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Introduction and Summary

> We must have a good definition of Money,
> For if we do not, then what have we got,
> But a Quantity Theory of no-one-knows what,
> And this would be almost too true to be funny.
> Now, Banks secrete something, as bees secrete honey;
> (It sticks to their fingers some, even when hot!)
> But what things are liquid and what things are not,
> Rests on whether the climate of business is sunny.
> For both Stores of Value and Means of Exchange
> Include among Assets a very wide range,
> So your definition's no better than mine.
> Still, with credit-card-clever computers, it's clear
> That money as such will one day disappear;
> Then, what isn't there we won't have to define.
>
> [Boulding 1969]

Monetary theory has a large number of unresolved basic issues. In fact, at times it is doubtful just what the meaning of the word "money" is, as shown by the above quotation. Is money's role best described as a wealth asset in an efficient portfolio? Virtually all of modern theory views money's role as almost exclusively an asset in a wealth portfolio. An alternative view, referred to here as the classical view, considers money's principal role as the most efficient lubricant for present transactions and as an inventory against uncertainty. As in most inventory models, the cost

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of holding money is relevant. In this paper money is considered to be the money of the classical view.

The first section of this paper attempts to show that the empirical counterpart of the classical concept of money must include unutilized trade credit available along with demand deposits and currency. Unutilized trade credit available is defined as the total additional capacity, aggregated over all entities, to acquire goods directly from sellers by incurring debt. Since unutilized trade credit available is an acceptable means of payment, there is no need to possess an intermediary commodity—demand deposits and currency—in order to acquire goods and services.

In the second section of this paper estimates are made of the simultaneously determined supply and demand equations for total real money, which include unutilized trade credit available. The demand equation, as opposed to the more traditional econometric estimates, includes two additional variables, one of which represents the real economic size per average unit in the economy; the other represents "the number of hands through which output passes," or the ratio of transactions to income (Keynes 1936, p. 196). Both of these variables are found to be statistically significant, thus supporting the view that economies of scale exist in real money balance holdings and also that in the postwar U.S. economy the demand for money is basically a transactions demand.

The third and final section empirically compares and contrasts three views of the money market. These three views include: (*a*) real money as a form in which wealth is held—demand deposits, currency and time deposits of commercial banks—as it is related to measures of wealth such as real permanent income, (*b*) real money as a transactions commodity—demand deposits and currency—as it is related to measures of transactions such as current real national income, and (*c*) an expanded concept of real money as a transactions commodity—as it is related to total transactions. Estimates of the reduced-form equations are made for all three types of money for the period 1946–63. The estimated equations, together with given exogenous variables, are used to compare the three approaches in terms of their standard errors of estimates and their predictions for 1964, 1965, and 1966. The transactions model that includes unutilized trade credit available is found to be the most accurate of the three competing models. It has the added advantage, given the interest rate, of being able to predict the distribution of money balances between unutilized trade credit available and demand deposits plus currency.

I. Trade Credit

Historically, trade credit—more specifically trade debt, one component of trade credit—has occupied the attention of some monetary economists.

Intuitively, trade debt appears to be closely related to money and was therefore deemed relevant to analyze in the context of the money market. In general, two basic hypotheses have been formulated—the "gross" and the "net" trade-debt theories.

Trade debt is here defined as the portion of trade credit which has been used. The other portion, unutilized trade credit available, is the additional amount of goods and services which could be acquired by economic entities under existing credit terms. Thus trade credit is definitionally equal to trade debt plus unutilized trade credit available—the sum of all entities limits on credit for direct purchase of goods and services.

The gross trade-debt theory can be viewed within a macroeconomic framework.[1] Assume that the demand for money—demand deposits plus currency—is of the following form:

$$M_t^* = kX_t, \tag{1}$$

where M_t^* is the desired stock of demand deposits plus currency at time t, X_t is total money disbursements per unit time, and k is the desired ratio of money to money expenditures. Total current money disbursements, X, are equal to total current transactions in goods and services plus the debt acquired during previous periods which must be paid less current transactions in goods and services taking place with debt. Present transactions taking place with debt less debts which must be paid are the increase in the total amount of trade debt. Thus

$$X_t = T_t - \Delta TD_t, \tag{2}$$

where T is total transactions in goods and services and ΔTD is the change in gross trade debt.

Substituting (2) into (1) we get:

$$M_t^* = kT_t - k\Delta TD_t. \tag{3}$$

Thus, increases or decreases in the aggregate amount of gross trade debt can be conceptually related to money. If one wishes to relate changes in the amount of gross trade debt to money, then money can be considered to be equal to demand deposits plus currency plus $k\Delta TD$.

The net trade-debt theory assumes that initially some firms have "idle" money balances, whereas other firms are using their money balances fully. In a macrocontext this can be represented as

$$M_t^* = kX_t, \tag{4}$$

and $M_t = M_t^* + M_{it} = kX_t + M_{it}$, where M_t is the total stock of money, M_t^* is desired money balances (determined by the level of money expenditures, X_t), and M_{it} is the stock of idle money balances held. Trade

[1] The "gross" and "net" trade debt theories are more elaborately described in Brechling and Lipsey (1963).

debt—more specifically the net extension of trade debt—is the means by which money is transferred from economic entities that have idle money balances to entities that need additional money balances. The transfer of idle balances into desired balances occurs through a net extension of trade debt. Thus net extensions of trade debt have the same effect as increases in the money stock.

The above formulations only touch upon the significant role played by trade credit in the money market.[2] In the literature, attention has been given solely to the trade-debt component of trade credit. Trade debt per se, such as accounts payable, is equivalent to demand deposits previously owned but presently depleted, that is, spent. As I shall attempt to show, unutilized trade credit available is conceptually very similar to demand deposits and currency.

A. The Demand for Money and Unutilized Trade Credit Available

The separation of purchases from sales through the use of money is the principal characteristic that distinguishes a market economy from a barter economy. Given an institutional environment that determines the discrete time intervals at which payments are made for goods and services, there is reason to hold real money balances rather than other assets if the fixed costs of lending or borrowing small amounts of money for short periods of time are prohibitively high. This is the basis of the transactions demand for money. Transactions balances of money are used as a temporary abode of purchasing power in order to make expenditure flows mesh with receipt flows intertemporally.[3] Unutilized trade credit available as well as demand deposits and currency can satisfy the transactions demand for money.

Imagine an individual who is paid \$500 on the last day of every month for labor services rendered during the month. Also imagine that he purchases apples continuously over the entire month at a rate of \$500 per month. Likewise, imagine an apple retailer who purchases apples on the fifteenth day of each month for \$500 and sells all of them to the apple consumer during the month for the same price as he paid for them. If all purchases and sales are made with demand deposits and currency, the

[2] The gross trade-debt theory with only a few reasonable assumptions can be shown to be inconsequential. If the desired income velocity of demand deposits and currency equals 4.25 per annum and the transactions/income ratio equals 3.0, then k equals 0.078 on an annual basis. Taking the largest annual change in gross trade debt since 1960, \$11.5 billion in 1965, we find that this is equivalent to approximately an additional \$0.9 billion, 0.54 percent of demand deposits and currency for that year. The net trade-debt theory is distasteful because it assumes nonmaximizing behavior on the part of business firms. Firms with truly idle balances would lend them (acquire financial assets) in the capital market.

[3] For a full formulation of the transactions demand for money, see Angell (1937), or Howard Ellis (1948). Throughout this paper we are continually referring to real money balances, although we may sometimes use dollars as a numeraire.

apple retailer will not have any money balances at the beginning of the sixteenth of each month—immediately after purchasing his monthly stock of apples—and will have $500 of demand deposits and currency just prior to buying a new stock of apples on the fifteenth of each month. The apple consumer will start each month with $500 in demand deposits and currency and will end each month without any money. Thus, on average, the apple retailer and the apple consumer will each hold $250 in demand deposits and currency.

Imagine now that the apple retailer extends a line of credit of $500 to the apple consumer. A reasonable result will be that the apple consumer will purchase all apples on credit and will pay the apple retailer $500 in demand deposits and currency on the fifteenth of each month—when the apple retailer must pay his supplier for apples. The apple consumer will hold this $500 in demand deposits and currency for the first half of each month and then pay it to the apple retailer on the fifteenth of each month. The apple consumer will still have an average balance of $250 of demand deposits and currency. The apple retailer, however, will never hold any demand deposits and currency for transactions purposes. The apple consumer will start each month with $500 in demand deposits and currency and $250 in unutilized trade credit available. Just prior to paying his bill on the fifteenth of every month the apple consumer will have $500 in demand deposits and currency and will not have any unutilized trade credit available. Just after paying his bill the consumer will have $500 in unutilized trade credit available and will not have any demand deposits and currency. At the end of each month the apple consumer will have $250 in unutilized trade credit available and will not have any demand deposits and currency. On average, the apple consumer will hold $250 in demand deposits and currency and $250 in unutilized trade credit available.[4] The apple retailer and the apple consumer together hold on average $250 in demand deposits and currency and $250 in unutilized trade credit available. In the first case, where trade credit was not extended, they held on average $500 in demand deposits and currency. In this case an average balance of $250 of unutilized trade credit available has been substituted for an average balance of $250 of demand deposits and currency.

The example raises several questions: (*a*) What, if any, balance-sheet effects are there? (*b*) Under what conditions will the apple retailer and the apple consumer reach an agreement on a credit line? (*c*) What are the

[4] In the first case where trade credit was not extended, the apple consumer paid the apple retailer exactly at the time of purchase. In the second case, there is a lag of fifteen days which was assumed because of the present institutional environment. If we allow the apple consumer to postpay fifteen days and prepay fifteen days, then he will transfer $500 in demand deposits and currency to the apple retailer on the first of each month. Thus, the apple retailer will hold on average $250 of demand deposits and currency, and the apple consumer, $250 of unutilized trade credit available. This change will not affect our conclusions.

substitution effects if payments dates are varied? (*d*) What are the macroeconomic implications? And (*e*) what determines the distribution of transactions balances between demand deposits and currency on the one hand and unutilized trade credit available on the other?

a) Before trade credit was instituted, the separate balance sheets of the apple retailer and consumer were on average as follows:

RETAILER		CONSUMER	
Assets		*Assets*	
Apples	$250	Accrued wages	$250
Bank money	$250	Bank money	$250
Liabilities		*Liabilities*	
Net worth	$500	Net worth	$500

After instituting trade credit in the manner described above, the separate balance sheets were:

RETAILER		CONSUMER	
Assets		*Assets*	
Apples	$250	Accrued wages	$250
Accounts receivable	$250	Bank money	$250
		Bonds or some other asset	$250
Liabilities		*Liabilities*	
		Accounts payable	$250
Net worth	$500	Net worth	$500

After instituting trade credit in the manner described in footnote 4, we obtain:

RETAILER		CONSUMER	
Assets		*Assets*	
Apples	$250.00	Prepayments	$62.50
Accounts receivable	$62.50	Accrued wages	$250.00
Bank money	$250.00	Bonds	$250.00
Liabilities		*Liabilities*	
Prepayments	$62.50	Accounts payable	$62.50
Net worth	$500.00	Net worth	$500.00

These comparative balance sheets show that unutilized trade credit available has been substituted for bank money. They also show that the net worth of both the retailer and the consumer is not affected by introducing trade credit. Trade debt in the examples above—if and when it plays a role—is not a substitute for interest-bearing assets. These balance sheets show—especially those referring to the case in footnote 4—that this is not a variant of a trade-debt theory but is a theory based solely on unutilized trade credit available.

b) If there is a positive real opportunity cost per unit time of holding demand deposits and currency, i, then it will be profitable for consumer and ratailer to agree to a line of credit when the discounted present value of the opportunity cost savings on $250 of demand deposits and currency is

greater than the discounted present value of all the net real costs involved in setting up and operating a credit system. Prior to the establishment of a line of credit the apple retailer and consumer held a $500 average balance of demand deposits and currency. After the establishment of the line of credit, together they held only $250 average balance of demand deposits and currency. On average $250 were released from their joint holdings of demand deposits and currency. The distribution of the net gains in this bilateral case depends upon the relative bargaining power of the retailer and consumer.

c) The whole range of the substitution effects of unutilized trade credit available for demand deposits and currency can be seen by allowing the retailer's payment date to his supplier to vary. If all days of the month have equal probability, then an average lag of fifteen days—the lag selected in the initial example—is the expected value of the lag. If, however, the retailer must buy the apples and pay his supplier instantaneously after the consumer is paid for his rendering of labor services, then the retailer need not hold—except for an instant—any balances of demand deposits and currency, and likewise the consumer need hold solely unutilized trade credit available to the amount of $250. In this case $250 of unutilized trade credit available has substituted for $500 average demand deposit and currency balances. Similarly, if the retailer must pay his supplier just before the consumer receives payment for his labor services, then the $250 average balance of unutilized trade credit available does not release any demand deposit and currency balances.

d) By introducing trade credit—more specifically unutilized trade credit available—the system has had an effective increase in its money supply. All the consequences of an increase in the money supply will follow, even though there has not been any increase in the stock of demand deposits and currency. In the short run, interest rates will tend to fall and prices and/or employment will tend to rise. This is accomplished without any reference to the private wealth effect of unutilized trade credit available, for there is none. When the retailer and the consumer are consolidated, trade credit has no net balance-sheet effect.

e) The distribution of transactions balances between unutilized trade credit available on the one hand and demand deposits and currency on the other depends upon the opportunity cost of holding bank money and the present value of the net real costs associated with trade credit. The higher the opportunity cost of holding bank money, *ceteris paribus*, the more unutilized trade credit available will be substituted for demand deposits and currency and vice versa. This, of course, assumes a continuum of real costs associated with the extension of trade credit. Likewise, the lower the net real costs of extending trade credit, the greater the proportion of unutilized trade credit available will be to demand deposits and currency.

Because U.S. law forbids the explicit payment of interest on demand deposits and currency, it has traditionally been assumed that short-term interest rates reflect the opportunity cost of holding bank money. This tradition is retained in this paper.

In the case of the precautionary demand for money, the simple bilateral example used above will not suffice. In that example individual uncertainty can only be passed on but not eliminated. The precautionary demand for demand deposits and currency depends upon individual risk, which in the aggregate nets out to zero. In a closed economy risks associated with movements in income, employment, and prices cannot be hedged by the entire set of individual entities; they can only be redistributed. Individual risk, however, which is totally unrelated to macrorisk, can be eliminated through the pooling of individual risks. This latter form of risk can be reduced, to some extent, by additional holdings of money balances—the precautionary demand for money.

Let us retain our original apple retailer with expected sales of apples of $\$(n \cdot 500)$ and n apple consumers all having the same characteristics. The expected purchase of apples per apple consumer is equal to \$500 per month; only now there is some risk of higher and lower purchases for each apple consumer. Let us assume this risk is normally distributed with a standard error of \$5 per month. If all apple consumers hold precautionary balances up to the point where they can pay for the maximum amount of apple purchases, subject to the condition that the probability of higher needed purchases is only 1 percent, then each customer will hold about \$11.65 in precautionary balances.[5] The standard error for (receipts of) the retailer will equal $\$5 \cdot \sqrt{n}$, and he will hold precautionary balances of $\$11.65 \cdot \sqrt{n}$.

Now, if the retailer extends additional trade credit to the apple consumers in a sufficient amount—in the first period \$11.65 of unutilized trade credit available—then $n \cdot \$11.65$ of demand deposits and currency are released. Again, if the present value of the net real resources used to extend this additional trade credit are less than the present value of the opportunity cost of holding $n \cdot \$11.65$ of demand deposits and currency, then the retailer as well as the apple consumers has a positive sum gain, and a bargain should be made. Unutilized trade credit available will have been substituted—one for one—for demand deposits and currency. The remaining implications are the same as they were for the transactions demand for money. Again it can be shown that unutilized trade credit available, not trade debt, has been substituted for demand deposits and currency.

Some degree of heterogeneity of expectations about the future changes in the rate of interest are required for the existence of a stable-equilibrium speculative demand for money. Given a degree of heterogeneity of expec-

[5] A 1 percent tail on a normal distribution is 2.33 standard errors away from the mean. Therefore, we have $2.33 \cdot \$5$, which equals \$11.65.

tations, some people will wish to hold bonds and others money. Individuals who wish to hold bonds will reduce their unutilized trade credit available and with the released resources buy bonds. In a purely demand deposit and currency world they would reduce their holdings of demand deposits and currency to hold bonds. Those who do not want to hold bonds will expand their holdings of unutilized trade credit available by selling their bonds and paying off their trade debt. In a demand deposit and currency world these same individuals would sell bonds and increase their holdings of demand deposits and currency. Again unutilized trade credit available is a very close substitute for demand deposits and currency.

Only two basic conceptual differences exist between demand deposits and currency on the one hand and unutilized trade credit available on the other. Bank money—demand deposits and currency—is generalized purchasing power, whereas unutilized trade credit available is a collection of specialized purchasing powers. This does not present any special problems in the analysis that follows.[6]

The other major difference is that demand deposits and currency can be considered as a form in which people hold private wealth, whereas unutilized trade credit available cannot. In an economic system where money is considered solely as an asset in an efficient wealth portfolio, unutilized trade credit available would not be a close substitute for demand deposits and currency, but time deposits would be. If, however, we were in a classical monetary world, then unutilized trade credit available would be a very close substitute for demand deposits and currency, and time deposits would not be. In a classical monetary world the relevant money variable would be demand deposits, currency, and unutilized trade credit available —the total stock of acceptable means of payment. In general, if the wealth constraint is operative, we would not expect the transactions constraint to be operative, and vice versa.

One other point of similarity exists between the banking system and the trade credit system. The banking system and the trade credit system not only can create an acceptable means of payment but also can allocate real resources between net savers and net investors. Insofar as each nonbank entity does not have a balanced account with the banking system (liabilities equal to assets), real resources may be transferred by the banking system. Similarly, if accounts payable (trade debt) do not equal accounts receivable (trade assets) for each entity, then real resources may have been transferred by the trade credit system. Thus, the function of allocating real resources is also performed by nonbank financial intermediaries. This function is the basis of the "gross" and "net" trade debt theories discussed earlier.

[6] Because of the resource cost involved in estimating every entity's trade credit requirements properly, it is possible for some entities to have redundant unutilized trade credit available for certain commodities. This does not present a problem in this paper because we do not directly measure unutilized trade credit available.

It also is interesting to note that in most studies of the British economy unutilized overdraft facilities at British banks are included in the money stock data. Conceptually, it is difficult to discern any relevant differences between unutilized overdraft facilities and unutilized trade credit available. Both are acceptable means of payment and potential assets with a corresponding potential liability to all parties concerned.

B. The Historical Behavior of Components of Trade Credit in the United States

As mentioned earlier, gross trade credit definitionally equals gross trade debt plus gross unutilized trade credit available. Data on gross trade credit, as defined above, and on gross unutilized trade credit available do not exist. Although conceptually they are measurable, no attempt has been made to measure them. Gross trade debt, on the other hand, is relatively easily measured, and a data series exists dating from 1939.[7] From the previous discussion on trade credit it is possible, theoretically at least, to derive a relationship between trade debt, which has been measured, and unutilized trade credit available, which has not been measured. If institutional factors in the United States did not change radically during the time period considered, and the economic system, in general, remained close to an everchanging equilibrium position, then the most reasonable relationship between trade debt and unutilized trade credit available would be positive.

If trade credit were to expand, both trade debt and unutilized trade credit available should expand, *ceteris paribus*. Imagine an increase in the short-term rate of interest on bank money, due perhaps to a decline in effective reserve money, with no change in nominal transactions or an increase in nominal transactions with no change in effective reserve money.[8] With a rise in bank interest rates, *ceteris paribus*, the net real value of releasing bank money—demand deposits and currency—by substituting unutilized trade credit available is increased. Assuming a continuum of real costs associated with an expansion of trade credit, there should be an increase in trade credit extended. This increase would occur along two basic lines. On the one hand entities which had given trade credit previously up to the point where the marginal cost of providing trade credit had equaled the marginal cost of holding bank money would now expand again up to the point where the marginal conditions were met. On the other

[7] See Appendix.

[8] By effective reserve money we mean reserves of the banking system after allowing for the effects of different reserve requirements. By using the short-term rate of interest as the opportunity cost of bank money, we assume that demand deposits and currency are not paid interest. If interest were paid on demand deposits and currency, we would use the differential between interest paid for close money substitutes and the interest paid on demand deposits and currency.

hand, some entities which previously had not deemed it worthwhile to acquire or extend trade credit would now find it profitable to do so. Thus trade credit would expand. In fact, trade credit should expand until the price of trade credit equals the price of bank money. If the additional recipients of trade credit behave as the previous recipients did, and if the recipients of additional trade credit also behave as the previous recipients did, then the ratio of unutilized trade credit available to total trade credit will remain unchanged. There is no net incentive for a change in the composition of the total stock of trade credit. If such is the case, then unutilized trade credit available, as well as trade debt, will expand if trade credit expands. If trade credit is contracted, then both will contract. With this system unutilized trade credit available will be proportional to trade debt.[9]

A simple way of intuitively seeing the above relationship is to compare trade credit with bank money. Unutilized trade credit available, as described earlier, is conceptually the same as the existing stock of demand deposits and currency. If each entity in the economy were classified according to its income-expenditure period, and then all payments (checks cashed and currency disbursements) were summed from the beginning of the income–expenditure period to the present time, the summation would be comparable with the trade-debt figure. Given the income-expenditure period, the volume of checks cashed (in dollars) and currency which changed hands will vary positively with the stock of bank money, demand deposits, and currency. Thus, by comparison, we have assumed that unutilized trade credit available varies positively with trade debt.

An alternative view of the relationship between unutilized trade credit available and trade debt assumes that economic entities behave as maximizers along some trend line but that during deviations from the trend they are unwilling to alter the existing relationships. In such a world, trade credit grows at a constant secular rate. If at one point in time trade debt were to expand substantially, we would find unutilized trade credit available contracting, and vice versa. Thus, secularly unutilized trade credit available would be positively related to trade debt, but during deviations from the secular trend of trade debt, unutilized trade credit available would deviate from its trend in the opposite direction. Because a direct measurement of unutilized trade credit available is at present impossible, both of these relationships will be juxtaposed in the later empirical section. This will be done even though on purely theoretical grounds the simple proportionality argument appears to be preferable.

In figure 1 bank money—demand deposits plus currency—trade debt and the ratio of trade debt to bank money are plotted annually. At the end of 1939 bank money totaled $35.3 billion, trade debt totaled

[9] The *ceteris paribus* assumption includes in it the assumption that credit risk in the aggregate is unchanged by changes in the interest rate on bank money.

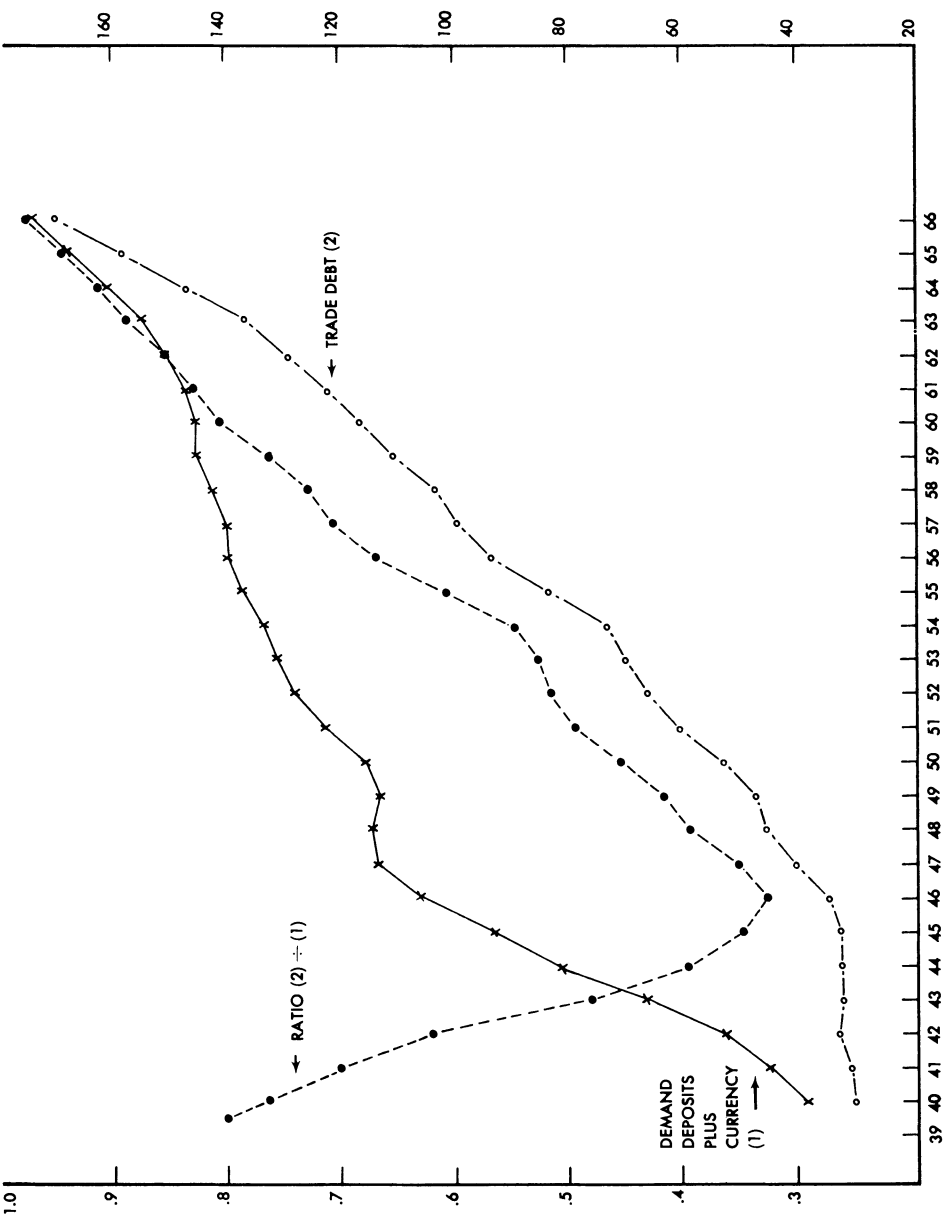

FIG. 1

$28.2 billion, and the ratio of trade debt to bank money was 0.800. From 1939 through 1946 bank money increased to approximately $106.0 billion, or at an annual rate of over 18 percent. During this same period trade debt hardly increased at all, it was approximately $34.1 billion in 1946. Naturally enough, the ratio of trade debt to bank money fell from 0.800 to 0.322. From 1946 on, however, trade debt grew at a faster rate than bank money every year. The ratio of trade debt to bank money also grew every year. From 1946 through 1966 trade debt grew at an annual rate of over 8.3 percent, whereas bank money grew at only 2.5 percent *per annum*. By 1966 the ratio of trade debt to bank money was approximately 0.974, with bank money totaling about $173.9 billion and trade debt, $169.4 billion.

It is interesting to note that for the recession years 1949, 1953–54, 1958, and 1961 the ratio of trade debt to bank money grew on average only 0.020 points per year, whereas during the other postwar years this ratio grew on average 0.036 points per year. In fact, with the single exception of 1952, the increase in nonrecession years was as large as or larger than any increase during recession years. Another interesting observation about trade debt is that only a very small proportion of total trade debt is trade debt of the household sector. The household sector's total direct trade debt accounted for only 10.6 percent of all trade debt in 1946 and only 12.2 percent in 1966. Many other factors, however, must be considered before these observations can be properly evaluated. In the next section of this paper an econometric formulation of the money market which assumes unutilized trade credit available to be identical with bank money is derived, and in the final section the prediction capacity of our model with other generally accepted models is contrasted.

II. The Money Market

With very few exceptions the real money supply has been viewed as fixed in the short run, depending solely upon the whims of the monetary authorities.[10] The money demand function has been considered to be a combination of stable relationships between real money demanded and other economic variables. Thus, the supply of money is exogenously determined and shifts over time, whereas the demand function for money is stable. The actual time series observations, therefore, supposedly map out the demand function for money. Upon reconsideration, however, it should be obvious that the supply of money, especially when unutilized trade credit available is included, is not purely exogenously determined. Considering solely the supply of money, if the price of money were to rise—the difference between bank lending rates and deposit rates as well as trade credit—

[10] Two major exceptions in empirical research are: Teigen (1964) and Brunner and Meltzer (1964).

certeris paribus, the quantity of money supplied should increase.[11] Banks would want to reduce excess reserves and make additional loans at the greater margins. Similarly, firms would attempt to extend additional trade credit at the higher rates.

In traditional analyses of the money market the deposit rate for demand deposits and currency is assumed to be zero. If this were true, the short-term rate of interest would be an accurate reflection of the opportunity cost of holding money. In fact, although it is illegal to pay interest explicitly, there are implicit interest payments to bank depositors. Data series on these implicit rates do not exist. The assumption is made, as in previous analyses, that short-term rates of interest are, in fact, a good proxy for the opportunity costs of holding demand deposits and currency.

Due to the regulation of the banking system in the United States, banks are required to have at least a minimum percentage of their liabilities held in reserves; the total amount of these reserves is controlled by the Federal Reserve. The quantity of bank money supplied should depend upon the level of effective reserves—the level of total reserves standardized for reserve requirement percentages. If effective reserves increase (decrease), *ceteris paribus*, the quantity of bank money as well as *all* money should increase (decrease). Thus, looking at the supply function of money by itself, it can be seen that in general the quantity of money supplied should depend positively upon the price of money—the bank rate of interest—and positively upon the level of effective reserves. Effective reserves are assumed to be entirely exogenous.

The demand for money, on the other hand, should depend negatively upon the price of money. As the opportunity cost of alternative uses of money increases, money balances should be conserved. In a world so conceived, any attempt simply to measure the interest elasticity of the demand for money, without considering explicitly the supply of money, will definitely yield biased results if it does, in fact, even identify the relationship.[12] Econometric techniques exist, however, for circumventing this simultaneity problem. The techniques involve the use of reduced-form equations and instrumental variables from which the true parameters of the structural equations can be estimated.

In the traditional analysis of the money market—more specifically the demand for money—the concept of transactions, as opposed to the concept of national income, was used. Theoretically, the concept of transactions is preferable to that of national income if the demand for money is

[11] The assumptions here are that prices are sticky and that real national income in any single period is not a function of the monetary conditions of that same period. These assumptions do not preclude the possibility of relationships between monetary variables, prices, and real income if they occur with at least a one-period lag.

[12] If the supply of money were very sensitive to the interest rate, and the demand for money, less sensitive, the money-demand equation could be perversely related to interest rates if the simultaneous nature of the system were not considered.

thought to arise from its use as a means of payment. However, explaining the demand for money per se is of secondary importance; of primary importance is the relation between money, national income, and employment. National income and employment are not necessarily perfectly related to transactions.[13] In lieu of a bisected analysis in which transactions are related to money and then national income is related to transactions, money will be related to national income directly.

There is, however, some information about changes in the relation between transactions and national income which can be used to assess the importance of that relation. Changes in the degree of aggregate market utilization in the economy are one cause of changes in that relation. If the degree of aggregate market utilization were to increase, *ceteris paribus*, we would expect the demand for money to increase, and vice versa. Adequate time series data on aggregate market utilization for the entire U.S. economy do not exist, but these data do exist for the corporate sector, whose value added constitutes about 50 percent of total national income. The series used in this study is comprised of total corporate sale divided by corporate value added (see Appendix).

The final problem discussed in this section relates directly to money's role. Money is considered here to satisfy a need for working balances or, alternatively, for inventories. There are many plausible functional relationships relating inventories to the disbursement of the product (see, for example, Hadley and Whitin 1963). Linear, square root, cube root, and other relationships all appear reasonable under differing assumptions about the probability distributions of demand, etc. The question is empirical and must be so approached. It is not easily solved. With the exception of the linear form, the sum of microinventory models is not a macromodel of the same form as the micromodels. Different micromodels will not be assumed in the empirical part of this paper. A linear relationship will be used to see if any effect of economies of scale in money holdings can be discerned.

A. The Model (See Appendix)

Let STM = real supply of total money—demand deposits, currency and unutilized trade credit available divided by the GNP price deflator; DTM = real demand for total money—demand deposits, currency, and unutilized trade credit available divided by the GNP price deflator; RM = effective real reserve money; i = the short-term interest rate in percentage per annum—a proxy for the price of holding money or, in the case of unutilized trade credit available, the price of credit; S_1 = mean real size of money-holding units; S_2 = degree of market utilization—

[13] Divergences occur via market trade in nonproduced goods such as land and stock certificates and previously produced goods such as antiques, etc.

corporate sales divided by corporate value added; and Y = real national income. Let L denote log.

The money market model, when assumed multiplicative with constant elasticities, is of the following form:

$$STM = a_0 \cdot RM^{a_1} \cdot i^{a_2}; \tag{5}$$

$$DTM = b_0 Y^{b_1} \cdot i^{b_2} \cdot S_1^{b_3} \cdot S_2^{b_4}. \tag{6}$$

Equation (5) describes the supply of total money in part as a function of the effective reserves in the banking system. The principal effect of a change in effective reserves should naturally be on demand deposits and currency, tending to change them in the same direction as the effective reserve money change; a_1 should be positive. The interest rate in the money supply equation should also have a positive coefficient. Banks and other issuers of money should find it more advantageous to lend with higher interest rates than lower interest rates, thus implying that the higher i, the larger STM, *ceteris paribus*.

In the demand-for-money equation, real national income, representing the transactions demand for money, should have a positive coefficient. Interest rates, too, may be important and should have a negative coefficient. The higher the level of interest rates, the lower we would expect the demand for money to be, *ceteris paribus*. The mean real size of the representative economic unit, S_1, should have a negative coefficient, b_3, if inventory theory lines are followed in hypothesizing that there are economies of scale in the handling of money balances. The degree of aggregate market utilization, S_2, should have a positive coefficient, b_4. The more economic activity that passes through the market place, the greater should be the demand for money.

In estimating the above equations the model first will be put in log form as follows:

$$LSTM = La_0 + a_1 LRM + a_2 Li + \epsilon_1; \tag{1'}$$

$$LDTM = Lb_0 + b_1 LY + b_2 Li + b_3 LS_1 + b_4 LS_2 + \epsilon_2. \tag{2'}$$

Due to the simultaneous nature of the equations above, a two-stage least-squares estimation procedure is used in which a specific instrumental Li variable is calculated by regressing Li on all the exogenous variables, LRM, LY, LS_1, and LS_2. The estimated values of Li are then used in the structural equations.[14] The model is tested on annual data for the period

[14] In simultaneous equation estimation there are numerous possible normalization rules, the procedure of normalizing along the diagonal is the most commonly used but is by no means a statistically superior procedure. Koopmans, Rubin, and Leipnik (1950) state: "The precise form of the normalization rule is obviously a matter of choice, and different normalization rules are most convenient in different problems" (p. 68). They also indicate "the trivial nature of the question of normalization" (p. 68). Theil—the originator of two-stage least squares—used the same normalization procedure that I use, in an example of his two-stage least-squares procedure (1958, p. 234). The conditions of his example are similar to those we face.

from 1946 through 1966. Once again, the reader should be aware of how the data on unutilized trade credit available were obtained.

1. Statistical Results

Using the above formulation of the money market and annual data, we obtain the following results for the money supply and demand functions for the period 1946 through 1966.[15]

$$LSTM = 1.625 + .5247\,LRM + .1778\,L\hat{i} \qquad \text{(A)}$$
$$(9.48) \qquad (22.27)$$
$$R^2 = .979 \qquad \bar{R}^2 = .977 \qquad \text{D-W} = 0.92.[16]$$

$$LDTM = .6777 + .7617\,LY - .0831\,L\hat{i} - .1871\,LS_1 + .2286\,LS_2 \qquad \text{(B)}$$
$$(9.89) \qquad (2.43) \qquad (1.84) \qquad (1.27)$$
$$R^2 = .988 \qquad \bar{R}^2 = .985 \qquad \text{D-W} = .88.[17]$$

A major problem with the above results is that the residuals are highly correlated over time. When a significant degree of positive serial correlation is encountered, it is prudent to follow an alternative procedure which would give consistent, asymptotically unbiased, efficient estimates of all the coefficients, including the autoregressive parameter. The procedure to be followed here was developed by Dhrymes (1966).[18] In each estimation equation all the variables are transformed by taking the original observations and subtracting ρ times the observation lagged one period. No observations are lost because the first observation is multiplied by the square root of one minus ρ squared. Rho is allowed to range from zero to one at intervals of 0.1. The equation which has minimized the standard error of estimate is the equation Dhrymes suggests one use. In the case of

[15] In these statistical equations the numbers in the parentheses below the coefficients are the t-tests; R^2 is the coefficient of determination; $\bar{R}^2$ is the coefficient of determination corrected for degrees of freedom; and D-W is the Durbin-Watson d-statistic of serial correlation of the residuals. Because two-stage least squares is employed, the R^2 and D-W are not entirely appropriate. We report them anyway for lack of better alternatives.

[16] Using the alternative definition of unutilized trade credit available, these estimates are obtained:

$$LSTM^* = .9168 + 1.039\,LRM + .1530\,L\hat{i} \qquad \text{(A2)}$$
$$(14.38) \qquad (14.68)$$
$$R^2 = .973 \qquad \bar{R}^2 = .970 \qquad \text{D-W} = 1.31.$$

$$LDTM^* = -2.081 + 1.453\,LY - .4031\,L\hat{i} + .0008\,LS_1 + 1.416\,LS_2 \qquad \text{(B2)}$$
$$(11.09) \qquad (6.91) \qquad (0.01) \qquad (4.64)$$
$$R^2 = .974 \qquad \bar{R}^2 = .967 \qquad \text{D-W} = 1.11.$$

[17] See n. 16 above.

[18] Using the Dhrymes procedure, the t-tests reported are the conditional t-tests given ρ.

the supply function the ρ selected was one. In the case of the demand equation the ρ selected was 0.7. The results are as follows:

$$\Delta LSTM = .5457\Delta LRM + .1269\Delta L\hat{i} \qquad (A')$$
$$(5.48) \qquad (5.18)$$
$$R^2 = .46 \qquad \bar{R}^2 = .42 \qquad \text{D-W} = 1.87.^{19}$$

$$LDTM = .1413 + .9076\,LY - .1705\,L\hat{i} - .1416\,LS_1 + .6187\,LS_2 \qquad (B')$$
$$(19.28) \qquad (7.80) \qquad (2.09) \qquad (3.89)$$
$$R^2 = .99 \qquad \bar{R}^2 = .99 \qquad \text{D-W} = 1.63.^{20,21}$$

By comparing the results of the different estimating forms for the demand and the supply functions derived from our basic model, we can see that they are fundamentally quite similar. Each variable has the "correct" a priori sign according to the theoretical construct. When estimated using the Dhrymes procedure, each variable is statistically significant at the 2.5 percent level or better.

The market-usage variable, LS_2, which is defined as the log of corporate sales divided by corporate value added, is by far the most elusive of our variables. In the simple log form of (B) the variable was statistically insignificant and had a relatively small coefficient. In the most efficient transformation, however, (B'), the coefficient was substantially larger and statistically very significant—it was statistically significant at greater than a 0.1 percent level. The a priori reasonableness of this variable and the results in the most efficient transformation warrant its inclusion.

2. Interpretations

The results from the preceding representation of the money market and their interpretation are quite interesting. The most important conclusion is that the supply of real money, as well as the demand for real money, is sensitive to short-term interest rates prevailing in the market. Most money models have implicitly or explicitly assumed that the supply of money is fixed and that exogenous shifts in the supply of money have mapped out the money demand function. In the above model both the demand for

[19] Using the alternative definition of unutilized trade credit available discussed on page 255 above, the following estimates where ρ equals one were obtained:

$$\Delta LSTM^* = .7897\Delta LRM + .0821\Delta L\hat{i} \qquad (A2')$$
$$(4.95) \qquad (2.07)$$
$$R^2 = .432 \qquad \bar{R}^2 = .402 \qquad \text{D-W} = 1.63.$$

$$\Delta LDTM^* = 1.154\Delta LY - .2341\Delta L\hat{i} - .4249\Delta LS_1 + .9512\Delta LS_2 \qquad (B2')$$
$$(6.40) \qquad (3.22) \qquad (3.01) \qquad (3.31)$$
$$R^2 = .682 \qquad \bar{R}^2 = .626 \qquad \text{D-W} = 1.59.$$

[20] See n. 19 above.

[21] In the first difference form the demand-for-money equation is as follows:

$$\Delta LDTM = .8039\Delta LY - .1043\Delta L\hat{i} - .2154\Delta LS_1 + .5434\Delta LS_2 \qquad (B'')$$
$$(6.93) \qquad (2.23) \qquad (2.38) \qquad (2.94)$$
$$R^2 = .676 \qquad \bar{R}^2 = .619 \qquad \text{D-W} = 1.94.$$

money and the supply of money were found to be sensitive to the level of interest rates. This finding conflicts with other findings but can perhaps be explained by the different definitions of money or different empirical counterparts of the same definition (see Friedman 1959, pp. 327–51).[22] If changes in the level of short-term interest rates originate in the bank money portion of total money—changes in effective reserves relative to changes in other exogenous variables—and not in the unutilized trade credit available portion of total money (that is, if the cost function of trade credit does not shift over time), then the proportion of unutilized trade credit available to total money should vary positively with the level of short-term interest rates. This is an empirically testable proposition. If P equals the proportion of unutilized trade credit available to total money—demand deposits, currency and unutilized trade credit available—then the following results for the 1946–66 period are obtained.

$$LP = -.5378 + .3578\,Li \qquad \text{(C)}$$
$$(15.17)$$
$$R^2 = .924 \qquad \bar{R}^2 = .920 \qquad \text{D-W} = 1.83.$$

The proposition stated above appears to be validated. The proportion of utilized trade credit available to the total stock of money is positively correlated with the level of short-term interest rates.[23] As interest rates rise (fall), the proportion of unutilized trade credit available to total money rises (falls). If the measure of unutilized trade credit available is accurate, then the relationship demonstrates that there is a very close substitution between bank money (demand deposits and currency) and trade credit money (unutilized trade credit available).

The implications of the close substitutability of trade credit money for bank money are by no means harmless. If demand deposits and currency did not have a very close substitute, controls on the amount of effective reserves would: (*a*) have a much stronger impact on the quantity of money and on interest rates and (*b*) be subject to a lesser degree of uncertainty as to the quantitative outcome. Because unutilized trade credit available is a very close substitute for bank money and is not regulated, policy measures attempting to change bank money are to a large extent offset by changes in unutilized trade credit available. Thus policy measures aimed solely at bank money will have less impact if unutilized trade credit available exists than if unutilized trade credit available did not exist or were similarly controlled. If unutilized trade credit available did not exist, one would only need to know the relationships between

[22] In many instances it could also be due to the failure by others to consider the simultaneous nature of the money market.

[23] If exogeneous changes had occurred in unutilized trade credit available instead of in the bank money area, the a priori sign of the *Li* coefficient would be negative and not positive.

effective reserves and both interest rates and demand deposits plus currency in order to regulate the economy. With the existence of unutilized trade credit available, however, one must know, in addition to the above-mentioned relationships, the relationships between unutilized trade credit available and both interest rates and bank money. These additional relationships almost surely add to uncertainty about the total effects of a change in policy.

The empirical results also show that economies of scale in money holdings exist in the postwar American economy. This is demonstrated by the statistical significance of the LS_1 variable in the estimated-demand equation. As the real economic size of a representative economic unit in the economy increases, the demand for money decreases, *ceteris paribus*. I did not, however, attempt to define the precise microrelationship between real size and money demand. This would require a great deal more work and even then might yield ambiguous results. Given the complexities of defining economic units properly and of acquiring the relevant time series data, it would be fortunate if any attempt could yield satisfactory results in a reasonable amount of time. Probably the best indications can be obtained by using cross-section data on firms and households.[24] In spite of the lack of precise formulation, it is possible to discern that economies of scale in money holdings probably do exist.

Although much debate has centered on the existence of economies of scale in money holdings, there has been little discussion of the degree of market utilization. The degree of market utilization, where relevant, has been automatically subsumed under the aegis of income. Naturally, the "number of hands through which output passes" should not be an important consideration in the demand function for money as purely a form of holding wealth (Keynes 1936). Wealth, which is the capitalized value of all net factor payments, is conceptually separate and distinct from the level of total transactions. In a classical monetary theory world, however, transactions are one of the relevant variables. Transactions can be partitioned into national income and the degree of market utilization.

The aggregate annual movements of the transactions-income ratio during the postwar period have not been large, but there are distinguishable cyclical movements. There also appears to be a postwar secular increase in this variable, but the trend is gradual. During war periods, there is a distinct fall in this variable, thus representing a decline in the degree of market utilization.

The econometric representation of our money market model shows that the supply of total money is very sensitive to the amount of effective reserves of the banking system. Because of the importance of effective reserves as a policy tool, it is interesting to note that in our formulation a

[24] A study by Vogel and Maddala (1967) on cross-section firm data confirms our more aggregate finding.

10 percent increase in effective reserves implies a 20 percent fall in the level of short-term interest rates—perhaps from 5 to 4 percent—and an increase of approximately 1.7 percent in the quantity of total money.[25] Unutilized trade credit available, however, will fall—by an estimated 2 percent—and bank money will rise by approximately 5.5 percent.[26]

Also intuitively appealing is the fact that the elasticity of the supply of money with respect to effective reserves is approximately 0.6 and that on average bank money accounted for about 60 percent of total money. One might infer that the elasticity of bank money with respect to effective reserves is approximately one, *ceteris paribus.*

One of the more interesting empirical findings is that the elasticity of the demand for real money with respect to real national income is significantly less than unity in this formulation. This is true after allowing for the effects of other variables. Of course, because of the relatively imprecise measure of trade credit money, we cannot be absolutely certain of this result.[27] If our results are correct, however, this elasticity basically means that the income velocity of our money rises as income rises, *ceteris paribus.*

Many people have noted the postwar rise in the income velocity of money as a secular occurrence. This has not, however, been compared explicitly with income per se. In our final equation (B′), this relationship is no longer a secular or time related occurrence but is, instead, an income-related occurrence. In time series studies, the log of income itself is closely correlated with time, but in equation (B′), and especially in equation (B″) in footnote 22, this is no longer true. Due to the direct observation that during this period our nonbank money, unutilized trade credit available, has grown a great deal faster than bank money, any reduction in the estimated amounts of unutilized trade credit available would imply an even lower income elasticity of the demand for money.

All this leads me to believe that during the postwar period, at least, the demand for money has principally responded to classical monetary theory motives. Money is both a lubricant and an item of wealth. As an item of wealth, it is reasonable to suppose, and empirically not refuted, that money, which includes time deposits at commercial banks, is a luxury good (Friedman and Schwartz 1963). During the postwar period, however, it appears as though the demand for money has been responsive principally to transactions needs and not to wealth needs.[28]

[25] This formulation is based entirely on equations (A) and (B).

[26] These results make use of equation (C) as well as equations (A) and (B).

[27] The econometric results using the alternative definition of unutilized trade credit available show the income elasticity of the demand for money to be greater than unity.

[28] This observation is by no means inconsistent with the general tone of the discussion of the postwar period by Friedman and Schwartz. They concluded that the historical pattern of the relationship between income and money was not observable

Perhaps this dilemma could have been explained if permanent income instead of current real income had been compared with our money stock. Permanent income is a much more stable time series than is the time series of current income. (Friedman and Schwartz 1963, p. 643). Thus, with smaller fluctuations perhaps the elasticity of our money with respect to permanent income would have more nearly equaled or even exceeded unity. The economic reasoning behind a comparison of permanent income with unutilized trade credit available combined with bank money is not very credible. To consider unutilized trade credit available as a wealth item implies the worst type of liability myopia. Specific economic units would have to view potential accounts receivable in a different manner from the corresponding potential accounts payable, even though they are effectively identical in all characteristics.

The lack of credibility of the economic reasoning which would allow a comparison of unutilized trade credit available with permanent income tends, during the postwar period, to have some spillover onto bank money—a very close substitute for unutilized trade credit available. Whatever the case may be, in the system described here there is no a priori reason to expect the income elasticity of the demand for money to be greater than, equal to, or less than unity. This, too, is an empirical question, the answer to which appears to be less than unity.

III. Three Views of the Money Market: A Comparison

Sections I and II of this paper have attempted to show that: (*a*) theoretically unutilized trade credit available can and in some instances should be considered as a component of the total money stock, and (*b*) using unutilized trade credit available as a component of the money stock, we obtain reasonable and statistically significant coefficients when we estimate money demand and supply functions for the postwar U.S. economy. This section attempts to show that when unutilized trade credit available is included as a component of the money stock, it is possible to predict the stock of money more accurately than when money is defined as demand deposits, currency and time deposits of commercial banks, or demand deposits and currency.

The conceptual frameworks implied by the above-mentioned definitions of money are not identical, and we therefore have to adapt the exogenous variables to fit the respective conceptual frameworks. The conceptual framework of the view of demand deposits plus currency, view 2, is

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during this period. Even after allowing for the effects of changes in the return on alternative assets and the development of money substitutes, much of the postwar rise in the velocity of money was still left unaccounted for. Tentatively, they concluded that the high degree of economic stability reduced the demand for money (Friedman and Schwartz 1963, chaps. 12, 13).

identical with the conceptual framework of our view of money, henceforth referred to as view 3. Therefore, with respect to views 2 and 3 the exogenous variables included in the analysis will be the same.[29] The demand deposits, currency, and time deposits view, view 1, has a conceptual framework in which money is considered solely as an asset in an efficient wealth portfolio. Conceptually, therefore, permanent income as opposed to current income should be used in evaluating the accuracy of its predictions. Although conceptually the degree-of-market-utilization variable, S_2, does not fit in the general framework of money as a form in which wealth is held, failure to include it might bias the results of our statistical tests.[30]

For the period 1946 through 1966 we shall estimate the reduced-form money equation for all three of the above views of money. The only difference—aside from the dependent variable, money—is that view 1 demand deposits, currency, and time deposits of commercial banks will have real permanent income as an exogenous variable instead of current real income. In this form, comparisons will be made on: (*a*) the standard errors of estimates and (*b*) the coefficients of determination.

In addition, we shall also estimate the most efficient reduced form equations for the period 1946 through 1963 using the Dhrymes procedure discussed earlier. In this form we shall again compare: (*a*) the standard errors of estimates and (*b*) the coefficients of determination. We shall also make an additional comparison. We shall compare the respective predictions for the years 1964, 1965, and 1966.

In the stock form there is little doubt, indeed, that our view of money, view 3, is far superior to the other two views. In table 1 we have the three respective views of money and: (*a*) their standard error of estimate, (*b*) the percentage errors implied by the standard errors of estimate, and (*c*) the coefficients of determination or the amount of original variance explained by these reduced-form equations.

TABLE 1

A COMPARISON OF THE STOCK REDUCED-FORM EQUATIONS FOR THREE VIEWS OF MONEY, ANNUALLY 1946–66

Money View	Standard Error of Estimate	Percentage Error	R^2
View 1	0.01360	3.2	.931
View 2	0.00775	1.8	.684
View 3	0.00575	1.3	.988

[29] Current real national income, effective real reserves, real economic size per economic unit, and the degree of market utilization.

[30] It is also not obvious that the variable economies of scale in individual money balance holdings fits the conceptual framework of money as an item of wealth.

For each of the two distinct statistics, view 3 is superior to both view 1 and view 2. The standard error of estimate, and thus the percentage error, is significantly less than either of the other two standard errors of estimates. Similarly, the amount of original variance explained is greater using view 3 than either of the other two views. Due to the large difference in the original variation of the money stocks between view 1 and view 2, we find that the standard error of estimate of view 2 is less than the standard error of estimate of view 1, while the amount of variance explained by view 1 is greater than the amount of variance explained using view 2. The important point here, however, is that view 3, our view using demand deposits, currency, and unutilized trade credit available as money, is unambiguously superior to the other two views of money.

In the most efficient form for the period 1946 through 1963 I obtained the results in table 2. Again we must conclude that the view of money as demand deposits, currency, and unutilized trade credit available is unambiguously superior to the other two views of money. View 3's standard error of estimate is less than those of the other two views, and view 3's amount of variance explained is greater than those of the other two views.

The final step is a comparison of the absolute errors in the predictions for the years 1964, 1965, and 1966 (see table 3). Although not markedly better than view 2, view 3 is the best predictor for the years 1964, 1965, and 1966. The mean absolute error of view 3 is less than the mean absolute error of the other two predictors. Considering all the estimation results, our view of money—demand desposits, currency, and unutilized trade credit available—is clearly superior to the other two views. Naturally, I have not been able to compare my view of money with every other possible view of money or even with all the different interpretations of views 2 and 3. In spite of the limitations of my comparisons, we can conclude with a high degree of certainty that my view of money should not be excluded as not being empirically applicable to the postwar U.S. economy.

TABLE 2

A COMPARISON OF THE MOST EFFICIENT REDUCED-FORM EQUATIONS FOR THREE VIEWS OF MONEY, ANNUALLY 1946–63

Money View	Standard Error of Estimate	Percentage Error	R^2
View 1	0.00749	1.74	.566*
View 2	0.00675	1.57	.469
View 3	0.00501	1.16	.660

* The R^2 of view 1 is the R^2 where ρ equals one. For view 1 the most efficient reduced-form equation occurs where ρ equals 0.9; for the other two views, where ρ equals one.

TABLE 3

A COMPARISON OF ABSOLUTE ERRORS IN PREDICTION FOR THREE VIEWS OF MONEY—1964, 1965, AND 1966

MONEY VIEW	ABSOLUTE ERRORS FOR THE YEARS			MEAN ABSOLUTE ERROR
	1964	1965	1966	
View 1	0.01443	0.01112	0.00323	0.00959
View 2	0.00715	0.00609	0.00020	0.00448
View 3	0.00757	0.00245	0.00079	0.00360

Appendix

The Data

All data have been updated to include 1966, using the Federal Reserve Bulletin of February 1968.

1. *Total Money*

The stock of total money is the summation of six separate categories: (*a*) installment credit of retail outlets; (*b*) noninstallment credit at nonfinancial institutions, which also includes all credit cards; (*c*) corporate nonfarm nonfinancial business trade debt; (*d*) trade debt of farm business; (*e*) noncorporate nonfinancial nonfarm trade debt; and (*f*) private demand deposits plus currency in circulation outside banks. The sources for these are as follows:

a) *Federal Reserve Bulletin* (October 1966), p. 1510; and *Supplement to Money and Banking Statistics* (1965), sec. 16, p. 38.
b) *Federal Reserve Bulletin* (October 1966), p. 1510; and *Supplement to Money and Banking Statistics* (1965), sec. 16, p. 33.
c) *Federal Reserve Bulletin* (October 1966), p. 1541; and *Flow of Funds in the United States 1939–53*, p. 368. These two series were made comparable by multiplying the Federal Reserve Board data by 1.1.
d) *Federal Reserve Bulletin* (October 1966), p. 1541; and *Flow of Funds in the United States 1939–53*, p. 368.
e) *Federal Reserve Bulletin* (October 1966), p. 1541; and *Flow of Funds in the United States 1939–53*, p. 368. These data were made comparable by multiplying the FRB data by 1.535.
f) For the period 1939–46 this series is from the Friedman-Schwartz data in *Historical Statistics of the United States, Colonial Times to 1957*, p. 646; series no. 267 is multiplied by 1.0589 in order to reverse the seasonal adjustment factor. For the period 1947–53 the series is from *Federal Reserve Bulletin* (October 1960), pp. 1116–19; for the period 1954–60 the series is from *Supplement to Banking and Monetary Statistics* (1965), sec. 1, pp. 21–22; for the period 1961–65 the series is from *Federal Reserve Bulletin* (October 1966), p. 1478.

These data, when combined, are as of December 31 of the year shown and are converted into midpoint figures by averaging two consecutive year-end figures.

2. *Effective Reserve Money*

The stock of effective reserve money is composed of two factors: (*a*) actual reserves and (*b*) reserve requirements relative to 20 percent. The sources for these are:

a) Total reserves of member banks are from the *Federal Reserve Bulletin* (October 1966), p. 1468; and *Historical Statistics of the United States*, p. 641, series no. 252.
b) Twenty percent divided by the reserve requirements of central reserve city banks found in several issues of the *Federal Reserve Bulletin.*

These two series when multiplied give the total effective stock of reserves as of December 31 of each year. These, too, were made into midyear figures by averaging consecutive year-end figures.

3. *Gross National Product*

This series is simply gross national product in current dollars obtained from the *Economic Report of the President 1968*, table B-1, p. 209.

4. *Degree of Market Utilization*

This series is total corporate sales divided by total corporate value added. Total corporate sales and total corporate value added are from *National Income and Product Accounts of the United States 1929–1965*, tables 6.19 and 1.13, respectively.

5. *Interest Rates*

This series comprises the rates on prime bankers' acceptances, which may be obtained from the *Federal Reserve Bulletin* and from *Historical Statistics of the United States, Colonial Times to 1957*, series no. 309, p. 654.

6. *Real Size per Economic Unit*

This series is again composed of two separate and distinct parts and conceptually tries to arrive at some mean real sum expended per economic unit in the United States. The first part of this series has to do with the household sector and is simply mean real consumption expenditures per person. Consumption expenditures in 1958 prices and population are obtained from the *Economic Report of the President 1967*, table B-2, p. 214, and table B-19, p. 235, respectively. Family data, although conceptually preferable, were not available. This part of the series was put on an index basis with 1939 = 100.

On the corporate side, average compiled receipts is obtained by dividing total compiled receipts by the number of corporations in each asset size category. The result was a matrix of mean compiled receipts, with the two different axes being years and size categories. Another matrix with the same axes was calculated, but this time the percentage of total money held by each size category summed to 100 for every year. These two matrices were then cross-multiplied and summed across by year, giving a figure of mean nominal sales per firm per year. All the above data are from *Historical Statistics of the*

	1	2	3	4	5	6	7	8	9	10	11
1946 . . .	140.1	16.083	208.5	3.0703	0.61	114.95	321.0	0.667	106.0	138.0	140.1
1947 . . .	153.5	16.700	231.3	3.2561	0.87	127.72	322.8	0.746	113.7	148.2	147.8
1948 . . .	159.1	16.505	257.6	3.1687	1.11	133.89	325.5	0.796	114.3	149.8	149.6
1949 . . .	160.2	15.404	256.5	3.1354	1.13	126.02	328.2	0.791	113.1	149.1	152.7
1950 . . .	168.1	15.434	284.8	3.2161	1.15	137.09	338.0	0.802	115.7	152.0	157.3
1951 . . .	182.3	16.363	328.4	3.1545	1.60	142.59	353.1	0.856	122.0	159.3	163.5
1952 . . .	193.9	17.281	345.5	3.1121	1.75	136.60	367.1	0.875	127.9	167.4	172.2
1953 . . .	200.1	17.875	364.6	3.0602	1.87	141.31	381.2	0.883	131.0	173.7	181.4
1954 . . .	206.9	18.693	364.8	3.0855	1.35	130.76	388.0	0.896	133.7	180.0	190.0
1955 . . .	220.2	19.259	398.0	3.1814	1.71	138.13	403.2	0.909	137.1	186.0	194.3
1956 . . .	233.0	19.388	419.2	3.1526	2.64	137.56	415.5	0.940	139.5	190.0	198.0
1957 . . .	238.6	19.478	441.1	3.2216	3.45	136.88	426.5	0.975	139.8	193.8	205.7
1958 . . .	245.4	20.209	447.3	3.2603	2.04	129.89	432.0	1.000	142.0	202.6	217.1
1959 . . .	255.8	21.015	483.7	3.2503	3.49	134.14	444.6	1.016	145.2	210.8	227.9
1960 . . .	261.8	22.202	503.7	3.2606	3.51	134.84	455.3	1.033	145.2	214.5	238.1
1961 . . .	269.1	23.877	520.1	3.2902	2.81	132.36	466.7	1.046	147.1	223.5	252.1
1962 . . .	279.2	24.336	560.3	3.3121	3.01	133.55	481.6	1.058	150.5	239.7	267.7
1963 . . .	291.1	24.716	590.5	3.3016	3.36	134.39	500.1	1.072	154.5	258.3	284.3
1964 . . .	307.4	25.667	632.4	3.2905	3.77	139.00	520.6	1.088	160.7	278.8	302.7
1965 . . .	326.2	26.863	683.9	3.3618	4.22	142.57	544.9	1.109	168.0	303.2	322.5
1966 . . .	343.3	28.210	743.3	3.3484	5.36	147.92	574.2	1.139	173.9	324.9	343.2

NOTE:
1 = Total nominal money—demand deposits, currency plus unutilized trade credit available (billions of dollars).
2 = Nominal effective reserve money (billions of dollars).
3 = Current gross national product (billions of dollars).
4 = Degree of market utilization.
5 = Short-term rate of interest (percentage per annum).
6 = Real size per economic unit (index 1939 = 100).
7 = Real permanent income (billions of 1958 dollars).
8 = GNP price deflator (index 1958 = 1).
9 = Nominal money—demand deposits plus currency (billions of dollars).
10 = Nominal money—demand deposits, currency plus time deposits (billions of dollars).
11 = Nominal money—demand deposits, currency plus an alternative estimate of unutilized trade credit available (billions of dollars).

United States, Colonial Times to 1957 and the *Supplement* to 1962, and, to update, the direct sources are cited. The 1960 money weights were used for 1962 on.

This series was deflated by the GNP price deflator and put on an index basis with 1939 = 100.

The two indices were combined by weighting the first series by .33 and the second by .67.

7. *Real Permanent Income*

Real permanent income per capita was obtained from S. B. Chase, Jr., "Household Demand for Savings Deposits, 1921–1965," mimeographed (Washington, D.C.: Brookings Institution, March 1968). The series was updated to obtain figures for 1966. These were then multiplied by the population figures from the *Economic Report of the President 1968*, table B-21, p. 233.

8. *GNP Price Deflator*

This is from the *Economic Report of the President 1968*, table B-3, p. 212.

9–11. *Other Views of Money*

The data for demand deposits adjusted plus currency in circulation outside banks are from the *Federal Reserve Bulletin*, several issues, such as October 1966, p. 1478; for 1946 data are from the Friedman-Schwartz data in *Historical Statistics of the United States, Colonial Times to 1957*, p. 646 (series no. 267 is multiplied by 1.0589 in order to reverse the seasonal adjustment factor). (See sec. 1.*f.* above.)

Data for time deposits at commercial banks adjusted are from the *Federal Reserve Bulletin*, several issues, such as October 1966, p. 1478.

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