Recent Interest Rate Developments

Most market interest rates have risen in recent weeks after declining in late July and August and rising sharply earlier this year. This note traces the recent course of interest rates, discusses some causal forces affecting these movements, and comments on the outlook for interest rates.

Yields on three-month Treasury bills rose from 5.66 per cent at the end of 1968 to 7.10 per cent during the week ending July 25. Yields then declined to a low of 6.86 per cent during the week of August 22, and have since moved upward, reaching 7.02 per cent in the first week of October. Yields on commercial paper and bankers' acceptances have shown similar movements. Yields on four- to six-months commercial paper rose from 6 per cent in Dec., 1968 to a peak of 8% per cent in mid-July, retreated to 8¼ per cent in late August and early September, and recently have climbed back to 8% per cent.

Interest rates on long-term securities rose in the first half of the year, drifted lower until late August, and have since risen. In early October, the average yield on long-term Government bonds was 6.56 per cent, up from 6.00 per cent in late August. In early July the average yield was 6.11 per cent, following an increase from 5.55 per cent last December.

Table I summarizes selected interest rate movements over the past year. While other interest rates have generally moved upward, Regulation Q ceiling rates on commercial bank time deposits have remained constant.
Why Interest Rates Fluctuate

Market interest rates are the prices of loan funds and, like all unregulated prices, are determined by demand and supply. Numerous factors influence both the demands for and the supply of loan funds, but practically speaking, only a few forces are dominant in most interest rate movements which last for periods of several weeks or more.

Changes in the total demand for loan funds are to a great extent influenced by people's decisions to spend which, in turn, are affected after a lag by monetary actions and by expectations about future returns on investment and future price changes. If entrepreneurs become more optimistic as to future sales and profits, they tend to demand more credit to expand the productive capacity of their plant and equipment and to increase their inventories. A change in expected returns may result from a variety of events, including a break-through in technological research, changing tastes, a more stimulative tax structure, and changing expectations about the influence of stabilization policies on total spending and prices. If expectations change so that future prices are expected to rise faster than had been anticipated previously, demands for credit increase as consumers and businessmen seek to buy goods now, at cheaper prices.\(^1\)

The supply of loan funds is influenced by personal and business saving, by monetary actions, and by actions of commercial banks. Changes in the level of savings are influenced significantly by changes in income, with the level of savings rising as income rises and falling as income falls. Changes in saving tend to dampen movements in interest rates. Monetary developments have an impact on interest rates in two different ways. An increase in the supply of base money (the monetary base) increases the banks' demand for earning assets and hence increases the funds supplied to the market by the banks. The volume of loan funds increases in the short run, providing a downward force on interest rates. However, the resulting expansion of banks' holdings of earning assets, other factors constant, results in an increase in the money stock which usually has a longer-run counter influence of pushing interest rates up after several months, since it stimulates spending and the demand for funds.

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\(^1\)William P. Yohe and Denis Karnosky have found, in research conducted at this bank, that current price expectations can be accounted for almost completely by price movements over the two preceding years.
Interest Rate Movements in 1969

Analyzing the movements in market interest rates since last December, in terms of the demands for and the supplies of loanable funds, is helpful in understanding the economic forces prevalent in the economy.

First Half of 1969

The rise in market interest rates in the first half of the year was due to an accelerating growth in the demand for loan funds while growth in the supply of loan funds moderated. The rise in demand reflected reinforced expectations of accelerating price rises and expectations of higher real returns on capital. These expectations reflected in large part the experience of 1968.

Passage of the surtax in June 1968 had temporarily lowered anticipations about price increases and profitability, and as a result, interest rates remained fairly level for a brief period after mid-1968. But as it became evident that these expectations were not being realized, anticipations regarding demand and price increases were revised upwards, and interest rates rose.

The economy failed to slow in 1968 partly because of expansionary monetary actions. The money stock grew 7 per cent in 1968, about the same as in 1967, and far faster than the trend rate of 2.6 per cent from 1957 to 1967. The monetary expansion in 1968, as indicated by the growth of the money stock, also stimulated spending and credit demands in early 1969.

Both total spending on goods and services and the price indexes continued to rise rapidly through the first half of 1969. Employment rose at a 2.4 per cent annual rate in the first half of 1969, continuing the rapid growth of the previous year and a half. Industrial production grew at a 6.1 per cent annual rate in the first six months of the year, even faster than the 4.1 per cent increase in 1968. Personal income rose at an 8.6 per cent annual rate in the first six months of the year, close to the 1968 rate of 9.6 per cent.

Demands for credit in the first half of 1969 were also stimulated by the fact that price rises not only failed to slow, but accelerated. Consumer prices rose at a 6.4 per cent annual rate in the first half of 1969, compared with the 4.7 per cent increase in 1968 and the 1.7 per cent trend rate from 1957 to 1967.

The total supply of credit probably rose at a slower rate in the first half of 1969. During this six-month period the money stock rose at a 4.4 per cent annual rate, after growing 7 per cent in 1968.

July to August

The moderate declines in interest rates in July and August may have resulted primarily from a decrease in the demands for credit. There probably was a temporary lull in demand, following large anticipatory borrowing in May and early June which reflected market expectations of a severe tightening of
credit around the mid-June tax date. The moderately slower growth in monetary magnitudes in the first half of the year may have had some dampening effect on spending decisions, with corresponding reduction of credit demands. In addition, there may have been some belief that the monetary actions in the first half of the year combined with the continued fiscal restraint, soon would moderate the upward trends of demand and prices.

Since August

The rise in interest rates since August reflects changes in both supply and demand. The rate of monetary growth has slowed further since June, indicating a reduction in the supply of loanable funds and thereby placing temporary upward pressure on rates. From early June to early October, the money stock was about unchanged.

Demands for loan funds may have increased somewhat since August. Lack of firm indications that total spending was slowing and the continued rapid rise in prices may have increased the demand for credit. Total spending on goods and services rose at a 7.8 per cent annual rate during the third quarter, slightly higher than in the previous two quarters. Capital spending by business firms has remained strong. Consumer prices have risen at a 6 per cent annual rate in 1969, up from a 5 per cent rate in 1968. Overall prices, as measured by the GNP price deflator, rose at a 5.4 per cent rate in the third quarter.

Conclusion and Outlook

Experience indicates that a reduced growth of monetary magnitudes, such as occurred moderately in the first part of the year and much more intensively since late last spring, will reduce the growth in total spending after several months' lag. With a slower growth in spending, the demand for loan funds falls and the rate of price increases usually slows after some further lag. Expectations of moderated price rises and reduction in the rate of growth in spending may be expected to dampen the very strong demands for credit. When the monetary authorities are convinced that the growth of total spending is no longer excessive, they are likely to provide for moderate growth of the monetary base, tending to add to the supply of loan funds and to place downward pressure on interest rates.

Over the Years certain articles appearing in the Review have proved to be helpful to banks, educational institutions, business organizations, and others. To satisfy the demand for these articles, a reprint series was made available, and has been expanded frequently by the addition of new articles. A complete listing of the series, as well as individual reprints, are available on request from: Research Department, Federal Reserve Bank of St. Louis, P.O. Box 442, St. Louis, Mo. 63166
Revision of the Money Supply Series
by ALBERT E. BURGER

THE RECENT REVISION by the Federal Reserve System of the statistical series on the amount of currency and demand deposits held by the nonbanking public consisted of two major parts. The largest part of the revision was made in August and involved adjusting the demand deposit component of the money supply. This revision was necessary to correct for an understatement of demand deposits, which had arisen from an increasing volume of cash items generated by a rapidly growing volume of Eurodollar transactions. The second part of the revision, first available on September 25, included the incorporation of new benchmark data for nonmember bank demand deposits and holdings of vault cash, and the annual review of the seasonal adjustment factors for the demand deposit and currency components of the money supply.

When Is a Revision Necessary?
The collecting, processing, and maintaining of any series of data involve the allocation of scarce resources for that purpose. These data are not free goods; they involve an opportunity cost. One major justification for the cost of collecting data on demand deposits and currency is that such data provide useful information for policy-making purposes. There is a well-developed theoretical framework that includes as its focal point the stock of money balances held by the nonbanking public. This theoretical framework and considerable empirical evidence indicate that changes in the magnitude of the money stock have important implications for the future course of economic activity.

Reasons for the Revision

Seasonal Factors
Most weekly, monthly, and quarterly economic time series are subject to recurrent seasonal factors. To view movements of the series free of seasonal distortions, economic data are frequently seasonally adjusted by some method such as the X-11 computer program developed by the Bureau of the Census. Seasonal adjustment factors applying to the money stock are revised to take into account any changes that have occurred in the usual seasonal pattern of the public's holdings of demand deposits and currency.

Benchmark Adjustments
Deposits and vault cash holdings of nonmember banks must be estimated between semi-annual call of condition reports. The use of new benchmark data provides added information on these items for
nonmember banks, and hence permits a more accurate measurement of total demand deposits and currency held by the nonbanking public. The June 1969 benchmark data adjusted primarily the demand deposit component of the money supply series resulting in an addition of $400 million to money supply growth over the first half of 1969.2

**Demand Deposit Revision**

The demand deposit component of the money supply includes only demand deposits of the public, that is, demand deposits at all commercial banks other than those due to domestic commercial banks and the U.S. Government, less cash items in process of collection. A simple example will explain why cash items are deducted:

Suppose Mr. A writes a check for $100 on his bank CBA. He then gives the check to Mr. B who deposits it in his bank CBB. While the check (item) is in process of collection, it appears as a demand deposit in both CBA and CBB. Due to an institutional constraint which prevents instantaneous check clearing, gross demand deposits rise by $100.

Mr. A knows that he no longer holds $100 in his checking account. Since the purpose of the money supply series is to measure the currency and demand deposits held by the public, which the public knows it holds, we must deduct the cash item in process of collection (the $100 check of Mr. A) to get an accurate measure of the size of the quantity we want to measure with our statistical series.

Before July 31, 1969, the rapidly growing volume of drafts used in transferring or repaying Eurodollar borrowings, usually referred to as "bills payable checks" and "London checks", were not included in gross demand deposits by the issuing bank. However, these drafts were included in the cash items of the foreign branch of the bank, and as such were deducted from gross demand deposits of the domestic bank.

Since member banks’ reserve requirements are calculated on the basis of net demand deposits (i.e. gross demand deposits minus cash items in process of collection and demand balances due from domestic banks), inclusion of London checks and bills payable checks lowered their required reserves. These actions did not involve any double counting of demand deposits held by the public, yet they operated to reduce the demand deposit component of the money supply, and the data representing the money supply was biased downward. The actual holdings of demand deposits by the public were greater than reported in the money supply data.

Effective July 31, 1969, under a revision of Federal Reserve Regulation D, the issuing banks are required to include bills payable checks and London checks used in repayment and borrowing of Eurodollars in gross demand deposits as well as in cash items in process of collection. To take into account the impact of this change in banks' actions on the reporting of money supply figures prior to August 1969, the demand deposit component of money was revised by the Federal Reserve System.

**Has the Revision of the Money Supply Series Substantially Revised Conclusions Based on its Use?**

To consider this question, we shall examine three money supply series for three recent periods of time: (1) the money supply series as reported before August, (2) the money supply series as revised in early August, which included estimated revisions in the old money supply series, and (3) the new money supply series available in the week of September 25, which includes seasonal and benchmark revisions.3 The three periods considered are December 1967 to December 1968, December 1968 to early June 1969, and early June 1969 to early September 1969.

### Table I

<table>
<thead>
<tr>
<th>MONEY SUPPLY SERIES FOR SELECTED PERIODS</th>
<th>(Annual Rates of Change)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Four weeks ending 12/25/68 to Four weeks ending 6/11/69</td>
</tr>
<tr>
<td></td>
<td>Four weeks ending 6/11/69 to Four weeks ending 9/10/69</td>
</tr>
<tr>
<td>Old Series 6.5%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Revised Series</td>
<td></td>
</tr>
<tr>
<td>(August 6)</td>
<td>7.0</td>
</tr>
<tr>
<td>Revised Series (September 25)</td>
<td>7.2</td>
</tr>
<tr>
<td>N.A.—Not available</td>
<td></td>
</tr>
</tbody>
</table>

Comparing the old money supply and demand deposit series with the revised series of September 25 in Tables I and II, the major difference is that both new series show faster growth rates during 1968 and the first half of 1969. Both the old and new revised series show the same pattern of changes in the growth

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2The data for time deposits at all commercial banks were also revised using the new benchmark data and seasonal factors. The June 1969 benchmark data added $500 million to nonmember bank time deposit growth during the first half of 1969.

3The September 25 revision of the money supply is referred to as the "new money supply series" only as an aid in exposition.
rate of money, a slowing in the first half of 1969 compared to 1968. The new revised series shows a less pronounced slowing in the growth rate of money and demand deposits over the first half than was shown by the old series.

The August Revision

In early August the first revised money supply series became available to policymakers. This series pointed out that money and demand deposits had grown somewhat faster over the first part of 1969 than the old money supply data had indicated. Also, with the preliminary adjustments for changes in the demand deposit series, the annual rate of increase of demand deposits for 1968 rose from 6.2 per cent to 6.9 per cent. Hence, the growth of the money supply for this period was also adjusted upward from an annual rate of 6.5 per cent to 7 per cent.

The August series was only an interim measure until new benchmark data could be included, and new seasonal factors calculated. However, the August revision moved a long way toward pointing out the difference in trends between the old money supply series and the new money supply series which became available on September 25.

The August series was used until late September, when the completed new series became available.\textsuperscript{4} Comparing the August series and the new series for the period from mid-year through early September, we see that the new data show slightly less of a slowing in the annual rate of increase of money and demand deposits than was indicated by the August revision. However, whether one looks at the new series or the August series, the pattern of monetary developments is very much the same. Both sets of data reveal a marked decrease in the rate of growth of money and the demand deposit component of money since mid-year.

Would a person, who used the money supply data in 1969 as a guide to the influence of monetary actions on the future course of economic activity, have made a major change in his interpretation of the direction of these influences as new data became available? Comparing the pattern of movements of the three series on money, it seems that only over the first half of 1969 could the observer of money supply data have been misled by the unrecognized impact of changed bank behavior on the reported data. Using the old money supply data until late summer, an observer of the money supply would have concluded there had been a decided slowing in the monetary impulses transmitted to the economy since December 1968. When the revised series became available in August, he would have modified his views on the actual severity of the slowing in the money supply, but he would have maintained the belief that there had been some reduction in the magnitude of monetary influences on the economy. Using the August revision, an observer of the money supply would have concluded that there was a much sharper decrease in the rate of monetary expansion about midyear. The new data available in September did not significantly alter this view.

Effects of Revisions in the Money Supply Series on Forecasting the Impact of Monetary Influences on GNP

An increasing body of empirical evidence supports the conjecture that during past time periods, changes in the rate of change of the magnitude of the money stock have been the dominant factor in determining the future course of economic activity. When attempting to determine the probable impact of monetary policy on spending for final goods and services, this empirical evidence is extremely useful. One means of forecasting the impact of monetary influences on GNP using past and projected changes of the money supply is to use a reduced-form forecasting equation which directly relates changes in GNP to changes in money.

One such equation was developed by Leonall C. Andersen and Jerry Jordan, not primarily for forecasting purposes, but to test certain assertions about the relative magnitude and speed with which monetary and fiscal actions affect GNP.\textsuperscript{5} The use of this

\textsuperscript{4}The money supply revision released on September 25 included revised data for the money supply beginning January 1967. Minor revisions of the data for recent years prior to 1967 will be available in late October or early November.

equation as a forecasting device requires a projection of the future growth rates of money and high-employment expenditures. It also requires the use of past data on money supply and expenditures. A question that may be posed is: If past data are substantially revised, does this seriously affect GNP forecasts based on this type of forecasting equation?

To answer this question, the Andersen-Jordan equation was run using the data from each of the three money supply series and, for illustrative purposes, an annual growth rate of 2 per cent for money from the second quarter 1969 through the second quarter of 1970 was assumed. The results for predicted annual rates of change of GNP and dollar changes in GNP are given in Table III.6

Examining Table III we see that the major impact of the revision of money supply data is on GNP projections for the third and fourth quarters of 1969. In July 1969, when projecting the growth of GNP for the remainder of 1969, the use of the old money supply series would have given a slower projected growth of GNP than would have been predicted by the use of the September money supply data. However, the projected growth rate of economic activity in the first two quarters of 1970 was not significantly different than what would be projected in mid-September after all revisions in the money supply data were completed.

In August, when the first revision in the money supply data was completed, a new run of the Andersen-Jordan equation would have corrected most of the discrepancy. The projection for fourth quarter 1969 using the August revision of money supply data would still have been somewhat lower than using the September revision. However, the projections made in August 1969 for growth rates of GNP in the last quarter of 1969 and through the first half of 1970 would have been almost identical to the projections possible after September 25 using the latest revision in the money supply data.

The projected dollar change of GNP from II/1969 through II/1970 would be $38.1 billion using the old money supply data, $40.3 billion using the August revision and $41.6 billion using the late September money supply data. The difference between II/1970 GNP projected in July 1969 using the old money supply data, and the forecast made in late September 1969 using the September 25 revision of the money supply data, was only $3.5 billion, or 0.36 per cent. Using new money supply data, the total GNP figure projected for II/1970 was $966.4 billion.

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6Using this equation and the actual data from the new money supply series, the average difference between the actual dollar change in GNP and the dollar change in GNP predicted by the equation for the six quarters I/1968 through II/1969 was only $1.4 billion.
Elements of Money Stock Determination

By JERRY L. JORDAN

RECENT DISCUSSION of the role of money in stabilization policy has culminated in two central issues. The first involves the strength and reliability of the relation between changes in money and changes in total spending. If this relation is sufficiently strong and reliable, changes in the money stock can be used as an indicator of the influence of monetary stabilization actions on the economy.1 The second issue centers on whether or not the monetary authorities can determine the growth of the money stock with sufficient precision, if it is deemed desirable to do so.

This article is concerned primarily with the second issue—determination of the money stock.2 A framework describing the factors which influence the monetary authorities' ability to determine the money stock is presented, and the behavior of these factors in recent years is illustrated. In addition, examples of ways in which these factors influence the money stock are discussed.

Factors Influencing the Money Stock

The following sections present essential elements and concepts which are used to construct a “money supply model” for the U.S. economy. First, the necessary information regarding institutional aspects of the U.S. banking system are summarized. Then, the main elements of the model—the monetary base, the member bank reserve-to-deposit ratio, the currency-to-demand deposit ratio, the time deposit-to-demand deposit ratio, and the U.S. Government deposit-to-demand deposit ratio—are discussed.

Institutional Aspects of the U.S. Banking System

Students of money and banking are taught that if commercial bank reserve requirements are less than 100 per cent, the reserves of the banking system can support a “multiple” of deposits. In fact it is often said that under a fractional reserve system the banking system “creates” deposits. The familiar textbook exposition tells us that the amount of deposits (D) in the system is equal to the reciprocal of the reserve requirement ratio (r) times the amount of reserves (R):

\[ D = \frac{1}{r} \cdot R. \]

Thus if the banking system has $100 of reserves, and the reserve requirement ratio is 20 per cent (.2), deposits will be $100/.2 or $500. If the banks acquire an additional $1 in reserves (for instance from the Federal Reserve), deposits will increase by $5.

There are many simplifying assumptions underlying this elementary deposit-expansion relation. First, it is assumed that all bank deposits are subject to the same reserve requirement. Second, all banks are subject to the same regulations; in other words, all banks are members of the Federal Reserve System, and the Federal Reserve does not differentiate among classes of banks. Third, banks do not hold excess

2 Private demand deposits plus currency in the hands of the public.
reserves; they are always "loaned up". And finally, there is no "cash drain". The public desires to hold a fixed quantity of currency, and their desires for currency are not influenced by the existence of more or less deposits.

Since the above assumptions are not true, the accuracy with which a monetary analyst can estimate how many deposits will be "created" by an addition of $1 in reserves to the banking system, depends on his ability to determine:

1. how the deposits will be distributed between member and nonmember banks;
2. how the deposits will be distributed between reserve city and country banks, which are subject to different reserve requirements;
3. how the deposits will be distributed among private demand deposits, Government demand deposits, and the sub-classes of time deposits, all of which are subject to different reserve requirements;
4. how the change in deposits will affect banks' desired ratio of excess reserves to total deposits; and
5. how a change in deposits will affect the public's desired ratio of currency to demand deposits.

These questions can be answered best within the context of a "money supply model" which is constructed to include the institutional realities of the U.S. banking system, and which does not require the special assumptions of the simple deposit expansion equation. A thoroughly developed and tested money supply model has been advanced by Professors Brunner and Meltzer. The following sections present the general form and essential features of this model.

The Monetary Base

A useful concept for monetary analysis is provided by the "monetary base" or "high-powered money". The monetary base is defined as the net monetary liabilities of the Government (U.S. Treasury and Federal Reserve System) held by the public (commercial banks and nonbank public). More specifically, the monetary base is derived from a consolidated balance sheet of the Treasury and Federal Reserve "monetary" accounts. This consolidated monetary base balance sheet is illustrated in Table I, and monthly data for the monetary base (B) are shown in Chart I.

The growth of the monetary base, that is, "base money," is determined primarily by Federal Reserve

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4For further discussion of this concept, see Leonall C. Andersen and Jerry L. Jordan, "The Monetary Base: Explanation and Analytical Use," this *Review*, August 1968.
holdings of U.S. Government securities, the dominant asset or source component of the base. In recent decades changes in other sources either have been small or have been offset by changes in security holdings. A change in the Treasury's gold holdings is potentially an important source of increase or decrease in the base. However, since March 1968 the size of the gold stock has been changing only by small increments. In the postwar period the influence of changes in the gold stock were generally offset by compensating changes in Federal Reserve holdings of U.S. Government securities.

The liabilities or uses of the monetary base, or net monetary liabilities of the Federal Reserve and Treasury, are shown in Table I to be currency in circulation plus member bank deposits at the Federal Reserve. Part of the currency in circulation is held by the public, part is held as legal reserves by member banks, and another part is held as desired contingency reserves by nonmember commercial banks. In order to relate the uses of the base to the money stock, the uses are regrouped from the uses side of Table I as

\[ R = RR_m + ER_m + VC_n, \]

where \( RR_m = \) required reserves of member banks, \( ER_m = \) excess reserves of member banks, and \( VC_n = \) vault cash of nonmember banks.

In turn, required reserves of member banks are decomposed as:

\[ RR_m = R^d + R^t, \]

where \( R^d = \) required reserves behind demand deposits at member banks, and \( R^t = \) required reserves behind time deposits at member banks.

In turn, required reserves behind demand deposits at member banks are the sum of the amount of reserves required behind demand deposits over and under $5 million at each reserve city and country

| Table II |
| USES OF MONETARY BASE |
| (July 1969 — billions of dollars) |
| Currency in Circulation | $51.3 |
| Currency Held by the Nonbank Public | $45.1 |
| Member Bank Deposits at Federal Reserve | $22.3 |
| Commercial Bank Reserves | $28.5 |
| Uses of the Base | $73.6 |

NOTE: Not seasonally adjusted data.

For a discussion of the statistical relation among source components of the base, see Michael W. Keran and Christopher Babb, "An Explanation of Federal Reserve Actions (1933-68)," this Review, July 1969.

currency held by the nonbank public plus reserves of all commercial banks, shown in Table II below.

Uses of Reserves

As noted above, analysis of the U.S. monetary system is complicated by the existence of both member and nonmember banks, different classes of member banks, different reserve requirements on different types of deposits (private demand, Government demand, and time), and graduated reserve requirements for different amounts of deposits. It is thus necessary to allocate the uses of bank reserves among the different types of deposits. This is illustrated by an equation showing total bank reserves (\( R \)) in terms of their uses:

\[ R = RR_m + ER_m + VC_n, \]
Present required reserve ratios for each deposit category are shown in Table III.

Alternatively, the total amount of commercial bank reserves can be expressed as a proportion \( r \) of total bank deposits:

\[
R = r (D + T + G),
\]

where
- \( D \) = private demand deposits
- \( T \) = time deposits
- \( G \) = U.S. Government (Treasury) deposits at commercial banks.

The "r-ratio" is defined to be a weighted-average reserve ratio against all bank deposits, but is computed directly by dividing total reserves by total deposits.\(^7\) The trend of the r-ratio in the postwar period is shown in Chart II on page 14. An important factor contributing to the gradual downward trend of the r-ratio is the relatively more rapid growth of time deposits (which are subject to lower reserve requirements) than demand deposits.

### Currency Held by the Public

One of the important factors influencing the amount of money the banking system can create, given an increase in monetary base, is the proportion of currency to demand deposits the public desires to hold. For example, if the public held a fixed total amount of currency, all changes in the supply of base money by the Federal Reserve would remain in the banking system as reserves and would be reflected entirely in changes in deposits, the amount depending on the reserve requirement ratios for different classes and types of deposit. On the other hand, if the public always desired to hold a fixed ratio of currency to demand deposits (for example exactly $.25 in currency for every $.75 of demand deposits), the deposit creating potential of the banking system would be substantially less. Clearly the "currency drain" associated with an increase in the base must be taken into account in determining how much base money must be supplied to achieve a desired increase in the money stock. Currency (\( C \)) can be expressed as a proportion \( k \) of demand deposits (\( D \)), that is:

\[
C = k D, \quad \text{or} \quad k = C/D.
\]

Changes in the level of the "k-ratio" over time are influenced by such factors as income levels, utilization of credit cards, and uncertainties regarding general economic stability. The trend of the k-ratio is shown in Chart II.\(^8\)

### Time Deposits

Time deposits are not included in the definition of the money stock discussed in this article. Nevertheless, since member banks are required to hold

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\(^6\)Expanding the equation for total bank reserves,

\[
R = R^d + R^t + ERm + VC_n
\]

And since \( R^d \), for instance, is the appropriate required reserve ratio times the amount of deposits in each reserve requirement classification, the above expression is rewritten in terms of weighted average reserve ratios and deposits. See footnote No. 7.

\(^7\)For the interested reader,

\[
r = a \delta r^d + (1 - a) \tau r^t + e + v
\]

where
- \( a \) = the proportion of member bank demand deposits to total deposits,
- \( \delta \) = the proportion of net demand deposits of member banks to total demand deposits,
- \( r^d \) = a weighted-average reserve requirement ratio for member bank demand deposits,
- \( \tau \) = the proportion of net time deposits of member banks to total time deposits,
- \( r^t \) = a weighted average reserve requirement ratio for member bank time deposits,
- \( e \) = ratio of excess reserves to total bank deposits,
- \( v \) = ratio of nonmember bank vault cash to total bank deposits.

This definition is altered somewhat by the recently instituted lagged-reserve-requirement provisions of the Federal Reserve. It is worth emphasizing that some of the above ratios are determined by the behavior of commercial banks and the public, and others are determined primarily by the Federal Reserve. The fact that these ratios are not fixed does not impair the usefulness of the analysis.

reserves behind time deposits, information regarding the public's desired holdings of time to demand deposits is necessary in order to determine how much the stock of money will change following a change in the stock of monetary base.

Reserve requirements are much lower against time deposits than against demand deposits as shown in Table III; consequently a given amount of reserves would allow more time deposits to be supported than demand deposits. Time deposits (T) can be expressed as a proportion (t) of demand deposits (D), that is:

\[ T = tD, \]

or

\[ t = T/D. \]

The trend of the "t-ratio" is shown in Chart II.

The factors influencing the t-ratio are more complex to analyze than those affecting the k-ratio. Commercial banks are permitted to pay interest on time deposits up to ceiling rates set by the Federal Reserve and the Federal Deposit Insurance Corporation (see Table IV). Consequently, the growth of time deposits over time is influenced by competition among banks for individual and business savings within the limits permitted by the legal interest rate ceilings.

The interest rates which banks are willing to offer on time deposits (below the ceilings) are determined primarily by opportunities that are available for profitable investment of the funds in loans or securities. Similarly, the decisions by individuals and businesses to deposit their funds in banks are influenced by the interest rates available from alternative earning assets such as savings and loan shares, mutual savings bank deposits, bonds, stocks, commercial paper, and direct investments in real assets.\(^9\) If the interest returns from these other assets are sufficiently high that the interest rate ceilings on time deposits prevent banks from effectively competing for the public's savings,

then time deposits may not grow (or may even decline) and all increases in commercial bank reserves can be used to support demand deposits. This point will be discussed in more detail below.

**U.S. Government Deposits**

Commercial banks are required to hold the same proportion of reserves against Federal Government demand deposits as against private demand deposits. Therefore, even though Government deposits are not included in the definition of the money stock, changes in the amount of Government deposits influence the amount of private deposits the banking system can support with a given amount of base money or reserves. Government deposits (G) can be expressed as a proportion (g) of private demand deposits (D), that is:

\[ G = g \cdot D, \]

or

\[ g = G / D. \]

The amount of Government deposits in commercial banks is determined by the flow of Treasury receipts (primarily from taxes) relative to Treasury expenditures, and by the Treasury’s discretion about what proportion of its balances to keep with commercial banks rather than at the Federal Reserve. Thus, short-run fluctuations in the “g-ratio” are primarily the result of actions by the U.S. Treasury. The Federal Reserve must assess, from past experience and information available from the Treasury, what will happen to Treasury balances in an impending period in order to determine the influence of changes in Treasury balances on the money stock. The monthly pattern of the g-ratio is shown in Chart II.

**The Monetary Multiplier**

All of the essential elements for determination of the money stock have now been discussed. The definitional relations are as follows:

1. \( M = D + C \)
2. \( B = R + C \)
3. \( R = r \cdot (D + T + G) \)
4. \( C = k \cdot D \)
5. \( T = t \cdot D \)
6. \( G = g \cdot D \)

By substituting (3) and (4) into (2) we get:

\[ (7) \quad B = r \cdot (D + T + G) + k \cdot D \]

that is, we express the monetary base solely in terms of the various deposits. Substituting (5) and (6) into (7), we get:

\[ (8) \quad B = r \cdot (D + t \cdot D + g \cdot D) + k \cdot D, \]

that is, we express the base solely in terms of private demand deposits to reduce the number of variables. Simplifying, we write (8) as:

\[ (8') \quad B = \left[ r \cdot (1 + t + g) + k \right] \cdot D, \]

from which, by simple manipulation, we can express deposits in terms of the base as follows:

\[ (9) \quad D = \frac{1}{r \cdot (1 + t + g) + k} \cdot B. \]

Since we want to find D plus C, we use (4) and (9) to redefine C in terms of the base:

\[ (10) \quad C = \frac{k}{r \cdot (1 + t + g) + k} \cdot B. \]

Substituting (9) and (10) into (1) gives:

\[ (1') \quad M = \frac{1 + k}{r \cdot (1 + t + g) + k} \cdot B, \]
or the money stock defined in terms of the monetary base.\(^\text{10}\) We can denote the quotient as:

\[
m = \frac{1 + k}{r (1 + t + g) + k}
\]

where \(m\) is called the “monetary multiplier.”\(^\text{11}\)

The factors that can cause changes in the monetary multiplier are all of the factors which influence the currency \((k)\), time deposit \((t)\), Government deposit \((g)\), and reserve \((r)\) ratios, that is, the “behavioral parameters”. The observed monthly values of these ratios in the past twenty years are shown in Chart II, and the monthly values for the monetary multiplier \((m)\) are shown in Chart III. Quite obviously, if the monetary multiplier were perfectly constant, at say 2.5, then every $1 increase in the monetary base would result in a $2.50 increase in the money stock. On the other hand, if the monetary multiplier were subject to substantial unpredictable variation, the Federal Reserve would have difficulty in determining the money stock by controlling the base.

Since the monetary multiplier is not constant, the Federal Reserve must predict the value of the multiplier for the impending month in order to know how much to increase the monetary base to achieve a desired level of the money stock. Techniques for predicting the monetary multiplier go beyond the scope of this paper.\(^\text{12}\) However, examples of how changes in time deposits and Government deposits influence the stock of money will be discussed.

### The Influence of Two Factors on the Money Stock

The following sections present examples of the ways changes in the growth of time deposits and U.S. Government deposits influence the money creation process. The effects are illustrated both by changes in the ratios in the monetary multiplier and with the use of commercial bank balance sheet “T-Accounts.”

\(^{10}\)Since the monetary base is adjusted for the effect of changes in reserve requirements, a corresponding adjustment is made to the reserve ratio \((r)\).

\(^{11}\)The reader should be able to demonstrate that if money is defined to include time deposits \((M_2 = D + C + T)\), then

\[
m_2 = \frac{1 + k + t}{r (1 + t + g) + k}
\]

\(^{12}\)For one straight-forward approach, see Lyle Kalish, A Study of Money Stock Control, Working Paper No. 11, Federal Reserve Bank of St. Louis, July 1969.

### Changes in Time Deposits

The growth of time deposits relative to demand deposits is determined by many factors, including those which influence the interest rates offered by commercial banks on such deposits and those which influence the quantity of time deposits demanded by the public at each interest rate. Both the banks’ supply of time deposits and the public’s demand for them are a function of relative costs and returns of alternative sources of funds and earning assets. Thus, accuracy of predictions of the t-ratio (time deposits to demand deposits) for a future period is influenced by the ability of the forecasters to anticipate the banks’ and public’s behavior. Experience has shown that changes in this ratio tend to be dominated by rather long-run trends, with exceptions occurring at those times when interest rate ceilings imposed by the monetary authorities prevent banks from effectively competing for deposits. It is these special cases that will be discussed.

When market interest rates rise above the ceiling rates banks are permitted to offer on time deposits, some individuals and businesses who might otherwise hold time deposits decide to buy bonds or other
earning assets instead. This effect has been most pronounced on the banks’ class of time deposits called “large negotiable certificates of deposit” (CD’s). To depositors, these are highly liquid assets which are considered by the purchasers to be close substitutes for Treasury bills and commercial paper.13 On at least four occasions since 1965 the yields on these substitute assets have risen above the rates banks were permitted to offer on CD’s, causing the growth of CD’s to slow sharply or even become negative.

To illustrate the effect on the money stock of a rise in market interest rates above Regulation Q ceilings, assume that the growth of time deposits ceases, and banks hold the same total amount of time deposits while demand deposits continue to grow. In the money supply model this is reflected in a decline in the t-ratio (time deposits divided by demand deposits), and since the t-ratio appears in the denominator of the multiplier, the multiplier would get larger as the t-ratio gets smaller.

For example, assume the following initial values for the monetary base and the parameters of the multiplier:

\[ B = \$75 \text{ billion} \]
\[ t = 1.3 \]
\[ g = .04 \]
\[ k = .3 \]
\[ r = .1 \]

Since \[ M = \frac{1 + k}{r (1 + t + g) + k} \cdot B, \]
we can solve to find \[ M = \$182.6 \text{ billion}. \]

Now suppose that in the course of several months the base increases by $1 billion, but time deposits do not grow at all as a result of the high market rates of interest relative to Regulation Q ceilings. If all of the ratios in the multiplier (including the t-ratio) had remained unchanged in this period, the money stock would have increased by about $2.4 billion to $185 billion. But, since time deposits did not change while demand deposits continued to grow, the t-ratio would fall, to 1.28 for example, which causes the multiplier to increase (still assuming the other behavioral parameters remain the same).14

The reader should be careful not to interpret this greater increase in money (especially demand deposits) to mean that the banks can extend more credit than otherwise. Since the reserve requirements on demand deposits are greater than on time deposits, the $1 billion increase in monetary base would have supported a greater amount of total deposits (demand plus time) if time deposits grew proportionally to demand deposits, rather than only demand deposits increasing. With the assumed initial values for the parameters of the multiplier and the postulated $1 billion increase in the monetary base, money plus time deposits would have increased by almost $4.8 billion, almost twice as much as money.

To interpret the effects of this increase in money on the economy, it is necessary to analyze the increase in the supply of money compared to the demand for money to hold, and the supplies of and demands for other assets. We postulated above that market interest rates rose above the ceiling rates banks are permitted to pay on time deposits (especially CD’s). In such a situation the volume of CD’s (quantity supplied) is any amount depositors wish at the ceiling rates. Since the yields on good substitutes become more attractive than CD’s, the demand for CD’s declines, resulting in a decline in the outstanding volume of CD’s or a slowing in the growth rate. In other words, a change in the relative yields on substitute assets causes a shift in the demand for CD’s (negative), which causes a decline in the volume.

**Disintermediation**

We noted above that total deposits of banks may decline as a result of this “disintermediation” of time deposits. This means that banks must contract their assets, either loans or security holdings, as deposits decline. An understanding of the actions of banks in the face of a deposit drain and actions of those who withdraw their deposits is important information in assessing the effects of the disintermediation caused by the interest rate ceilings.

To illustrate two possible effects of disintermediation, we will use highly simplified examples and T-accounts (commercial bank balance sheets). Account I shows the banking system in its initial condition having total reserves (TR) = $25, required reserves (RR) = $25 and excess reserves (ER) = 0, security holds (S) = $100 and loans outstanding (L) = $175. Bank liabilities are demand deposits (DD) = $100 and time deposits (TD) = $200. We have assumed that reserve requirements against demand deposits are 15 per cent and reserve requirements against time deposits are 5 per cent.
Account II shows the effect of a corporation reducing its holdings of time deposits by $20 and buying $20 in securities from the banks, because of the higher return available on the latter. The immediate effect is that the ownership of the securities is changed—the corporation directly holds the securities instead of having a deposit in a bank which owns the securities, hence the term “disintermediation”—and the banks are left with $1 of excess reserves. The banking system can create loans (or buy some securities), based on the dollar of excess reserves, and increase demand deposits by a multiple of $1. In this simplified example, the effect of disintermediation resulting from relatively low interest rate ceilings is potentially expansionary on total loans, even though total deposits decrease.

For the second example, a bank, in its usual role as an intermediary, sells CD’s to a corporation which wishes to invest short-term funds. With the proceeds of the sale of the CD’s, the bank lends to another corporation (less the amount the bank must hold as required reserves, of course). Another simplified example of the potential effects of disintermediation on the banking system and total credit is illustrated in Account III. For exposition, assume that the one-bank holding companies of commercial banks establish subsidiaries for the purpose of buying and selling commercial paper.

For our example, assume the first corporation does not wish to renew $20 of its CD holdings when they reach maturity, but rather, because of generally rising short-term market interest rates, seeks a yield greater than the bank is permitted to pay. Our hypothetical subsidiary of the one-bank holding company can offer to sell its own commercial paper (I.O.U.) to the first corporation at competitive market interest rates (Account IV).

We assume the corporation buys the subsidiary’s commercial paper. As a result of their reduced deposits the banks are forced to contract assets proportionately (as a first step in a partial analysis). Instead of selling securities, as in our previous example, the banks can contract loans outstanding by $20, as shown in Account III (as compared to Account I). The subsidiary can in turn use the proceeds of its sale of commercial paper to purchase the paper of another corporation which seeks to borrow short-term money, possibly a corporation which was having difficulty getting a bank loan since bank assets and liabilities were contracting.

We find that the initial effect of the disintermediation is that the total of bank loans plus commercial paper debts of borrowing corporations is the same as the initial amount of bank loans outstanding, and that the total of time deposits plus commercial paper assets of lending corporations is the same as the initial amount of time deposits at banks. However, we also find that banks have acquired an additional $1 of excess reserves which they can lend and thereby increase demand deposits.

In summary, both of the examples of the disintermediation of time deposits caused by the interest rate ceilings show that the same initial amount of reserves in the banking system can, under certain circumstances, support a larger amount of demand deposits (and therefore money stock). In other
words, if the disintermediation means only that some funds flow through channels which are not subject to reserve requirements and interest rate ceilings, the effects of the relatively low interest rate ceilings on commercial bank time deposits are potentially expansionary on total loans.

**U.S. Government Deposits and Money**

As previously discussed, the monetary base summarizes all of the actions of the Federal Reserve which influence the money stock. However, the Treasury cannot be overlooked as an agency which can influence the money stock over at least short periods. In the money supply model, the influence of changes in the amount of Government deposits is reflected in movements in the g-ratio (Government deposits divided by private demand deposits) in the monetary multiplier.

In recent years the Government's balances at commercial banks have fluctuated from $3 billion to $9 billion within a few months time. Private demand deposits averaged about $150 billion in mid-1969. The g-ratio is therefore quite small, ranging from about .02 to about .06, but frequently doubles or falls by half over the course of a month or two.

Similar to the effect of changes in the t-ratio, increases in the g-ratio result in a fall in the multiplier since the ratio appears in the denominator. Using again the initial values we assumed for the base and multiplier, we have:

\[
M = \frac{1 + .3}{.1 (1 + 1.3 + .04) + .3} \cdot $75\text{ billion} = $182.6\text{ billion}
\]

where .04 is the value of the g-ratio. These values imply that demand deposits (D) are about $140.5 billion and Government deposits (G) are $5.6 billion. Now suppose that individuals and businesses pay taxes of $1 billion by writing checks which draw down (D) to $139.5 billion, and Government balances rise to $6.6 billion. Assuming no change in time deposits or currency held by the public and no change in the base, we would find that the g-ratio rises to .047 (and the k- and t-ratios rise slightly) to give us:

\[
M = \frac{1 + .302}{.1 (1 + 1.309 + .047) + .302} \cdot $75\text{ billion} = $181.6\text{ billion}
\]

A similar example of the effects on the money stock of an increase in Government deposits at commercial banks which is associated with a change in time deposits (people pay taxes by reducing their savings or holdings of CD's) would be somewhat more complicated. In the above example, taxes were paid out of demand deposits, and the reserve ratio (r) was not changed, which implies that the distribution of the increment in Government deposits among reserve city, country and nonmember banks was the same as the distribution of the $1 billion reduction in private demand deposits.

When taxes are paid out of time deposits, the r-ratio rises, since reserve requirements against Government deposits are approximately three times the reserve requirements against time deposits. These movements are very small, and any accompanying reduction in the excess reserve ratio would attenuate the effect. Nonetheless, the effect on money is a combination of small changes in the k-, r-, t-, and g-ratios.

**Summary**

The behavioral parameters of the money supply framework presented here are the currency (k), reserve (r), time deposit (t), and Government deposit (g) ratios. The changes in these ratios reflect the actions of the Treasury, banks, and nonbank public which influence the money stock. The k-ratio is determined by the public's preferences for currency versus demand deposits; the t-ratio reflects the interaction of the banks' supply of and the public's demand for time deposits as compared to the supply of and demand for demand deposits; and the g-ratio is dominated by changes in Government balances at commercial banks. The r-ratio is the least volatile of the behavioral parameters, although it is influenced by the banks' desired holdings of excess reserves and the distribution of total deposits among all the sub-classes of deposits in the various classes of banks, which are subject to a large array of reserve requirements.

The main policy actions of the monetary authorities — open market operations, changes in reserve requirements, and administration of the discount window — are summarized by the monetary base. The growth of the base summarizes the influence of the monetary authorities' defensive and dynamic actions on the growth of the money stock, regardless of the intent of these actions. The degree of accuracy that can be achieved by the monetary authorities in controlling the money stock is a function of their ability to determine the monetary base, and to predict the net influence of the public's and banks' behavior as summarized by changes in the money supply multiplier.

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