population in $SMSA$, 1960.
R_c, R_s, R_w	= Regional dummy, variables: $R_c = 1$ if North Central, 0 otherwise; $R_s = 1$ if South, 0 otherwise; $R_w = 1$ if West, 0 otherwise; and $R_c = R_s = R_w = 0$ if Northeast.
ϵ	= Random error terms with usual characteristics.

The variables N_b, N_s and A_s are introduced to account for differences in transaction costs. Low population per bank (or per savings institution) office suggests that customers will need to spend less time going to and from their banks, thereby reducing their opportunity costs.

Similarly, high advertising expenditures provide more information and should reduce individuals' search costs. Differences in these transaction cost variables, therefore, will cause differences in the *effective* yield individuals receive on money and near-money assets.[11] The variables MSB, TP, R_c, R_s and R_w are included primarily for statistical purposes. MSB, which is a dummy variable for mutual savings banks, is introduced on the rationale that consumers may behave differently towards savings banks than they do towards savings and loan associations.[12] For example, they may view mutual savings banks as less risky institutions. The regional dummy variables (R_c, R_s, and R_w) have been used in previous studies and are therefore introduced into some of our equations in order to provide comparable results. Other researchers have argued that there may be important regional differences not taken into account by the other variables. Cultural differences, for example, may conceivably affect savings habits.[13] Finally, total population (TP) of each metropolitan area is introduced as a separate variable because the estimating equations may not be homogeneous with respect to population, an assumption which is implicit when deflating by population.[14]

The income variable used here is also somewhat different from that used in prior studies. Past studies have employed either current income, permanent income, or financial wealth. Since the latter is not available by metropolitan area, the choice was between current and permanent income. Of the two, permanent income seems preferable from a conceptual point of view because it encompasses both the trans-

[11] See Appendix I. Figures on bank advertising expenditures by $SMSA$ are not available. In 1962, total bank advertising expenditures were, in any case, very small. In recent years, however, they have increased markedly. A structurally complete model would also include bank advertising.

[12] The liabilities of mutual savings banks and savings and loan's are combined because we are primarily interested in substitutability between commercial bank and nonbank liabilities. In addition, since mutual savings banks operate in only eleven states, it was preferable to combine them with savings and loan's when estimating cross-section equations. Operationally, they are practically identical.

[13] Since our demand deposit variable includes business deposits, regional dummy variables may also reflect the variation in business deposits relative to household deposits.

[14] Meltzer presents evidence to indicate that this assumption is inappropriate for time-series demand for money equations. See [29, pp. 234–37].

action and wealth demands.[15] It is not, however, possible to compute permanent income for 1962 by metropolitan areas with the Friedman and Schwartz technique (14), because metropolitan income data is available only for 1962 and 1959 (35). Given this limitation, a simple average was taken over the income figures for the years 1959 and 1962. This variable arguably approximates permanent income.[16] In addition, although income per capita is the most frequently used income variable, the demand theory underlying the equations estimated in this study calls rather for family income. It is the family which is the relevant decision-making unit rather than the individual. Some equations estimated with per capita income, therefore, also contain family size (*FS*) as a separate variable. Alternatively, equations are estimated using only family income.

Finally, contrary to the general demand model set-out in part II, all of the asset stock and income variables are in nominal rather than real values. In addition, no attempt is made to introduce a price-expectation variable. The reason for this procedure is simply that adequate price data are not available by metropolitan area. How serious are these omissions? The omission of a price-expectations variable is unlikely to be important. First, since the difference in price changes between metropolitan areas is much smaller than the variation of prices for all metropolitan areas (national prices), price expectations will arguably be formed on the basis of national price experience, which is the same for all cross-section observations. Second, to the extent that local price changes do affect expectations, regional interest yields may already reflect these differences.

Using nominal rather than real values for asset stocks and income may be a more serious omission. If, for example, local price levels are positively related to local yields on near-money assets, we may find a complimentary relationship between nominal money balances and the yields on near-money assets; whereas, if real money balances were used, we would have found substitute relationship. A negative relationship between local yields and prices, on the other hand, would cause us to overestimate the degree of substitutability if we used nominal values. Available evidence suggests that the use of nominal values is not responsible for our results. For thirteen of our sample metropolitan areas for which consumer price data is available in 1962,[17] the simple correlation coefficients between the consumer price index and *BTS* and *SLM* yields are −27 and −14 respectively. Since a negative relationship between price levels and near-money yields will cause us to overestimate rather than to underestimate the degree of substitutability between money and near-money, our finding (presented in the next section) that there is no substitution

[15] Recent studies also suggest that permanent income is a better explanatory variable than either current income or nonhuman wealth. See [5] and [25].

[16] The demand equations were also estimated with 1959 and 1962 per capita income. The results did not change substantially. Generally, income in 1962 yields slightly higher elasticities and 1959 income yields slightly lower elasticities than the average income variable. The only exception is the nonbank savings equations, where the 1962 income elasticity is significantly smaller than the 1959 income elasticity and somewhat smaller than the average income coefficient. In no case, however, does the use of one measure of income rather than another alter the conclusions with respect to asset substitutability.

[17] See [36].

between money and near-money is clearly not due to the use of nominal values.

Cross-section data also has its drawbacks. A usual problem is lack of variability. For example, the variability of the three critical interest yield variables used in this study is as follows. The yield (or service charge) on demand deposits has a range of 112 basis points, about double its mean value; the yield on bank savings deposits has a range of 189 basis points, which is 61 percent of its mean value; and the yield on nonbank savings deposits has a range of 94 basis points, which is only 24 percent of its mean value. Further, the respective standard deviations of these yields, in basis points, are 24, 48, and 20. The small variability of these variables is undoubtedly responsible for their low significance values in the demand equations presented in the next section. The yield on nonbank savings deposits, which has the smallest variability, performs particularly poorly.

Another problem present in metropolitan data, indeed in all aggregate data, time series as well as cross-section, is the inability to separate household and business ownership of demand deposits.[18] If business deposits are random with respect to the independent variables, this problem will not bias our results.[19] There are good reasons to expect such randomness for the data used in this study, especially with respect to the critical yield variables. First, either because of legal prohibitions or lack of desire, businesses did not hold many savings deposits in 1962, so that they may not have been sensitive to the yields on these assets. Second, demand deposit balances held by businesses are often so large that service charges are not a relevant consideration. Lastly, the magnitudes of the income coefficients estimated in the next section compare favorably with those obtained in another study (27) where this data problem did not exist.

IV. EMPIRICAL RESULTS

Estimating the parameters of equations I-III (or equation 7 of Appendix I) allows us to investigate substitutability in several ways. First, the estimated interest rate parameters can be observed; second, we can look at the "cost" parameters (convenience and advertising); and, third, the results of all three equations can be compared to ascertain their consistency. Although the following empirical work fails to isolate strong statistical relationships, the internal consistency of the results nevertheless suggests definite conclusions about asset substitutability.

Table 1 presents the estimated equations. The first five equations (part A) are for demand deposits (*DD*), the second five (part B) for bank time and savings deposits

[18]In 1962, business ownership of bank savings deposits was not important, especially for this study, since New York City, San Francisco, and Los Angeles are not among the observations. There may, however, have been a concentration of business savings in one area which is included in our sample-Chicago. Consequently, the regression equations presented in Table 1 were also estimated with Chicago omitted from the sample. The results were identical. For a discussion of the business savings market, see Willis [38].

[19]With a random error in the dependent variable, we would still obtain unbiased regression coefficients. Such an error, however, would raise the standard errors of all regression coefficients and therefore cause us to understate the statistical significance of the regression coefficients.

TABLE 1 (PART A)

Eq. No.	Dependent Variable	Constant	Y_a	Y_f	DDR	$BTSR$	$SLMR$	N_b	N_s	MSB	FS	A_s	TP	R_c	R_s	R_w	R^2	F
(1)	*DD*	-315.15 (956.68)	.3186*** (.0898)		475.64*** (124.16)	31.33 (63.67)	191.68 (155.12)	-.0007 (.0048)	.0052 (.0042)	-16.17 (79.61)	-106.26 (181.71)	-.0316 (.0976)		-42.35 (62.43)	155.85* (71.20)	133.05 (112.18)	.75	5.83***
(2)	*DD*	-28.73 (1015.33)	.2827*** (.0906)		486.45*** (118.52)	63.27 (67.22)	220.05 (151.86)	.0036 (.0043)	.0000 (.0043)		-234.03 (195.08)	-.0720 (.1011)					.62	5.76***
(3)	*DD*	-276.23 (1061.61)	.3325*** (.1022)		495.03*** (119.52)	59.52 (67.69)	228.10 (152.89)	.0047 (.0045)	.0016 (.0048)		-189.45 (202.86)	-.0614 (.1023)	-.2106 (.2456)				.63	5.15***
(4)	*DD*	-1229.60 (612.66)		.0915*** (.0330)	423.30*** (121.21)	40.49 (70.73)	332.00 (152.34)	.0043 (.0047)	.0047 (.0048)			-.0168 (.1055)	-.2648 (.2593)				.58	4.73***
(5)	*DD*	-1188.08** (509.13)	.2984*** (.0854)		483.75*** (101.46)	80.95 (60.08)	306.89 (132.62)										.59	11.38***

TABLE 1 (PART B)

Eq. No.	Dependent Variable	Constant	Y_a	Y_f	DDR	$BTSR$	$SLMR$	N_b	N_s	MSB	FS	A_s	TP	R_c	R_s	R_w	R^2	F
(1)	*BTS*	1817.15 (1256.71)	.0777 (.1180)		274.05 (163.10)	143.93** (83.63)	-170.79 (203.77)	.0040 (.0063)	.0007 (.0055)	9.94 (104.57)	-343.95* (238.70)	-.1451 (.1281)		-46.34 (82.01)	-126.86 (93.53)	62.02 (147.37)	.37	1.15
(2)	*BTS*	1441.91 (1154.10)	.1458* (.1030)		179.22 (134.72)	139.59** (76.41)	-137.84 (172.62)	-.0014 (.0049)	.0027 (.0049)		-321.38* (221.74)	-.1388 (.1149)					.30	1.48
(3)	*BTS*	1927.17 (1172.95)	.0678 (.1131)		162.39 (132.18)	146.94** (74.86)	-153.64 (169.08)	-.0037 (.0050)	-.0005 (.0052)		-408.80** (224.34)	-.1597* (.1132)	.4130 (.2727)				.35	1.63
(4)	*BTS*	218.71 (577.84)		.0134 (.0365)	84.90 (134.11)	124.38* (78.25)	-37.63 (168.55)	-.0042 (.0053)	+.0028 (.0053)			-.1091 (.1167)	.3507 (.2869)				.25	1.17
(5)	*BTS*	28.80 (576.00)	.1934** (.1006)		152.30 (118.90)	137.10** (70.60)	-92.46 (154.60)										.19	1.46

TABLE 1 (PART C)

Eq. No.	Dependent Variable	Constant	Y_a	Y_f	DDR	$BTSR$	$SLMR$	N_b	N_s	MSB	FS	A_s	TP	R_c	R_s	R_w	R^2	F
(1)	*SLM*	419.05 (2618.70	.5335** (.2459)		-349.34 (339.86)	-278.49* (174.27)	205.02 (424.61)	.0164 (.0132)	-.0025 (.0114)	136.19 (217.90)	-432.31 (497.39)	.4061* (.2670)		-215.97 (170.90)	-224.70 (194.89)	-454.41* (307.07)	.50	1.98
(2)	*SLM*	830.34 (2487.93)	.5262** (.2220)		-222.77 (290.42)	-283.94** (164.71)	-62.04 (372.10)	.0065 (.0105)	-.0007 (.0011)		-196.60 (478.02)	.6049** (.2477)					.40	2.37**
(3)	*SLM*	1396.14 (2603.44)	.4353** (2510)		-242.39 (293.38)	-275.37* (166.15)	-80.45 (375.28)	.0039 (.0110)	.0044 (.0117)		-298.51 (497.94)	.5806** (.2512)	.4814 (.6052)				.42	2.15
(4)	*SLM*	-69.03 (1435.78)		.1232* (.0772)	-346.57 (284.07)	-303.17** (165.75)	70.81 (157.02)	.0033 (.0111)	.0001 (.0112)			.6457** (.2473)	.4010 (.6078)				.39	2.20
(5)	*SLM*	-585.0 (1332.25)	.4932** (.2242)		-271.00 (265.70)	-289.70** (173.35)	217.30 (347.43)										.24	2.47

* = Significant at 10% Level
** = Significant at 5% Level
*** = Significant at 1% Level

(*BTS*), and the last five (part C) for nonbank savings deposits (*SLM*). Each of the three sets of equations uses the same independent variables, permitting us to examine the symmetry of the estimates. Significance levels are based upon both one-tail and two-tailed tests, depending upon which is relevant to the hypothesis in question.

Equation 1 includes dummy variables, and is similar to equations estimated in prior cross-section studies (12) (27). It is the only equation which includes dummy variables (*MSB* and regional variables), and, for all three dependent variables, it yields the highest R^2's. However, analysis of this equation revealed the existence of serious multicollinearity. In particular, the Farrar-Glauber tests (10) showed high intercorrelation between two of the regional dummy variable (R_c and R_s), between the yield on demand deposits and the third regional dummy variable, and between the mutual savings bank dummy variable and the yield on nonbank liabilities. Use of the dummy variables, therefore, results in serious multicollinearity, making equation 1 unsatisfactory.

Since the theoretical basis for including dummy variables in the structural model is by no means clear (other researchers offer very flimsy justifications), additional equations are estimated without such variables. Specifically, equation 2 is identical to equation 1 except that the four dummy variables are omitted. Since this equation includes all of the theoretically relevant structural variables and is relatively free of multicollinearity problems, it would seem to be the preferable equation.[20] Equation 3 adds the variable "total population" to equation 2 in order to determine if deflating by population affected the results of equation 2. Little change can be observed. Equation 4 is estimated with family income in place of per capita income and family size. Finally, equation 5 includes only the income and yield variables, omitting the transaction cost variables and family size. This equation is similar to those estimated in time series studies. Although the discussion which follows is based upon the results of equation 2, which for the reasons given above is considered the superior equation, all of the equations suggest the same general conclusions.

The demand deposit equation contains almost no indications of substitutability. Both of the yield parameters on bank and nonbank savings deposits have positive rather than the negative signs which would indicate substitutability. In addition, none of the convenience cost variables show a relationship with demand deposits. N_b has the wrong sign (positive) and N_s is extremely close to zero. Advertising (A_s), on the other hand, does have a sign consistent with substitutability but is statistically insignificant. The lack of a substitution relationship is also supported by symmetrical findings in the *BTS* equation. There the *DDR* coefficient has the wrong sign (positive) indicating the absence of substitution between demand deposits and bank savings deposits. In the *SLM* equation, however, the *DDR* coefficient has a negative sign which is inconsistent with our other findings, although it is not statistically significant.

[20]Even this equation is not completely free of multicollinearity. In particular, the partial correlation test between *DDR* and *BTSR* still showed a statistically significant relationship. Although admittedly not a defensible precedure, the same equations were therefore run after omitting *DDR*. These results were consistent with our general conclusions.

Both the equations for bank and nonbank savings deposits suggest the existence of substitutability between these two assets. Most convincing is the coefficient for the yield on bank time and savings deposits (*BTSR*), which is statistically significant and has "substitution" signs in both the *BTS* and *SLM* equations. Further verification of substitutability, however, must come from inferential evidence, as the data yields few additional statistically significant relationships. Specifically, the variables N_b, N_s, and A_s all have signs consistent with the substitution hypothesis. N_b is negative in the *BTS* equation and positive in the *SLM* equation; N_s is positive in the *BTS* equation and negative in the *SLM* equation; and A_s is negative in the *BTS* equation and positive in the *SLM* equation. Although we can not place great confidence in any one of these estimates, if taken together, their consistency and symmetry clearly suggest substitutability. The last piece of evidence is the *SLMR* coefficient. It has the expected negative sign in the *BTS* equation but is not statistically significant; it does not have the expected positive sign in the *SLM* equation. The latter result is a serious inconsistency in the symmetry of our findings and is probably attributable to poor data: the *SLMR* variable has considerably less variability than any of the other yield variables (see page 559).

Lastly, income is positively related to all three asset variables. The estimated income elasticities for equation 2 are approximately: 1.00 for demand deposits, .72 for bank savings deposits, and 1.70 for nonbank savings deposits. These elasticities compare favorably with those of other studies (12) (27) (29).

V. COMPARISON WITH OTHER CROSS-SECTION STUDIES

Two similar cross-section studies of substitutability have been done using different data. Feige (12) uses state data; Lee (27) uses household survey data. Metropolitan area data has several advantages over the data used by both Feige and Lee. First, both Feige's and Lee's data are more aggregative and therefore require additional assumptions about the underlying sample distributions. State data is obviously so, while Lee's study is more aggregative because he is forced to use "state" interest yields rather than yields which correspond to the location of his basic unit of observation—households. In other words, Lee assigns the mean "state" interest rate on each financial asset to all households in that state, irrespective of actual local interest rates. Second, Lee is unable to separate households' ownership of commercial bank savings deposits from their ownership of mutual savings bank deposits. He is not, therefore, able to estimate the degree of substitutability between commercial bank and nonbank savings liabilities. Metropolitan area data permits the separation of these liabilities. Lastly, neither Lee nor Feige are able to calculate good variables to represent transaction costs. Lee is unable to include any variables to account explicitly for differences in such costs (transaction costs are likely to vary considerably among households). Feige, on the other hand, does use transaction-cost variables but without success. Since he uses states as observations, and since a state is clearly a poor geographical delimitation of a banking market, his measures of transaction costs are conceptually less satisfactory than ours.

How do our results compare with those of Lee and Feige? First, both Lee and Feige fail to find much of a substitute relationship between demand deposits and bank time and savings deposits.[21] In Lee's equations the yield on bank time and savings deposits does not have a "substitution" sign (negative), while Feige's equations indicate only a weak substitution relationship. Since our findings also do not indicate the presence of such substitutability, this study is further support for the conclusion that no substitutability exists between demand deposits and bank savings deposits.[22]

Second, although Lee finds strong substitutability between demand deposits and nonbank savings deposits, both Feige's and our results suggest the absence of such substitutability. Lee's study yields significant "substitution" coefficients for the savings and loan rate in the demand deposit equation and for the service charge rate in the savings and loan deposit equation, while Feige's results are conflicting. He finds a complimentary relationship in the demand deposit equation but a substitution relationship in the savings and loan equation. Our estimated coefficients are similar in sign to Feige's but are not statistically significant, which suggests the absence of a substitute relationship.

Third, Lee, Feige, and the present study all find some evidence of substitutability between bank and nonbank savings deposits. Feige estimates cross-interest-elasticities of less than one, while Lee's cross-elasticity estimates are considerably higher, ranging up to 2.86. Using the estimates in Table 1 (Equation 2) to calculate cross-interest-elasticities, our results compare to those of Feige and Lee as follows:[23]

	This study	Feige	Lee
Elasticity of *BTS* with respect to *SLMR*	− 1.20	− .55	− 2.87
Elasticity of *SLM* with respect to *BTSR*	− 1.60	.00	.59

In sum, the results of the present study both support and contradict the earlier findings of Feige and Lee. It supports their findings of substitutability between bank and nonbank savings liabilities, but sharply contradicts their (especially Lee's) evidence that demand deposits and nonbank savings deposits are substitutes.

[21] References to Feige are to his equations presented in [12, p. 25, Table 1], and references to Lee are to his equations in [27, p. 451, Table 2]. Although Feige's equations have been questioned by Lee (see [27, p. 453–54]), Lee's criticism, that the dummy variables in Feige's equations are highly correlated with some of Feige's other independent (interest rate) variables, does not seem critically damaging, since the independent variables in question are frequently statistically significant in Feige's equations.

[22] It is interesting to note that Lee attributes the "poor" performance of the *BTSR* yield to its low variability, due to Regulation Q. This is not a problem in the present study. First the *BTSR* exhibits adequate variability as can be seen from its performance in the *BTS* and *SLM* equations. In both cases it is statistically significant with the expected signs. Second, Regulation Q was raised early in 1962, which largely eliminates the problem for my study.

[23] Since the variables are not always exactly the same, as indicated in the earlier discussion, these comparisons are only suggestive. For example, Lee's estimate of −2.87 is with respect to the savings and loan yield and not with respect to the *SLMR* yield. Further, its higher value is probably due to the fact that his dependent variable aggregates commercial bank and mutual savings bank deposits.

VI. CHETTY'S MODEL: ANOTHER APPROACH

Contrary to the findings of this study, Chetty (4) finds a high degree of substitutability between money and near-moneys. His approach is to estimate a household's indifference curve with respect to money and some other near-money asset in order to determine the degree of substitutability (or the partial elasticity of substitution) between these assets.

The indifference curve is derived by assuming that consumer behavior with respect to financial assets can be adequately described by a utility function along the lines of a generalized constant-elasticity-of-substitution production function (7) (31). In particular, the utility function of a consumer is represented as

$$U = (BM^{-\rho} + B_1 X_1^{-\rho_1} + B_2 X_2^{-\rho_2} \cdots + B_n X_n^{-\rho_n})^{-1/\rho}$$

where M is a consumer's money holdings in the present period and the X's are the money (or cash) value of his near-money financial asset holdings in the next period. Assuming $r_1, \ldots r_n$ represent the respective yields on near-money financial assets, the total present cash value of a consumer's next-period holdings of near-money financial assets is given by

$$\sum_{i=1}^{n} \frac{X_i}{1 + r_i}$$, and his budget constraint is given by

$$M_0 = f(Y, r_1, \ldots r_n) = M + \frac{X_1}{1 + r_1} + \ldots \frac{X_n}{1 + r_n}$$

where Y is income and M_0 is a consumer's total cash holdings which he allocates between money and near-money assets.

By maximizing the utility function subject to the budget constraint, Chetty derives a two-equation model from which estimates of the B_j's and the ρ's can be made in order to calculate the partial elasticities of substitution between money and each near-money asset.[24]

[24]These estimates together with the formula for the partial elasticity of substitution give the degree of substitution between money (M) and each near-money asset (X_j's). Specifically, the partial elasticity of substitution is defined as:

$$\sigma_{m,x_j} = \frac{d \log (M/X_j)}{d \log \left(\dfrac{\partial U/\partial M}{\partial U/\partial X_j}\right)} = \frac{1 + \dfrac{B_j \rho_j X^{-\rho_j}}{B \rho M^{-\rho}}}{1 + \rho + (\rho_j - \rho)}$$

This is the Hicks-Allen direct partial elasticity of substitution. See Chetty [4, p. 277]. (Since only ordinal utility is used, B is also set equal to one.)

These two equations are:

$$\log M = a_0 + \sum_{j=1}^{n} a_j \log (1 + r_j) + a_{n+1} \log Y \tag{1}$$

$$\log X_j = \frac{-1}{\rho_j + 1} \log \frac{B\rho}{B_j \rho_j} - \frac{1}{\rho_j + 1} \log \frac{1}{1 + r_j} + \frac{\rho + 1}{\rho_j + 1} \log M \tag{2}$$

Since income (Y) and interest rates (r) may not be exogenous, Chetty argues that simultaneous estimation may not be superior to ordinary least squares (at least with respect to the consistency of the estimates). He therefore uses ordinary least squares to estimate only the latter equation. With time series data, this equation is estimated for bank savings deposits, savings and loan liabilities, and mutual savings bank deposits. His results show a surprising degree of substitutability. All near-money assets are found to be close substitutes for money.

When Chetty's model is applied to cross-section metropolitan area data, our results are different from his and are consistent with the results reported in Section IV of this study. Specifically, equation (2) above was estimated with both ordinary least squares and two-stage least squares for bank time and savings deposits (*BTS*) and for nonbank savings deposits (*SLMS*). *SLMS* is the sum of Chetty's savings and loan and mutual savings bank variables, and M is demand deposits. The estimated equations are (with t-values):[25]

Ordinary least squares:

$$\log BTS = \underset{(3.081)}{1.922} - \underset{(1.484)}{19.65} \log \frac{1}{1 + r_{BTS}} + \underset{(.740)}{.160} \log M$$

$$R^2 = .08$$

$$\log SLMS = \underset{(1.354)}{1.599} - \underset{(.065)}{3.65} \log \frac{1}{1 + r_{SLMS}} + \underset{(1.042)}{.397} \log M$$

$$R^2 = .04$$

Two-stage least squares:

$$\log BTS = \underset{(.228)}{.553} \quad \underset{(2.487)}{1.957} \log \frac{1}{1 + r_{BTS}} + \underset{(1.395)}{.427} \log M$$

[25]The asset variables M, *BTS*, and *SLMS*, are assets per capita. Equations run with undeflated asset variables and population as a separate variable indicated even less substitutability than the estimates presented above.

$$\log SLMS = \underset{(.582)}{1.466} + \underset{(.245)}{1.230} \log \frac{1}{1 + r_{SLMS}} + \underset{(1.114)}{.569} \log M$$

Using these estimates to calculate B_{BTS}, B_{SLMS}, ρ_{BTS}, ρ_{SLMS}, and ρ, and then using these values to calculate the partial elasticities of substitution (see footnote 24) between demand deposits and both *BTS* and *SLMS* at mean values, we have the following comparisons:

Partial elasticities of substitution	Chetty	This study: ordinary least squares	This study: two-stage least squares
$\sigma_{M,BTS}$	30.864	46.942	2.417
$\sigma_{M,SL}$	35.461		
$\sigma_{M,MS}$	23.310		
$\sigma_{M,SLMS}$		6.847	-1.231

Unlike Chetty's study, simultaneous estimation does not give the same results as ordinary least squares. Since with cross-section data the calculated and observed values of M may differ substantially (see Table 1), our two-stage least squares estimates of Chetty's model are clearly preferable to our ordinary least squares estimates. Consequently, the above table shows that the partial elasticities of substitution between M and both *BTS* and *SLMS* are very close to zero (2.417 and -1.231 respectively compared to Chetty's estimates of 30 and 23).

Thus, we conclude that Chetty's approach applied to our data yields results identical to those found earlier in this paper: that there is no substitutability between demand deposits and either bank or nonbank savings liabilities.[26]

VII. CONCLUSIONS

Both the discussion and the empirical results of this paper suggest that a sceptical attitude should be adopted towards past findings which show strong substitutability between money and near-moneys. There are severe data and conceptual difficulties

[26] The disparity in results appears to be due to a difference in data rather than to important conceptual differences in our models. Although Chetty's prices are absolute yields rather than yield differentials (or opportunity cost prices), introducing them into the estimating equations in the form of $1/1 + r$ is as theoretically sound as using opportunity cost yields. In the latter approach consumers are considered to compare two assets (money and a near-money) by comparing them both to a third financial asset (such as long-term bonds), while in Chetty's approach consumers are considered to compare the marginal utility of a dollar of money today with the marginal utility of $1 + r$ dollars of a near-money asset today. Both are valid intertemporal approaches. Unlike Chetty's model, however, models which use yield differentials rather than absolute yields imply that changes in absolute yields need not alter the demand for a financial asset, since yield differentials may remain constant even though absolute yields are changing. The inference is that consumers do not alter their real consumption time-preferences as a result of different interest levels, which seems unlikely. This problem, fortunately, does not arise with respect to the demand equations estimated in Section IV of this study, since our use of cross-section data holds the absolute level of interest rates constant for all observations. Thus, although our's and Chetty's models may not be conceptually identical, they seem similar when applied as we have here.

which hinder statistical attempts to estimate the degree of this substitutability. First, time-series estimates of money substitutability based upon a single-equation approach are biased because of the endogenous nature of the money supply. Second, all past studies fail to distinguish between "nominal" and "effective" asset yields, since they ignore the substantial changes in asset quality which have occurred over time. In this respect, it is not surprising that time-series studies find greater substitutability than do cross-section studies. Although asset quality varies to some extent in the cross-section, it varies far more over time. The strength of the present study is that we use cross-section data and attempt to hold asset quality constant by explicitly introducing quality variables. Our findings of very low or zero substitutability between money and near-moneys may therefore be more realistic than the estimates of high substitutability found in many prior studies.

Our results, however, are subject to several qualifications. First, there is the problem of poor data. In particular, our inability to separate corporate from personal demand deposit balances and the small variability in cross-section interest rates may contribute to the results of this study. Second, even if our findings are correct, they represent only one year of cross-section data, or cover only a small range of the total possible variation in interest yields over time. Since there is no reason to assume a demand function of constant elasticity, different cross-section data may yield different estimates. Despite these problems, the findings of the present study must be considered as at least a tentative refutation of the prior studies which find strong substitutability between money and near-moneys.

On the other hand, the present study supports earlier findings of substitutability between bank and nonbank savings deposits. Since substitutability between these assets can change the money multiplier via the savings-to-demand deposits ratio, monetary authorities may experience difficulty in controlling the money supply. As this problem is a consequence of imposing different reserve requirements on different kinds of banks' deposit liabilities, it would seem advisable for monetary authorities to discard the present system of differential reserve requirements in favor of a system of uniform reserve requirements.

Finally, since almost all empirical studies find substitutability between bank savings deposits and both savings and loans' and mutual savings banks' liabilities, it is clear that there exists no rationale for including one but not the others in any definition of money. Either money is narrowly defined, as suggested by the results of this study, or it is given a much broader definition, such as Lee, Chetty, and Hamburger propose.[27]

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APPENDIX I: ON EFFECTIVE YIELDS AND TRANSACTION COSTS

The necessity of adding transaction cost variables to equations I, II, and III can be seen by examining the underlying portfolio theory. These equations do not include yields on assets subject to market risk, such as bonds or stock, so that the portfolio theory underlying them is simply one of "return versus convenience." Individuals hold liquid assets against the uncertainty of an excess of payments over receipts [1], [34] or in connection with financial transactions [6], such as the purchase and sale of stocks, bonds, and real estate. If an individual holds cash or demand deposits, the most liquid assets, he trades return for convenience. Thus, it is important to define the "return" on near-money assets as correctly as possible if we are to identify substitution relationships between money and these assets.

The return on a near-money asset is not simply the income received during a given period of time. Individuals also incur costs. For example, there are costs in acquiring the pertinent information and in actually transferring funds from one asset form to another. These costs are referred to as "transaction costs" and designated as T_c. The *net* income an individual receives by holding a near-money asset can be expressed as:

$$\left(Q_i \times \frac{n_i}{12} \cdot r_i\right) - T_c^i = \text{net income from } i\text{th asset, where} \tag{1}$$

Q_i is the volume of dollars invested to the ith near-money asset, n_i is the number of months such asset is held, and r_i is the annual nominal yield on this near-money asset. Restated the net or effective yield can be expressed as:

$$\left(\frac{n_i}{12} r_i - \frac{T_c^i}{Q_i}\right) = \text{net yield on the } i\text{th asset.} \tag{2}$$

The yields in the demand equations I, II, and III should be these net or effective yields rather than simply nominal yields.

Since effective yields are not directly observable, an alternative procedure is to use transaction cost variables in addition to nominal yields. Proceeding along these lines, we define

$$T_c^i = \Psi_i Y \tag{3}$$

$$Q_i = j_i Y \tag{4}$$

Since the transaction costs related to holding money and near-money assets consist mainly of the time expended in searching and transacting, transaction costs are expressed as the value of an individual's lost time, or as $\Psi_i \times Y$, where Ψ_i is the proportion of one's year used-up on the ith asset and Y is a person's annual earnings. The sum $\Psi_i Y$, therefore, is the money value of an individual's annual transaction costs in the ith asset. Q_i is the average size of an individual's transaction in the ith asset during the year, and is expressed for simplicity as a proportion of his annual income (where j_i is some proportional factor). Although it seems reasonable to assume that individuals with higher incomes hold more wealth in all asset forms and therefore shift larger dollar balances when they do switch assets, the validity of assuming a constant proportional relationship is, of course, debatable.

Given these assumptions as at least approximately realistic, however, annual transaction costs per dollar can be expressed as

$$\frac{T_c^i}{Q_i} = \frac{\Psi_i Y}{j_i Y} = \frac{1}{j_i} \Psi_i \tag{5}$$

substituting into equation (2) for T_c^i/Q_i gives us

$$\left(\frac{n_i}{12} r_i - \frac{1}{j_i} \Psi_i\right) = \text{net yield on the } i\text{th asset.} \tag{6}$$

If it can further be assumed that n_i is identical for all observations,[1] the basic demand equations I–III can be written as:

$$DD, BTS, \text{ or } SLM = k_0' + aDDR + bBTSR$$
$$+ cSLMR + dY_P - \frac{a}{j_{DD}} \Psi_{DD} - \frac{b}{j_{BTS}} \Psi_{BTS} - \frac{c}{j_{SLM}} \Psi_{SLM} + \epsilon. \tag{7}$$

Finding proxy variables to represent the transaction cost variables Ψ_{DD}, Ψ_{BTS}, and Ψ_{SLM} is obviously difficult. In our empirical work we used three such variables: Population per bank office (N_b), Population per nonbank savings office (N_s), and advertising expenditures per capita by nonbank savings institutions (A_s)[2]. These variables were added to our estimating equations in the linear manner suggested by equation (7) above. In sum, the above discussion demonstrates the following: (1) adding transaction cost variables to our estimating equations in a linear manner suggests definite (and rather restrictive) assumptions about the nature of transaction costs; (2) the values of the estimated parameters for the transaction cost variables Ψ_{DD}, Ψ_{BTS}, and Ψ_{SLM} depend upon the values of j_{DD}, j_{BTS}, and j_{SLM} and should therefore be interpretated with caution; and (3) the estimated parameters of the nominal yield variables DDR, $BTSR$, and $SLMR$ depend upon the expected n_i's and should therefore also be interpreted with caution. In the text we follow the usual procedure of ignoring these difficulties.

[1] More correctly, n_i should refer to an individual's "expected" n_i. As I am using aggregate cross-section data, the assumption of identical n_i's for all observations may be quite reasonable. It clearly would not be if households were the units of observation.

[2] See article text.