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The Role of the Money Supply in the Conduct of Monetary Policy

Evolution of the Concept of the Demand for Money

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The Role of the Money Supply in the Conduct of Monetary Policy

The following letter, dated November 6, 1973, by Arthur F. Burns, Chairman of the Board of Governors of the Federal Reserve System, was written in response to inquiries by Senator Proxmire regarding criticisms of monetary policy during the past year.

The Honorable William Proxmire
United States Senate
Washington, D. C.

Dear Senator Proxmire:

I am writing in further response to your letter of September 17, 1973, which requested comments on certain criticisms of monetary policy over the past year.

As stated in your letter, the criticisms are: (1) "that there was too much variation from time to time in the rate of increase in the money supply, that monetary policy was too erratic, too much characterized by stops and starts"; and (2) "that the money supply had increased much too much last year, in fact that the increase would have been too much even if we had been in the depths of a recession instead of enjoying a fairly vigorous economic expansion."

These criticisms involve basic issues with regard to the role of money in the economy, and the role that the money supply should play in the formulation and execution of monetary policy. These issues, along with the specific points you raise, require careful examination.

Criticism of Our Public Policies

During the past two years the American economy has experienced a substantial measure of prosperity. Real output has increased sharply, jobs have been created for millions of additional workers, and total personal income—both in dollars and in terms of real purchasing power—has risen to the highest levels ever reached.

Yet the prosperity has been a troubled one. Price increases have been large and widespread. For a time, the unemployment rate remained unduly high. Interest rates have risen sharply since the spring of 1972. Mortgage money has recently become difficult to obtain in many communities. And confidence in the dollar at home and abroad has at times wavered.

Many observers have blamed these difficulties on the management of public economic policies. Certainly, the Federal budget—despite vigorous efforts to hold expenditures down—continued in substantial deficit. There has also been an enormous growth in the activities of Federally-sponsored agencies which, although technically outside the budget, must still be financed. The results of efforts to control wages and prices during the past year have been disappointing. Partial decontrol in early 1973 and the subsequent freeze failed to bring the results that were hoped for.

Monetary policy has been criticized on somewhat contradictory counts—for being inflationary, or for permitting too high a level of interest rates, or for failing to bring the economy back to full employment, or for permitting excessive short-term variations in the growth of the money supply, and so on.

One indication of dissatisfaction with our public policies was provided by a report, to which you refer in your letter, on a questionnaire survey conducted by the National Association of Business Economists. Of the respondents, 38 per cent rated fiscal policy "over the past year" as "poor"; 41 per cent rated monetary policy "over the past year" as "poor"; only 14 per cent felt that the wage-price controls under Phase IV were "about right." If this sampling is at all indicative, the public policies on which we have relied are being widely questioned. Many members of the above group, in fact, went on record for a significant change in fiscal policy. In response to a question whether they favored a variable investment tax credit, 46.5 per cent said "yes," 40 per cent said "no," and 13.5 per cent expressed "no opinion."

Let me turn now to the questions raised in your letter and in some other recent discussions about monetary policy. I shall discuss, in particular, the role of money supply in the conduct of monetary policy; the extent and significance of variability in the growth of the money supply; and the actual behavior of the money supply during 1972-73.

Role of Money Supply

For many years economists have debated the role of the money supply in the performance of economic systems. One school of thought, often termed "monetarist," claims that changes in the money supply influence very importantly, perhaps even decisively, the pace of economic activity and the level of prices. Monetarists contend that the monetary authorities should pay principal attention to the money supply, rather than to other financial variables such as interest rates, in the conduct of monetary policy. They also contend that fiscal policy has only a small independent impact on the economy.

Another school of thought places less emphasis on the money supply and assigns more importance to the expenditure and tax policies of the Federal Government as factors influencing real economic activity and the level of prices. This school emphasizes the need for monetary policy to be concerned with interest rates and with conditions in the money and capital markets. Some economic activities, particularly residential building and State and local government construction, depend heavily on borrowed funds, and are therefore influenced greatly by changes in the cost and availability of credit. In other categories of spending—such as business investment in fixed capital and inventories, and consumer purchases of durable goods—credit conditions play a less decisive role, but they are nonetheless important.

Monetarists recognize that monetary policy affects private spending in part through its impact on interest rates and other credit terms. But they believe that primary attention to the growth of the money supply will result in a more appropriate monetary policy than would attention to conditions in the credit markets.

Needless to say, monetary policy is—and has long been—a controversial subject. Even the monetarists do not speak with one voice on monetary policy. Some influential monetarists believe that monetary policy should aim strictly at maintaining a constant rate of growth of the money supply. However, what that constant should be, or how broadly the money supply should be defined, are matters on which monetarists still differ. And there are also monetarists who would allow some—but infrequent—changes in the rate of growth of the money supply, in accordance with changing economic conditions.

It seems self-evident that adherence to a rigid growth rate rule, or even one that is changed infrequently, would practically prevent monetary policy from playing an active role in economic stabilization. Monetarists recognize this. They believe that most economic disturbances tend to be self-correcting, and they therefore argue that a constant or nearly constant rate of growth of the money supply would result in reasonably satisfactory economic performance.

But neither historical evidence, nor the thrust of explorations in business-cycle theory over a long century, give support to the notion that our economy is inherently stable. On the contrary, experience has demonstrated repeatedly that blind reliance on the self-correcting properties of our economic system can lead to serious trouble. Discretionary economic policy, while it has at times led to mistakes, has more often proved reasonably successful. The disappearance of business depressions, which in earlier times spelled mass unemployment for workers and mass bankruptcies for businessmen, is largely attributable to the stabilization policies of the last thirty years.

The fact is that the internal workings of a market economy tend of themselves to generate business fluctuations, and most modern economists recognize this. For example, improved prospects for profits often spur unsustainable bursts of investment spending. The flow of personal income in an age of affluence allows ample latitude for changes in discretionary expenditures and in savings rates. During a business-cycle expansion various imbalances tend to develop within the economy—between aggregate inventories and sales, or between aggregate business investment in fixed capital and consumer outlays, or between average unit costs of production and prices. Such imbalances give rise to cyclical movements in the economy. Flexible fiscal and monetary policies, therefore, are often needed to cope with undesirable economic developments, and this need is not diminished by the fact that our available tools of economic stabilization leave something to be desired.

There is general agreement among economists that, as a rule, the effects of stabilization policies occur gradually over time, and that economic forecasts are an essential tool of policy making. However, no economist—or school of economics—has a monopoly on accurate forecasting. At times, forecasts based largely on the money supply have turned out to be satisfactory. At other times, such forecasts have been quite poor, mainly because of unanticipated changes in the intensity with which the existing money stock is used by business firms and consumers.

Changes in the rate of turnover of money have historically played a large role in economic fluctuations, and they continue to do so. For example, the narrowly-defined money stock—that is, demand deposits plus currency in public circulation—grew by 5.7 per cent between the fourth quarter of 1969 and the fourth quarter of 1970. But the turnover of

money declined during that year, and the dollar value of GNP rose only 4.5 per cent. In the following year, the growth rate of the money supply increased to 6.9 per cent, but the turnover of money picked up briskly and the dollar value of GNP accelerated to 9.3 per cent. The movement out of recession in 1970 into recovery in 1971 was thus closely related to the greater intensity in the use of money. Occurrences such as this are very common because the willingness to use the existing stock of money, expressed in its rate of turnover, is a highly dynamic force in economic life.

For this as well as other reasons, the Federal Reserve uses a blend of forecasting techniques. The behavior of the money supply and other financial variables is accorded careful attention. So also are the results of the most recent surveys on plant and equipment spending, consumer attitudes, and inventory plans. Recent trends in key producing and spending sectors are analyzed. The opinions of businessmen and outside economic analysts are canvassed, in part through the nationwide contacts of Federal Reserve Banks. And an assessment is made of the probable course of fiscal policy, also of labor-market and agricultural policies, and their effects on the economy.

Evidence from all these sources is weighed. Efforts are also made to assess economic developments through the use of large-scale econometric models. An eclectic approach is thus taken by the Federal Reserve, in recognition of the fact that the state of economic knowledge does not justify reliance on any single forecasting technique. As economic research has cumulated, it has become increasingly clear that money does indeed matter. But other financial variables also matter.

In recent years, the Federal Reserve has placed somewhat more emphasis on achieving desired growth rates of the monetary aggregates, including the narrowly-defined money supply, in its conduct of monetary policy. But we have continued to give careful attention to other financial indicators, among them the level of interest rates on mortgages and other loans and the liquidity position of financial institutions and the general public. This is necessary because the economic implications of any given monetary growth rate depend on the state of liquidity, the attitudes of businessmen, investors, and consumers toward liquidity, the cost and availability of borrowed funds, and other factors. Also, as the nation's central bank, the Federal Reserve can never lose sight of its role as a lender of last resort, so that financial crises and panics will be averted.

I recognize that one advantage of maintaining a relatively stable growth rate of the money supply is that a partial offset is thereby provided to unexpected and undesired shifts in the aggregate demand for goods and services. There is always some uncertainty as to the emerging strength of aggregate demand. If money growth is maintained at a rather stable rate, and aggregate demand turns out to be weaker than is consistent with the nation's economic objectives, interest rates will tend to decline and the easing of credit markets should help to moderate the undesired weakness in demand. Similarly, if the demand for goods and services threatens to outrun productive capacity, a rather stable rate of monetary growth will provide a restraining influence on the supply of credit and thus tend to restrain excessive spending.

However, it would be unwise for monetary policy to aim at all times at a constant or nearly constant rate of growth of money balances. The money growth rate that can contribute most to national objectives will vary with economic conditions. For example, if the aggregate demand for goods and services is unusually weak, or if the demand for liquidity is unusually strong, a rate of increase in the money supply well above the desirable long-term trend may be needed for a time. Again, when the economy is experiencing severe cost-push inflation, a monetary growth rate that is relatively high by a historical yardstick may have to be tolerated for a time. If money growth were severely constrained in order to combat the element of inflation resulting from such a cause, it might well have seriously adverse effects on production and employment. In short, what growth rate of the money supply is appropriate at any given time cannot be determined simply by extrapolating past trends or by some preconceived arithmetical standard.

Moreover, for purposes of conducting monetary policy, it is never safe to rely on just one concept of money—even if that concept happens to be fashionable. A variety of plausible concepts merit careful attention, because a number of financial assets serve as a convenient, safe, and liquid store of purchasing power.

The Federal Reserve publishes data corresponding to three definitions of money, and takes all of them into account in determining policy. The three measures are: (a) the narrowly-defined money stock (M_1), which encompasses currency and demand deposits held by the nonbank public; (b) a more broadly-defined money stock (M_2), which also includes time and savings deposits at commercial banks (other than large negotiable time certificates of deposits); (c) a still broader definition (M_3), which

includes savings deposits at mutual savings banks and savings and loan associations. A definition embracing other liquid assets could also be justified—for example, one that would include large-denomination negotiable time certificates of deposit, U. S. savings bonds and Treasury bills, commercial paper, and other short-term money market instruments.

There are many assets closely related to cash, and the public can switch readily among these assets. However money may be defined, the task of determining the amount of money needed to maintain high employment and reasonable stability of the general price level is complicated by shifting preferences of the public for cash and other financial assets.

Variability of Money Supply Growth

In the short-run, the rate of change in the observed money supply is quite erratic, and cannot be trusted as an indicator of the course of monetary policy. This would be so even if there were no errors of measurement.

The record of hearings held by the Joint Economic Committee on June 27, 1973 includes a memorandum which I submitted on problems encountered in controlling the money supply. As indicated there, week-to-week, month-to-month, and even quarter-to-quarter fluctuations in the rate of change of money balances are frequently influenced by international flows of funds, changes in the level of U. S. Government deposits, and sudden changes in the public's attitude towards liquidity. Some of these variations appear to be essentially random—a product of the enormous ebb and flow of funds in our modern economy.

Because the demands of the public for money are subject to rather wide short-term variations, efforts by the Federal Reserve to maintain a constant growth rate of the money supply could lead to sharp short-run swings in interest rates and risk damage to financial markets and the economy. Uncertainties about financing costs could reduce the fluidity of markets and increase the costs of financing to borowers. In addition, wide and erratic movements of interest rates and financial conditions could have undesirable effects on business and consumer spending. These adverse effects may not be of major dimensions, but it is better to avoid them.

In any event, for a variety of reasons explained in the memorandum for the Joint Economic Committee, to which I have previously referred, the Federal Reserve does not have precise control over the money supply. To give one example, a significant part of the money supply consists of deposits lodged in nonmember banks that are not subject to the reserve requirements set by the Federal Reserve. As a result there is some slippage in monetary control. Furthermore, since deposits at nonmember banks have been reported for only two to four days in a year, in contrast to daily statistics for member banks, the data on the money supply—which we regularly present on a weekly, monthly, and quarterly basis—are estimates rather than precise measurements. When the infrequent reports from nonmember banks become available, they often necessitate considerable revisions of the money supply figures. In the past two years, the revisions were upward, and this may happen again this year.

Some indication of the extent of short-term variations in the recorded money supply is provided below. Table I shows the average and maximum deviations (without regard to sign) of M_1 from its average annual growth rate over a three and a half year period. As would be expected, the degree of variation diminishes as the time unit lengthens; it is much larger for monthly than for quarterly data, and is also larger for quarterly than for semi-annual data.

Table I

DEVIATIONS IN M_1 FROM ITS AVERAGE RATE OF GROWTH, 1970 THRU MID-1973

	Annual Rates of Change in per cent	
Form of Data	Average Deviation	Maximum Deviation
Monthly	3.8	8.8
Quarterly	2.4	5.5
Semi-annual	1.8	4.1

In our judgment, there need be little reason for concern about the short-run variations that occur in the rate of change in the money stock. Such variations have minimal effects on the real economy. For one thing, the outstanding supply of money is very large. It is also quite stable, even when the short-run rate of change is unstable. This October the average outstanding supply of M_1, seasonally adjusted, was about $264 billion. On this base, a monthly rise or fall in the money stock of even $2½ billion would amount to only a 1 per cent change. But when such a temporary change is expressed as an annual rate, as is now commonly done, it comes out as about 12 per cent and attracts attention far beyond its real significance.

The Federal Reserve research staff has investigated carefully the economic implications of variability in M_1 growth. The experience of the past two decades

suggests that even an abnormally large or abnormally small rate of growth of the money stock over a period up to six months or so has a negligible influence on the course of the economy—provided it is subsequently offset. Such short-run variations in the rate of change in the money supply may not at all reflect Federal Reserve policy, and they do not justify the attention they often receive from financial analysts.

The thrust of monetary policy and its probable effects on economic activity can only be determined by observing the course of the money supply and of other monetary aggregates over periods lasting six months or so. Even then, care must be taken to measure the growth of money balances in ways that temper the influence of short-term variations. For example, the growth of money balances over a quarter can be measured from the amount outstanding in the last month of the preceding quarter to the last month of the curent quarter, or from the average amount outstanding during the preceding quarter to the average in the current quarter. The first measure captures the latest tendencies in the money supply, but may be distorted by random changes that have no lasting significance. The second measure tends to average out temporary fluctuations and is comparable to the data provided on a wide range of non-monetary economic variables, such as the gross national product and related measures.

A comparison of these two ways of measuring the rate of growth in M_1 is shown in Table II for successive quarters in 1972 and 1973. The first column, labeled M, shows annual rates calculated from end-months of quarters; the second column, labeled Q, shows annual rates calculated from quarterly averages.

Table II

GROWTH RATES OF MONEY SUPPLY ON TWO BASES

		Annual Rate of Change, in per cent	
		M	Q
1972	I	9.2	5.3
	II	6.1	8.4
	III	8.2	8.0
	IV	8.6	7.1
1973	I	1.7	4.7
	II	10.3	6.9
	III	0.3	5.1

As may be seen, the quarterly averages disclose much more clearly the developing trend of monetary restraint—which, in fact, began in the second quarter of 1972. Also, the growth of M_1, which on a month-end basis appears very erratic in the first three quarters of 1973, is much more stable on a quarterly average basis. For example, while the level of M_1 did not expand significantly between June and September, the quarterly average figures indicate further sizable growth in the third quarter. For purposes of economic analysis, it is an advantage to recognize that the money available for use was appreciably larger in the third quarter than in the second quarter.

Experience of 1972-73

During 1972, it was the responsibility of the Federal Reserve to encourage a rate of economic expansion adequate to reduce unemployment to acceptable levels. At the same time, despite the dampening effects of the wage-price control program, inflationary pressures were gathering. Monetary policy, therefore, had to balance the twin objectives of containing inflationary pressures and encouraging economic growth. These objectives were to some extent conflicting, and monetary policy alone could not be expected to cope with both problems. Continuation of an effective wage-price program and a firmer policy of fiscal restraint were urgently needed.

The narrowly-defined money stock increased 7.4 per cent during 1972 (measured from the fourth quarter of 1971 to the fourth quarter of 1972). Between the third quarter of 1972 and the third quarter of 1973, the growth rate was 6.1 per cent. By the first half of 1973, the annual growth rate had declined to 5.8 per cent, and a further slowing occurred in the third quarter.

Evaluation of the appropriateness of these growth rates would require full analysis of the economic and financial objectives, conditions, and policies during the past two years, if not longer. Such an analysis cannot be undertaken here. Some perspective on monetary developments during 1972-73 may be gained, however, from comparisons with the experience of other industrial countries, and by recalling briefly how domestic economic conditions evolved during this period.

Table III compares the growth of M_1 in the United States with that of other industrial countries in 1972 and the first half of 1973. The definitions of M_1 differ somewhat from country to country, but are as nearly comparable as statistical sources permit. It goes without saying that each country faced its own set of economic conditions and problems. Yet it is useful to note that monetary growth in the United States was much lower than in other major industrial countries, and that it also was steadier than in the other countries.

Table III

ANNUAL PER CENT RATES OF GROWTH IN MONEY SUPPLY

	4th Quarter 1971 to 4th Quarter 1972	4th Quarter 1972 to 2nd Quarter 1973
United States	7.4	5.8
United Kingdom	14.1	10.0
Germany	14.3	4.2
France	15.4	8.7
Japan	23.1	28.2

The next table shows, in summary fashion, the rates of change in the money supply of the United States, in its total production, and in the consumer price level during 1972 and 1973. The table is based on the latest data. It may be noted, in passing, that, according to data available as late as January 1973, the rate of growth of M_1 during 1972 was 7.2%, not 7.4%; and that the rate of increase in real GNP was 7.7%, not 7.0%. In other words, on the basis of the data available during 1972, the rate of growth of M_1 was below the rate of growth of the physical volume of over-all production.

Table IV

MONEY SUPPLY, GNP, AND PRICES IN THE U. S.

(Per cent change at annual rates)

	4th Quarter 1971 to 4th Quarter 1972	4th Quarter 1972 to 2nd Quarter of 1973	4th Quarter 1972 to 3rd Quarter of 1973
Money supply (M_1)	7.4	5.8	5.6
Gross National Product			
Current dollars	10.6	12.1	11.7
Constant dollars	7.0	5.4	4.8
Prices			
Consumer price index (CPI)	3.4	7.1	7.8
CPI excluding food	3.0	4.0	4.1

The table indicates that growth in M_1 during 1972 and 1973 approximately matched the growth of real output, but was far below the expansion in the dollar value of the nation's output. Although monetary policy limited the availability of money relative to the growth of transactions demands, it still encouraged a substantial expansion in economic activity; real output rose by about 7 per cent in 1972. Even so, unemployment remained unsatisfactorily high throughout the greater part of the year. It was not until November that the unemployment rate dropped below 5½ per cent. For the year as a whole, the unemployment rate averaged 5.6 per cent. It may be of interest to recall that unemployment averaged 5.5 per cent in 1954 and 1960, which are commonly regarded as recession years.

Since the expansion of M_1 in 1972 was low relative to the demands for money and credit, it was accompanied by rising short-term interest rates. Long-term interest rates showed little net change last year, as credit demands were satisfied mainly in the short-term markets.

In 1973, the growth of M_1 moderated while the transactions demands for cash and the turnover of money accelerated. GNP in current dollars rose at a 12 per cent annual rate as prices rose more rapidly. In credit markets, short-term interest rates rose sharply further, while long-term interest rates also moved up, though by substantially less than short-term rates.

The extraordinary upsurge of the price level this year reflects a variety of special influences. First, there has been a world-wide economic boom superimposed on the boom in the United States. Second, we have encountered critical shortages of basic materials. The expansion in industrial capacity needed to produce these materials had not been put in place earlier because of the abnormally low level of profits between 1966 and 1971 and also because of numerous impediments to new investment on ecological grounds. Third, farm product prices escalated sharply as a result of crop failures in many countries last year. Fourth, fuel prices spurted upward, reflecting the developing shortages in the energy field. And fifth, the depreciation of the dollar in foreign exchange markets has served to boost prices of imported goods and to add to the demands pressing on our productive resources.

In view of these powerful special factors, and the cyclical expansion of our economy, a sharp advance in our price level would have been practically inevitable in 1973. The upsurge of the price level this year hardly represents either the basic trend of prices or the response of prices to previous monetary or fiscal policies—whatever their shortcomings may have been. In particular, as the above table shows, the explosion of food prices that occurred this year is in large part responsible for the accelerated rise in the over-all consumer price level.

The severe rate of inflation that we have experienced in 1973 cannot responsibly be attributed to monetary management or to public policies more generally. In retrospect, it may well be that monetary policy should have been a little less expansive in

1972. But a markedly more restrictive policy would have led to a still sharper rise in interest rates and risked a premature ending of the business expansion, without limiting to any significant degree this year's upsurge of the price level.

Concluding Observations

The present inflation is the most serious economic problem facing our country, and it poses great difficulties for economic stabilization policies. We must recognize, I believe, that it will take some time for the forces of inflation, which now engulf our economy and others around the world, to burn themselves out. In today's environment, controls on wages and prices cannot be expected to yield the benefits they did in 1971 and 1972, when economic conditions were much different. Primary reliance in dealing with inflation —both in the near future and over the longer term— will have to be placed on fiscal and monetary policies.

The prospects for regaining price stability would be enhanced by improvements in our monetary and fiscal instruments. The conduct of monetary policy could be improved if steps were taken to increase the precision with which the money supply can be controlled by the Federal Reserve. Part of the present control problem stems from statistical inadequacies—chiefly the paucity of data on deposits at nonmember banks. Also, however, control over the money supply and other monetary aggregates is less precise than it can or should be because nonmember banks are not subject to the same reserve requirements as are Federal Reserve members.

I hope that the Congress will support efforts to rectify these deficiencies. For its part, the Federal Reserve Board is even now carrying on discussions with the Federal Deposit Insurance Corporation about the need for better statistics on the nation's money supply. The Board also expects shortly to recommend to the Congress legislation that will put demand deposits at commercial banks on a uniform basis from the standpoint of reserve requirements.

Improvements in our fiscal policies are also needed. It is important for the Congress to put an end to fragmented consideration of expenditures, to place a firm ceiling on total Federal expenditures, and to relate these expenditures to prospective revenues and the nation's economic needs. Fortunately, there is now widespread recognition by members of Congress of the need to reform budgetary procedures along these broad lines.

It also is high time for fiscal policy to become a more versatile tool of economic stabilization. Particularly appropriate would be fiscal instruments that could be adapted quickly, under special legislative rules, to changing economic conditions—such as a variable tax credit for business investment in fixed capital. Once again I would urge the Congress to give serious consideration to this urgently needed reform.

We must strive also for better understanding of the effects of economic stabilization policies on economic activity and prices. Our knowledge in this area is greater now than it was five or ten years ago, thanks to extensive research undertaken by economists in academic institutions, at the Federal Reserve, and elsewhere. The keen interest of the Joint Economic Committee in improving economic stabilization policies has, I believe, been an influence of great importance in stimulating this widespread research effort.

I look forward to continued cooperation with the Committee in an effort to achieve the kind of economic performance our citizens expect and deserve.

Sincerely yours,

Arthur F. Burns

Evolution of the Concept of the Demand for Money

The concept of the *demand for money* is one of the more fundamental elements of contemporary macroeconomic analysis. This concept refers to the functional relationship, often expressed as a mathematical equation, between the quantity of money that people demand to *hold* and the variables (e.g., interest rates, income, wealth, etc.) on which that quantity depends. Demand-for-money equations are key components of current theoretical and empirical models of the aggregate economy. For example, such equations are used to represent the behavior of the demand side of the so-called "money-market sector" in large-scale econometric models employed in simulating the influence of policy actions and other changes on the economic system. In these models, money demand equations help to determine the solution (equilibrium) values of national income, interest rates, the price level, and other measures of aggregate economic activity.

The chief reason for economists' interest in the demand-for-money relationship, however, is its practical policy implications. Macroeconomic analysis suggests that certain properties of the money demand function may critically influence the degree of effectiveness of monetary policy. Especially important are (1) the interest rate *elasticity* of the demand for money, i.e., the responsiveness or sensitivity of the quantity of money demanded to changes in market interest rates and (2) the *stability* of the functional relationship between money balances demanded and the independent variables (interest rates, income, etc.) of the equation. For example, if the amount of money demanded is extremely interest elastic, monetary policy may be powerless to stimulate the economy because, in this case, the slightest fall in the rate of interest, resulting from a policy engineered expansion of the money stock, would simply induce cash holders to absorb all the new money into idle hoards. Consequently, no increase in expenditure would ensue. Even if the demand for money is not excessively responsive to interest rate changes, however, policymakers may still be confronted with the problem of an *unstable* demand relationship. Instability of the money demand function would hinder monetary policy by making it difficult for the authorities to predict the impact of policy-induced changes in the money supply. An erratically shifting demand function might offset the effect of a controlled shift in the money supply at one time yet accentuate it at another. Having no firm grasp on the demand function, policymakers could not hope to assess correctly the magnitude or direction of the effects of their policy actions.

Over the past two decades the demand for money has been the subject of many ingenious and complex theoretical and empirical studies. It was not always thus, however. Owing to the strategic importance of the money demand function, one might assume that there had been an early emergence of a sophisticated analysis of it. It seems reasonable to expect that the techniques and standards applied in demand-for-money constructions at least would have matched those employed in ordinary commodity demand analysis. Such was not the case, however, and for years the methods of monetary demand analysis differed from those of traditional demand theory.

By the turn of the century, commodity demand analysis was firmly anchored in the theory of utility-maximizing behavior—part of the general theory of rational choice. The utility-maximization analysis provided economists with a set of powerful analytical techniques that were employed systematically in identifying both the general form and the principal independent variables of commodity demand functions. By contrast, techniques of microeconomic value theory were not introduced into monetary analysis until the mid-1930's, and even then their application was incomplete. Not until the 1950's was money demand analysis fully integrated into the rational choice framework employed in ordinary demand analysis. One unfortunate consequence of this delay was that for years monetary theorists virtually ignored, or at least did not examine systematically, the influence of cost and yield considerations on money-holding decisions.

Why were economists so slow in applying the methods and procedures of traditional demand analysis to money? What did these methods and procedures consist of and how did money demand theory depart from them? How did the older approaches to the demand for money differ from their current counterparts? What were the main stages of transition from the older approaches to the current ones,

and how did this development manifest itself in successive formulations of the money demand function? What explanatory variables were stressed in each formulation? Most important, what were the chief policy implications of the alternative views? This article seeks to answer these questions by tracing against the backdrop of orthodox demand analysis the main lines of development of the theory of the demand for money from the early decades of the century to the present. The basic method employed in ordinary demand analysis is outlined in the following section, which then serves as a point of reference for the remainder of the article dealing with the study of demand-for-money relationships.

Conventional Demand Analysis Commodity demand analysis is founded on the theory of rational choice, or optimizing (i.e., constrained utility-maximizing) behavior. The analysis begins at the level of the individual consumer and seeks to deduce how he will allocate his limited money resources—the so-called budget constraint—among the various goods available to him at given market prices in such a way as to maximize his total satisfaction or utility. The conclusion is that he will apportion his budget in such a way that the rate at which he can substitute one good for another via market exchanges is just equal to the rate at which he is willing to do so (his subjective trade-off).

In principle, the individual's demand function for any commodity can be derived from this analysis of budget-constrained utility-maximization. The resulting demand functions indicate the relationships between the quantities demanded of the goods and the variables on which those quantities depend. With tastes and preferences given, the individual's demand for any commodity will depend chiefly on two sets of variables: (1) relative prices (the price of the good in question in comparison with the prices of all other goods that compete for the consumer's expenditure) and (2) the consumer's income (his budget constraint). The *relative price* variables represent the terms in which one good can be substituted for (transformed into) other goods via market exchanges. These variables also measure the opportunity costs of obtaining one good in terms of the amounts of other goods whose purchase must be sacrificed or foregone. The remaining variable, income, indicates the individual's command over all goods (the purchasing power of his budget) and thus serves to fix an upper limit on the amount of the commodity he can purchase.

Relative price and income variables play strategic roles in demand analysis. Operating through these variables are the *substitution* and *income effects*, the two main forces influencing the amount of any good demanded by an individual. The substitution effect refers to the shift in expenditure patterns following a change in relative prices, which, by altering the rates of exchange among commodities, induces the substitution of relatively cheaper for relatively dearer goods in the consumer's budget. The income effect refers to the demand impact of a price-induced change in the real purchasing power of the individual's total budget, which alters his entire range of alternatives. For example, the lowering of the price of a single good has the effect of increasing the consumer's effective budget, thereby expanding his field of choice and thus influencing his demand for all commodities including the particular good in question.

The next stage of the analysis is to derive the market demand function by aggregating over all the individual demand functions. In general, relative prices and income will also be the chief arguments in the market demand functions. The important point, however, is that the analysis proceeds from the level of the individual decision-making unit to the market; market demand functions follow from individual demand functions. Finally, in the last stage of the analysis, the market demand and market supply equations are solved simultaneously to determine the market clearing levels of price and output.

To summarize, traditional demand analysis: (1) is based on the principle of optimization or rational choice, (2) starts at the level of the individual decision-making agent and then proceeds, via aggregation, to the market level, and (3) predicts that demands will be largely determined by relative prices and income constraints.

The Demand for Money—Transactions Velocity Approach To the modern economist, it seems natural to construct demand-for-money equations in exactly the same way that commodity demand equations are formulated. The analysis begins at the level of the individual money holder, determines the appropriate budget constraint and the relevant opportunity cost or relative price variables that enter his demand-for-money function, and derives via aggregation the total market demand-for-money function. The analysis then proceeds to investigate both the substitution effects between money and competing assets stemming from changes in relative (comparative) rates of return and the income (or wealth) effects on the demand for money stemming from changes in national income.

This conventional approach is of relatively recent origin, however. Up through the early decades of

the twentieth century, economists as a rule did not examine the demand for money along the lines of orthodox demand theory. Rational choice principles, or utility-maximization analysis, it was argued, could not explain why any individual would want to hold money, because cash holdings as such were believed to produce no direct satisfaction. In short, money was viewed as just a mechanical *medium of exchange,* i.e., something used to facilitate market transactions and to circulate goods, but not in itself a utility-yielding asset.

The distinguishing feature of a medium of exchange is that it is transferred or circulated, not that it is held. Accordingly, theories that focus exclusively on the medium-of-exchange function of money tend to ignore the demand for money *per se* and instead concentrate on how fast money circulates from hand to hand. This interest in the *circulation velocity,* or rate of use, of money was particularly characteristic of most nineteenth and early twentieth century monetary theorists.

These analysts pointed out that the efficiency with which money facilitates exchanges depends on how rapidly it circulates in market transactions. In the limit, the turnover velocity of a perfectly efficient medium of exchange would approach infinity; and the demand for cash balances correspondingly would approach zero. It was, of course, recognized that perfect efficiency in circulation is never achieved, that velocity is necessarily finite, and that people often maintain inventories of idle cash for sustained intervals of time. The existence of positive cash balances, however, was attributed not to rational choices and utility-maximizing decisions but rather to institutional "frictions" in the economic system. In sum, the rate of circulation of money—and by implication the demand-for-money balances—was thought to be determined by technological and institutional factors associated with the aggregate payments mechanism rather than by the subjective processes of individual decision-making. Consequently, analysis tended to center on statistical measures of the aggregate transactions velocity of money, rather than on cost and yield considerations affecting the money-holding choices of individual optimizers.

The leading exponent of the transactions velocity approach was the American economist, Irving Fisher, whose principal writing in the field of monetary theory, *The Purchasing Power of Money,* appeared in 1911. Fisher did not write out an explicit demand-for-money function. Instead, he examined the behavior of velocity within the framework of his celebrated *equation of exchange,* $MV = PT$. This formula is an identity stating that total spending, MV—the product of the average stock of money, M, and the average number of times each unit of money turns over in financing exchanges (velocity), V—must equal the aggregate value of transactions, PT—the product of the total number of transactions, T, and the average price per transaction, P.

Fisher argued that the transactions velocity of money was determined by slowly changing technological and institutional factors, e.g., state of development of the banking system, frequency of receipts and disbursements, length of the payment period, degree of synchronization of cash inflows and outflows, rapidity of transportation and communication, etc. Since these factors were subject to only gradual, evolutionary change, velocity could be considered a virtual constant in the equation of exchange.

The constancy of velocity implies the complete stability of the demand for money. And with the latter absolutely stable, monetary policy could be expected to exert a powerful, predictable influence on prices and nominal income. Using the equation of exchange, Fisher demonstrated the potential potency of monetary policy in this stable demand case. With velocity, V, a constant, and transactions, T, also assumed to be a constant determined by the full-capacity utilization of the economy's productive resources, the equation could be expressed in a form, $P = (V/T)M = (\text{constant})\ M$, showing a constant proportional relationship between average prices and the money stock. This expression implied that a given percentage change in the money stock would cause the same percentage change in the price level.

The Cambridge Cash Balance Approach The initial step in moving the theory of the demand for money in the direction of ordinary demand analysis was taken simultaneously by several Continental and British economists. Among the more influential of these analysts was the small group associated with Cambridge University in England. In a series of writings spanning the period 1917-1930, economists of the Cambridge school contributed at least four innovations to monetary analysis, thereby advancing it beyond Fisher's transactions velocity formulation.

The first innovation was to concentrate on money in relation to final output, or national income, rather than on the much broader and more inclusive aggregate, total transactions. This innovation directed attention to the properties that make money a desirable object to *hold* as distinct from an object to *spend.* As long as one associates money with gross transactions, one necesarily tends to think of money exclusively as a means of exchange. By recasting the analysis in terms of income, rather than transactions,

however, the Cambridge school opened up the possibility of interpreting money as something more than just a medium of exchange.

With emphasis shifting from transactions to income, Fisher's equation of exchange was eventually restated as $MV_y = Py = Y$, where M is the stock of money in circulation, Y is nominal national income, y is real income or the national product valued at constant prices, P is the price level of the national product, and V_y is the income velocity of money, i.e., the ratio of nominal national income to the money stock or, alternatively, the rate of turnover of money as it circulates against the national product. A few analysts, particularly in the United States, began to use this equation to investigate the behavior of income velocity. The Cambridge school, however, for the most part generally eschewed analysis of money's circulation velocity and instead focused on the famous "Cambridge k," i.e., the desired ratio, k, of money balances to income. In other words, the Cambridge school sought to explain the proportion of annual income that the community of decision makers wished to hold in the form of money, not how rapidly money turns over in buying the national product.

This focus on the cash balance ratio was the second novelty of the Cambridge approach that ultimately led to a more conventional interpretation of the demand for money. Formally, k is just the reciprocal of the income velocity of circulation, i.e., $k = 1/V_y$. But the k ratio implies a desired *holding* of money balances, and is thus more suggestive of conventional demand theory than is V_y, the rate of spending of money. The Cambridge emphasis on cash *holdings* suggested that money might be a utility-yielding asset, and also that the demand for money, like the demand for any commodity, is a matter of individual choices and decisions.

As a third innovation, the Cambridge school reformulated the equation of exchange in a manner more consistent with orthodox demand and supply analysis. This step involved replacing the symbol for the income velocity of money with its reciprocal, the Cambridge k, and then incorporating the latter into the Cambridge cash balance equation $M = kPy$. The cash balance equation was interpreted as the equilibrium solution of a three-equation demand/supply system, rather than as a simple identity as had been the equation of exchange. Specifically, the Cambridge formulation implies (1) a demand-for-money equation $M_d = kPy$ with the income constraint, $Py = Y$, appearing as an explicit independent variable; (2) an exogenously determined money supply $M_s = M$; and (3) an equilibrium (market-clearing) condition stating that money supply must equal money demand, $M_s = M_d$, resulting in the cash balance equation, $M = kPy$.

As a fourth innovation, Cambridge economists explicitly stated a rudimentary money demand function and drew the demand curve corresponding to it. From the assumption that the community would wish to hold a constant quantity of real (price-deflated) cash balances at the full-capacity level of real output, an expression was derived showing the quantity of nominal balances demanded, M, as a function of the exchange value of the monetary unit (i.e., the reciprocal of the price level, 1/P). Admittedly an artificial construct, this particular demand equation expressed the product of the two variables M and 1/P as a fixed constant. Real income and the money/income ratio—the other factors that conceivably could influence the demand for money—were interpreted as fixed parameters in the function. The function was of a special form: when graphed in the Cartesian plane, with nominal money balances demanded, M, measured along the horizontal axis and the exchange value of money, 1/P, along the vertical axis, the equation described a downward-sloping *rectangular hyperbola.* The product of the coordinates of each point on this demand curve would be the same and equal to the constant quantity of real balances demanded, M/P. This special demand curve was used by the Cambridge school to demonstrate the validity of the *quantity theory of money.* The quantity theory asserts that, because people look to the purchasing power rather than to the mere money value of their cash balances, the price level would have to vary in direct proportion to the nominal money supply to maintain real balances intact.

One crucial element was missing from the Cambridge formulation, however. There was nothing in the money demand equations analogous to the relative price arguments that appear in ordinary demand functions. No variables entered the Cambridge equations to represent the opportunity costs of cash holdings, i.e., the yields on alternative non-monetary assets. Yet one normally would expect the demand for money to respond to changes in these costs or yields. For example, if cash holders behaved rationally, a rise in interest rates would probably induce a fall in k (the cash balance ratio) as people sought to economize on cash holdings and to substitute interest earning assets for money balances in their asset portfolios. Similarly, falling interest rates, by lowering the opportunity cost of holding money relative to the brokerage costs of converting it into and out of bonds, would most likely cause a rise in the cash balance ratio. Strangely, however, there was no explicit recognition of any yield or substitution effects in the

Cambridge equations. Instead, the Cambridge k ratio was treated as a numerical constant rather than as a variable whose magnitude is functionally related to rates of return on non-cash assets, i.e., $k = k(r)$.

Apparently the failure to include interest rates as a determinant of money demand stemmed from the Cambridge school's inability to see the full implications of its analytical approach. After constructing a framework conducive to the study of factors influencing cash-holding decisions, Cambridge economists failed to exploit this innovation fully. True, one can find in the writings of the Cambridge school references to a representative individual striking a balance between his holdings of cash and non-cash assets as well as some mention of trade-offs between costs and returns (convenience, safety, etc.) on cash holdings. But such passages were infrequent, and the insights they contain were never incorporated systematically into the Cambridge analysis. For the most part, Cambridge economists, when describing the determinants of k, referred to the same technological-institutional factors that Fisher had cited in his discussion of velocity.

The constancy of k in the Cambridge analysis had the same policy implications as the invariability of velocity in Fisher's theory. Both implied stability of the demand-for-money function and thus the powerful influence of monetary policy on prices and nominal incomes. According to the Cambridge analysis, the impact of policy-induced changes in the money supply would not be weakened or negated by perverse or unexpected shifts in the demand for money. To the contrary, the constant desired k ratio was interpreted as a reliable strategic link in the transmission mechanism connecting money to prices. Thus, any increase in the money supply would, first, raise the actual money/income ratio above the desired level; actual k would be greater than desired k. Then, individuals, finding that they were holding more cash than they wanted in relation to their incomes, would increase spending. The increased expenditure in a fully employed economy would push up market prices, thereby raising nominal income. This increased rate of spending would continue until the subsequent rise in the price level and nominal income was sufficient to bring the actual cash/income ratio into equality with the desired ratio. Since the desired ratio is constant, nominal income and the price level would have to rise in exactly the same proportion as the money stock. At this point the community would just be willing to hold the augmented stock of money and the adjustment process would be complete.

Keynes's Formulation As previously mentioned, the main shortcoming of the Cambridge cash balance analysis was its failure to incorporate yield or cost variables into the money demand function. This oversight was partially rectified in John Maynard Keynes's analysis of the speculative or liquidity preference demand for money, presented in his 1936 classic, *The General Theory of Employment, Interest, and Money.*

Keynes separated the demand for money into two distinct parts: (1) a demand for transactions or active balances to satisfy the transactions and precautionary motives for holding cash and (2) a demand for idle or asset balances to satisfy a speculative motive. Keynes labeled these two demands M_1 and M_2, respectively.

It was in conjunction with the speculative demand that he gave explicit consideration to the yields on assets that compete with money in individuals' portfolios. Keynes argued that individuals make their cash-holding decision by comparing the interest income that would be sacrificed by holding money with the expected capital gain or loss on holding bonds. The latter depends on decision makers' anticipations of future movements in bond prices and the degree of certainty with which those expectations are held. According to Keynes, these anticipations are formulated via comparisons of the current rate of interest with some expected "normal" or permanently maintainable rate. If the observed rate is above the normal rate, individuals will expect it to fall. Since bond prices vary inversely with bond yields, however, anticipations of falling interest rates mean expectations of rising bond prices and thus capital gains. The higher the current rate of interest the greater the amount of capital gains expected. Why? Because the larger the spread between the current and expected maintainable rates, the greater the *likelihood* that the interest rate will fall (bond prices will rise), and the greater the *amount* by which it can be expected to fall. Thus, the higher the current yield, the more costly are idle cash holdings in terms of expected capital gains sacrificed, as well as interest income foregone. Consequently, the smaller will be the quantity of cash demanded to satisfy the speculative motive.

Conversely, if the observed rate is below the expected normal rate, anticipations of rising bond yields and declining bond prices render cash the preferred asset in individuals' portfolios. An individual expecting the price of bonds to fall at a rate that would more than offset the interest earned on them would be motivated to hold zero-yield cash rather than the overpriced bonds. Generally, the lower the current

rate, the more unanimous will be the expectations that interest rates will subsequently rise, imposing capital losses on bond holders. Thus, the lower the current rate of interest the greater the number of people who prefer to hold cash rather than bonds and therefore the greater the total quantity of cash demanded. Aggregating over all individual portfolio optimizers gives a smooth downward-sloping function, $M_2 = f(r)$, relating the quantity of speculative or asset balances demanded to the current interest rate.

As for the transactions balance component of the total demand for money, i.e., the portion held to finance day-to-day purchases and to provide a reserve for emergencies, Keynes agreed with his predecessors, Fisher and the Cambridge school, that it would exhibit a simple, linear (proportional) relation to nominal income. In fact, Keynes's formulation of the transactions demand function is identical to the Cambridge school's and may be expressed by the Cambridge cash balance equation, $M_1 = kY$. The reader will note that Keynes did not apply rational choice, optimizing considerations to the transactions component of the demand for money. This task remained for later analysts, who showed that transactions balances also respond to cost and yield considerations.

Combining the two components of demand gives the Keynesian total money demand function, $M = M_1 + M_2 = kY + f(r)$. According to this function, the quantity of money demanded would vary in direct proportion to income and inversely with the interest rate. It should be noted that the last term in this equation is improperly specified. According to Keynes's discussion, the demand for speculative balances depends on the current rate of interest *in relation to* some expected normal rate. Thus the latter rate properly should be included as one of the explanatory variables determining the quantity of money demanded. Keynes and his followers, however, chose to treat the expected rate as an exogenous factor contributing to erratic shifts in the functional relationship between the quantity of money demanded and the current rate.

Keynes and his followers also broke new ground in their discussion of the behavior of the demand-for-money function. First, unlike Fisher and the Cambridge school, Keynesians argued that the money demand function is highly unstable, shifting erratically under the impact of volatile market expectations.

Second, Keynesians thought that in times of deep depression the money demand function would become horizontal (infinitely elastic) at some floor rate of interest. They argued that there is some critical positive rate of interest so low that if the current rate were actually at that level, no one would expect it to go any lower and everyone would expect it to rise. In other words, anticipations of falling bond prices would be unanimous. At this point, anticipated capital losses would offset interest returns, and there would be no advantage to holding bonds. Cash would become a perfect substitute for bond holdings, and the demand for money would become insatiable, i.e., infinitely sensitive to the slightest change in the rate of interest—a pathological condition that Keynes called *absolute liquidity preference*. Under these circumstances, any increase in the money supply would be completely absorbed into idle cash balances with no reduction in interest rates. Thus, if the central bank acted to increase the money supply by purchasing bonds on the open market, the slightest bidding-up of bond prices would simply induce individuals to sell their bonds to the central bank and absorb the cash proceeds. Since at the floor rate of interest the demand for cash is insatiable and the willingness to sell bonds is absolute, no amount of open market operations would overcome absolute liquidity preference and force interest rates to go any lower.

Both the instability and infinite elasticity properties of the money demand function, Keynesians pointed out, would have pessimistic policy implications. Instability of the money demand function would make accurate forecasting of the effects of monetary policy impossible. Confronted with a volatile and unpredictable money demand function, the authorities would never know whether shifts in demand would magnify or nullify policy-induced shifts in the money supply. Moreover, even if the monetary authorities *could* predict the behavior of money demand, monetary policy still would be powerless if conditions of absolute liquidity preference prevailed. In the latter case, increases in the money supply would have no effect on nominal income or economic activity through the interest rate channel. Since no cash holder would be willing to bid for bonds, there would be no rise in bond prices and consequent fall in interest rates to stimulate business investment spending. Moreover, none of the monetary injection would enter the spending stream. Instead, all of the new money would be absorbed in idle cash balances. In short, the economy would be caught in a *liquidity trap*.

To summarize, Keynesians argued that in times of deep depression, money stock changes would be negated by offsetting changes in velocity or the Cambridge k. With variable velocity, or k, absorbing all the impact of money stock changes, none would be transmitted to nominal income. The rigid linkage between money and economic activity postulated by

earlier economists would be severed. Thus, Keynesians arrived at policy conclusions at variance with those reached by Fisher and the Cambridge school.

J. R. Hicks's Analysis Keynes's chief contribution to the analysis of the demand for money was the introduction of a variable representing the cost of holding cash (the rate of interest) into the money demand function. This innovation permitted examination of the substitution effects on the demand for money stemming from changes in relative rates of return. In giving explicit consideration to the yields on assets that compete with money, Keynes became one of the founders of the *portfolio balance* approach to monetary analysis, i.e., the approach that interprets the demand for money as part of the choice of an optimum portfolio of assets. At least equal recognition for originating the portfolio approach, however, should be given to British economist John R. Hicks, who in 1935 first suggested that the demand for money be treated as a problem of balance sheet equilibrium or asset choice to be analyzed along the lines of orthodox commodity demand theory.

Hicks pointed out that if money were to be analyzed as a capital asset and not just as a mechanical medium of exchange, the demand-for-money equation would have to include as explanatory variables total wealth and expected rates of return on other assets. The wealth variable would represent the budget constraint on money holdings, since at the maximum individuals could choose to hold their entire wealth portfolios in the form of cash. And the yield variables would represent both the opportunity costs of holding money and the portfolio-substitution effects of changes in relative rates of return. Individual portfolio optimizers would compare these yields with the imputed convenience and security yield on money balances in deciding whether to substitute other assets for cash in their balance sheets.

Hicks's specification of wealth as the constraint variable, it should be noted, was a significant departure from the Cambridge and Keynesian formulations, both of which used *income* in the money demand equation. This shift from income to wealth as the constraint variable underscored the shift from the transactions approach to the capital asset or portfolio approach in Hicks's article. Income is a magnitude having the time dimension of a *flow* (an amount that occurs over an interval of time, or so much per unit of time). Wealth, on the other hand, has the time dimension of a *stock* (so much existing at a given point in time). The rationale for the income constraint in the Cambridge and Keynesian formulations was that money is used to finance a flow of transactions or spending that is closely related to the flow of income. Hicks's use of the wealth constraint, by contrast, called attention to the stock of money as a store of wealth, i.e., a service or utility-yielding asset alternative to other asset stocks.

In addition to his pioneering proposal that ordinary demand analysis be applied to money in its role as a balance sheet asset, Hicks also took the initial step in extending the theory of choice or optimizing behavior to explain the demand for transactions (as distinct from asset) balances. Prior to Hicks, no one had attempted this. Even Keynes had limited his application of rational choice analysis to the asset component of money demand. Moreover, no one previously had provided a convincing explanation of why individuals would be willing to hold transactions balances when riskless, interest-bearing assets of virtually instantaneous redeemability (e.g., time deposits) were available. Why would transactors voluntarily sacrifice the option of holding interest-yielding, speedily-convertible assets for the option of holding cash? Because the latter option may be less costly, said Hicks. In short, the existence of transactions balances could be explained as the outcome of rational, cost-minimizing behavior. More specifically, the only reason for holding transactions balances, suggested Hicks, was the conversion costs (brokerage fees, effort and inconvenience, etc.) of transferring cash into earning assets and vice versa. Hicks pointed out that it would not pay to get out of cash into earning assets for short periods of time if the two-way conversion costs exceeded the interest income foregone by holding cash.

Hicks's observation that the demand for transactions balances stems from cost-minimizing behavior, together with his proposal that cash holdings be analyzed as a component of a portfolio of assets, served to eliminate much of the remaining disparity between money demand theory and conventional demand theory. The final steps, however, were taken in the 1950's by analysts working along the lines opened up by Hicks. Chief among the contributions stemming from Hicks's work were Milton Friedman's elaboration of the portfolio balance approach and Baumol's and Tobin's refinement of the transactions cost approach. These studies succeeded in integrating money demand analysis into the optimizing behavior framework of orthodox demand analysis.

Money as a Capital Asset: Friedman's Contribution Following Hicks's suggestion, Milton Friedman in 1955 employed the procedures of conventional commodity demand theory to construct a detailed demand-for-money function. Like Hicks,

Friedman interpreted the demand for money as a problem in balance sheet equilibrium or asset choice. However, unlike earlier analysts (especially Keynes), he did not seek to explain the demand for money in terms of special motives that are satisfied by cash holdings. Instead, he treated money as a capital good, which, like any other capital good, yields a flow of services that makes it desirable to hold. This approach is characteristic of orthodox demand analysis, which avoids considerations of psychological motives prompting the purchase of goods.

Friedman's contribution consisted of a step-by-step demonstration of how a household's money demand function could be derived from first principles of orthodox demand analysis. Equally important, however, was his precise and complete specification of the relevant constraint and opportunity cost variables entering the function. The relation between these variables and the quantity of money demanded may be expressed as $Md = f(W, r_b, r_e, r_r, \dot{p})$, where W is wealth; r_b, r_e, r_r are the expected real rates of return on bonds, equities, and real assets, respectively; and $\dot{p}$ is the anticipated percentage change in the price level, a measure of the expected rate of depreciation in the purchasing power of money balances.

Like Hicks, Friedman specified *wealth* as the appropriate budget constraint, although he defined wealth somewhat unconventionally as the present value of expected future receipts from *all* sources, including human wealth (personal earning capacity) as well as real property and financial capital. Unlike Keynes, who viewed bonds as the only asset competing with cash, Friedman regarded all types of wealth as potential substitutes for cash holdings in individuals' balance sheets. Thus, in sharp contrast to the single interest rate variable in the Keynesian liquidity preference equation, Friedman's list of relative yield variables entering the money demand function included the expected rates of return on bonds, equities, and real assets. One additional novel feature was the inclusion of the expected rate of change of the price level as a measure of the rate of return on (or the depreciation cost of) money holdings. The rationale for this particular variable is that cash holders, recognizing that inflation erodes and deflation augments the purchasing power of cash balances, would take the expected rate of depreciation or appreciation of money into account in formulating their cash holding decisions. Nobody prior to Friedman had thought to incorporate the anticipated rate of inflation into the demand function as one of the rate-of-return or relative yield arguments.

Friedman's interpretation of money as a general substitute for all forms of wealth rather than as a specific substitute for a narrow range of financial assets led him to reject the Keynesian conclusions that monetary policy may be relatively ineffective. Keynes had argued that if a monetary change *does* influence economic activity, it does so through an indirect interest rate mechanism rather than through the direct expenditure of money for goods. Specifically, in the Keynesian model, a monetary increase initially upsets the preexisting optimum cash-bond mix in wealth portfolios. Wealth holders then attempt to restore portfolio equilibrium by substituting bonds for cash. The increased demand for bonds pushes their prices up and their yields down. Falling interest rates stimulate investment expenditure for new capital goods, and the increased investment spending has a multiplied effect on national income. But Keynes thought these indirect effects would be weak for two reasons. First, he thought cash and bonds were such close substitutes that only slight reductions in bond yields would be necessary to induce people to add the extra cash to their portfolios. Thus, increases in the money supply could generate only slight reductions in interest rates. Second, he thought that investment spending would be insensitive to small changes in the interest rate.

Friedman, however, argued that since money is a substitute for real goods and services as well as bonds, changes in the quantity of money would spill over into the market for consumers' and producers' goods, thereby exerting a strong direct effect on private spending and not merely a weak indirect effect via the bond interest rate. That is, excess cash balances are at least as likely to be spent directly for goods as for long-term bonds. Moreover, Friedman maintained that since the substitution effects between money and other assets would be dispersed over such a wide spectrum of assets, the particular substitution effect between money and any one class of assets would tend to be small. Thus, contrary to Keynes, Friedman believed that the quantity of money demanded would be relatively insensitive to changes in the yield on bonds. And if the demand for money is relatively unresponsive to interest rate changes, then the problem of hoarding anticipated in the Keynesian liquidity trap case will not arise. In sum, Friedman believes, as did Fisher and the Cambridge school, that the link between money and nominal income is strong and relatively stable and that changes in the money stock have a powerful impact on economic activity.

The Inventory Approach to the Transactions Demand for Money The chief deficiency of the Keynes-Hicks-Friedman asset choice or portfolio

formulation was that it was not addressed specifically to the question of why anyone would hold transactions (as distinct from asset) balances when they had the alternative of holding riskless, easily convertible, interest-yielding securities. As previously mentioned, Hicks had attempted to answer the question via his conjecture that transactions balances are held simply to avoid bond conversion costs. But Hicks's conjecture was not supported by rigorous proof until the mid-1950's, when William J. Baumol and James Tobin applied inventory management analysis to transactions balances, thereby integrating the latter into the rational choice optimizing framework of general demand theory.

Baumol and Tobin showed that the optimum inventory of transactions balances could be expressed in terms of the so-called lot-size or square-root formula of inventory theory. According to this formula, the average cash holdings of an individual transactor would be directly proportional to the square root of both the volume of payments (transactions) to be made and the brokerage cost per conversion from bonds to cash and inversely proportional to the square root of the carrying cost (interest income foregone) of the cash inventory. Thus, given the level of transactions, the size of average cash holdings would depend on the relation between the yield on securities and the costs of buying and selling them. If the latter were greater than the former, it would not pay to substitute earning assets for money; consequently, cash holdings would be relatively large. But as yields rose relative to conversion costs, it would pay to economize on transactions balances. Hence, the size of average cash holdings would be negatively related to the rate of interest. If the volume of transactions varied, however, the demand for money would vary in the same direction but less than proportionately. This implies that the more prosperous a person is, the smaller will be the increase in his cash balance necessary to cover a given increase in his transactions.

How did the Baumol-Tobin inventory analysis contribute to the closing of the gap between orthodox demand theory and money demand theory? In the first place, it indicated that the quantity of transactions cash demanded, like the quantity of a commodity demanded by a household, would be determined to a significant extent by relative price or opportunity cost variables. Second, and more important, it demonstrated that rational choice, or optimizing behavior, governs the demand for transactions balances just as it does the demand for asset balances or commodities. The only difference is that in the case of transactions balances optimizing behavior consists not of utility maximization but of cost minimization. Specifically, the optimizing transactor will attempt to manage his cash inventory in order to minimize the sum of two costs: (1) the opportunity costs of holding cash instead of bonds and (2) the transfer costs (brokerage fees, inconvenience, etc.) of converting bonds into cash. As long as the costs of frequent bond conversions exceed the interest income foregone by holding cash, the rational transactor will add to his average cash balances and reduce the number of conversions from bonds to cash. Notice that nothing is said about the services that money yields. In the Baumol-Tobin analysis, transactions money is held for one reason only, to minimize the total costs of transactions.

In sum, the notion of the balancing of two competing costs in order to minimize their total forms the basis of the demonstration that an inventory of transactions balances is kept, not for the services it provides, but because it is too costly to continually switch in and out of bonds.

The Money Demand Equation in the SMP Model

This article has sketched the evolution over time of the theory of the demand for money. This long process of theoretical development has culminated in the money demand equations appearing in large-scale econometric models currently in use. It is, therefore, fitting to close the article with a brief look at the demand-for-money equations in one particular econometric model. For this purpose, the SSRC-MIT-PENN (SMP) model was chosen. The SMP model is employed by Federal Reserve economists in forecasting future levels of economic activity and in simulating the effects of policy actions and other changes on the economic system.

As represented in the SMP model, the demand for money is broken down into its demand deposit and currency components. There is a separate equation for each component. In each case, the basic form of the equation is $M = k(r)Y$, where M is the quantity of money demanded, k is the Cambridge cash balance or money/income ratio (the reciprocal of the income velocity of circulation) expressed as the inverse function of a vector of interest rates on short-term assets, r, and Y is the level of nominal national income. These basic equations are used to express the general long-run equilibrium or desired level of money balances, M*, associated with the current interest rate vector and current income. Since time is required to adjust actual cash balances to this desired level, however, the actual demand for money in a given time period may differ from the long-run equilibrium level. Accordingly, a stock adjustment process is incor-

porated into the monetary sector of the SMP model to represent the dynamic sequence of short-run adjustments to the desired long-run equilibrium position described by the equation $M^* = k(r)Y$. The stock adjustment mechanism embodies the hypothesis that in any given period money holders adjust their cash balances by a fixed proportion of the discrepancy between the desired stock, M*, and the actual stock of money in existence at the end of the previous period, M_{-1}. If b represents the proportion of the gap closed in a given time period, then the change in money balances, $\triangle M$, may be written as $\triangle M = b(M^* - M_{-1})$. Since the long-run equilibrium demand for money is expressed as $M^* = k(r)Y$ and since the change in the demand for money by definition is $\triangle M = M - M_{-1}$, the demand for money in the current period may be shown to be $M = bk(r)Y - (1 - b)M_{-1}$.

The SMP money demand equation is particularly instructive because it embodies so many of the elements or features stressed in the various theories surveyed in this article. One such feature is the prominence of yield and income variables in the equation, which conforms to the post-Keynesian practice of incorporating relative price (yields) and budget constraint arguments into the demand function. Moreover, the appearance of the transactions-related income variable in the equation links the SMP version to earlier theories that emphasized the role of money as a transactions medium of exchange. In fact, the authors of the SMP money demand equations designate their formulation "the neo-Fisherian approach" and state that the demand for money is basically related to the flow of transactions and arises from a lack of synchronization between receipts and payments. The same hypothesis, of course, underlies Irving Fisher's formulation as well as the Baumol-Tobin theory.

Another noteworthy feature is the reemergence of the Cambridge k in the SMP model. In fact, the SMP money demand equation may be viewed as an improved, augmented version of the old Cambridge cash balance equation. The chief difference between the older and the newer version is the latter's treatment of k as an inverse *function* of the rate of interest rather than as a numerical *constant*. The original Cambridge formulation implied that changes in bond yields would exert no substitution effects on cash holdings. By contrast, the SMP equation implies that, at a given level of income, a rise in bond yields will induce a reduction in cash balances demanded. The postulated inverse relation between k and the rate of interest is consistent with both (1) the Keynes-Hicks-Friedman balance sheet hypothesis that rising interest rates induce the substitution of relatively higher yield assets (bonds) for relatively lower yield ones (money) in asset portfolios and (2) the Baumol-Tobin hypothesis that the ratio of cash to transactions (or income) is controlled by the interest obtainable on bonds relative to the cost of converting cash into bonds.

Still another feature is the stability of the money demand relation. Statistical tests of the SMP equation indicate that the parameters of the equation are very stable, changing at best only slowly over time. These findings conform to Friedman's hypothesis that the demand for money is a stable function of a relatively few variables.

Perhaps the most controversial aspect of the SMP formulation is the use of current income rather than wealth as the constraint variable. Similar to other models that stress the transaction or cost-minimizing approaches to the demand for money, the SMP model specifies income as the appropriate budget constraint on money holding. As previously mentioned, however, analysts who adhere to the portfolio-balance or utility-maximizing approach maintain that wealth is the relevant budget constraint. Since income and wealth are closely related variables, however, the difference between the two approaches may not be as great as it appears at first glance. Specifically, wealth is the present value of expected future income. And expected future income may be measured empirically by the weighted average of current and past levels of income. It follows, therefore, that money demand equations using current income as the constraint are not incompatible with equations employing wealth as the constraint, as long as the former equations also include lagged values of past income as supplementary variables. It can be demonstrated that recursive substitution for lagged values of the money demand variable M_{-1} in the equation $M = bk(r)Y - (1 - b)M_{-1}$ causes the transactions variable, Y, to enter the equation in the form of an exponentially weighted average of current and past levels of income. Thus, the SMP stock adjustment formulation reconciles the income and wealth approaches to specifying the constraint on the demand for money.

Summary This article has traced the sequence of steps that brought the theory of the demand for money into the rational choice, optimizing framework of conventional demand analysis. The integration process was accomplished in three stages.

First was the development, in the 1920's, of the cash balance approach, which replaced the concept of transactions velocity with the alternative concept of the desired money/income ratio. The cash balance

analysis tended to shift attention to factors affecting the *holding,* as distinct from the *spending,* of money. It also led to the formulation of a rudimentary demand-for-money function containing the cash balance ratio as a parameter and nominal income as the constraint variable.

The second step was taken in the 1930's, when variables representing relative yields and costs were introduced into the money demand function, and the demand for money was interpreted as part of the choice of a portfolio of assets optimally composed with regard to alternative yields. Incorporation of interest rate variables into the demand function permitted systematic analysis of the substitution effects between money and competing assets stemming from changes in relative rates of return.

The most recent stage occurred in the 1950's when it was shown (1) that the demand function for asset money could be derived from the utility-maximization analysis of conventional demand theory and (2) that holdings of transactions balances are consistent with rational cost-minimizing behavior.

Associated with each of these stages of theoretical development were certain policy implications. The cash balance approach led to the belief in the potency of monetary policy. This belief stemmed from the assumed stability (constancy) of the cash balance ratio linking money to nominal income. Coinciding with the introduction of cost and yield considerations into money demand analysis in the 1930's, however, was a reversal of the belief in the potency of monetary policy. Analysts began to emphasize such policy-debilitating forces as the high interest elasticity and the extreme instability of the demand-for-money relationship. These views contributed to the doctrine, widespread in the 1930's and 1940's, of the ineffectiveness of monetary policy. Since the 1950's, however, the consensus has tended to swing back toward belief in the potential power of monetary policy. Recent theoretical and empirical findings of the stability and relative interest inelasticity of the demand-for-money function tend to support this latter view.

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MONTHLY REVIEW INDEX

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