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Monetary Policy, Debt Management and Interest Rates: A Quantitative Appraisal

Arthur M. Okun

COWLES FOUNDATION FOR RESEARCH IN ECONOMICS

AT YALE UNIVERSITY

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Discussions appraising the effectiveness of monetary policy in recent years have been frequent, intense, and illuminating; but they have rarely been quantitative. It is the purpose of this paper to advance quantitative measures of the effect of monetary and debt-management actions on interest rates. The numerical estimates advanced below are necessarily speculative and highly tentative. They are drawn from time-series data of the United States post-war economy and they are subject to all the limitations of statistical manipulation on highly intercorrelated and autocorrelated time-series variables. They do, however, represent a possible answer to the needs of monetary economists for a more specific view of the potentialities of monetary and debt-management instruments. Theoretical discussions can help to tell us whether curves should be drawn steep or flat; and the exponents and disparagers of the central bank's role can debate such matters to the benefit of the profession and the policy-maker. But the issues are quantitative -- an appraisal of the effectiveness of monetary policy should estimate the changes in macro-economic variables that will be achieved by central bank actions. Quantitative measures of effectiveness offer something to debate, discuss, and refine; qualitative appraisals of effectiveness may depend heavily on preferences about the definitions of the word "effective."

Monetary Policy in Keynesian Theory

The Keynesian model of short-run income determination provides a clear specification of the way in which central bank instruments affect the level of output. A change in the volume of money alters the rate of interest so as to equate the demand for cash with the supply; the change in interest affects the level of investment; the change in investment has a multiplied effect on equilibrium income. The present paper is an empirical study of the first link in this chain of effects, i.e., the relationship between money and interest. In the Keynesian model, the central bank is assumed to fix the supply of money, while the public's demand for money depends on income and interest, as expressed in the liquidity preference function. The public can hold a single homogeneous earning asset as an alternative to cash in the world of the model and the yield required to induce the appropriate demand for the earning asset relative to zero-yielding cash depends on the supply of money relative to income. Thus, when the central bank alters the volume of money, it affects the rate of interest. The liquidity preference function is expected to display a negative relationship between the demand for money and the rate of interest. In the General Theory, this negative slope is explained primarily by inelastic expectations regarding interest rates.[2] The public allegedly feels that, when bond prices are low relative to their historical averages, they are more likely to rise and less likely to fall farther. Thus, when bond yields are high, the chance that interest returns will be canceled by capital losses appears smaller, making bonds more attractive. Tobin has shown that aversion to capital-value risk is sufficient to account for a negatively-sloped liquidity preference function, even if there are no expected capital gains or losses.[3] A higher yield on bonds compensates the investor for taking greater risk in holding an expanded volume of bonds. The rate of interest on a financial claim equates the attractiveness, on the margin, of safe zero-yield cash and the risky earning asset as portfolio components. When monetary policy alters the relative supplies of the earning asset and of cash, the equilibrium yield on the earning asset is changed. Furthermore, when income rises while the supply of cash is constant, more money is demanded for transactions purposes, and the interest rate must increase to maintain the required demand for earning assets. This theoretical world supplies an instructive approximation to reality, and it is easily adaptable for empirical verification. The rate of interest, according to liquidity preference theory, should be positively related to the level of income and negatively related to the supply of money. These hypotheses have been tested statistically any number of times and they have been confirmed.[4] There is no need for a further test of the qualitative relationships: if one found opposite results at this stage, suspicion would be cast on his empirical procedures rather than on the theory. The quantification of the relationships, however, deserves much additional study. For this purpose, the simple theoretical world is not so easily translated into operational terms. It must be adapted in a number of ways to yield estimates of relevant magnitudes.

Federal Reserve and Treasury Actions

In the first place, the institutional factors governing public control of the monetary system must be duly recognized. In the theoretical world, the central bank simply and directly controls the supply of money. In reality, public control over the volume of money is imperfect and indirect. The Federal Reserve System and the Treasury have particular instruments of monetary and debt policy at their disposal. These actions have complex effects on balance sheets. A review of these actions can assist the construction of an appropriate empirical framework for the evaluation of monetary policy instruments as determinants of interest rates.

When the Federal Reserve System purchases government securities on the open market, it reduces the volume of interest-bearing federal debt held by the private sector and increases the volume of zero-yielding demand obligations (deposits in the Federal Reserve and currency) of the government. This exchange of demand obligations for marketable term securities will normally increase the volume of money in the community. The maximum potential increase in money is easily calculated as the amount of the open market purchase divided by the percentage reserve requirement on the demand deposits of member banks. But the actual increase may differ substantially from the maximum potential: any induced rise in currency holdings of the public, any increase in excess reserves of commercial banks, any induced reduction in member bank borrowing from the Fed will make the actual fall short of the maximum. The resulting increase in money is the outcome of private actions and is not subject directly to control by public authority.

Another important instrument of Federal Reserve policy is the setting of the required reserve ratio for deposits of member banks. Changes in reserve requirements have no direct impact on the balance sheets of economic units. They alter the volume of demand deposit liabilities that can be supported by a given quantity of member bank reserves. When the Federal Reserve lowers reserve requirements, there is a determinate possible maximum increase in the supply of money. As in the case of open market transactions, the actual expansion is likely to differ from the potential, as banks and their customers make choices which are beyond Federal Reserve control.

The discount rate sets the cost of borrowing from the Fed by member banks. Changes in the discount rate induce movements in the volume of member bank reserves to the extent that the volume of borrowing changes. Again, the commercial banks, rather than the central bank, determine the resulting alteration in the stock of money.

The Fed may also alter the composition of its security-holdings by selling government obligations of a given maturity and simultaneously purchasing an equal volume of bonds of a different maturity. In this case, there is a change in the term structure of the Federal debt held in the private sector. Investors are induced to trade one type of government obligation for another.

The debt-management actions of the Treasury have effects on balance sheets which are identical to the pair of Federal Reserve open market transactions described above. When the Treasury retires one type of outstanding security at maturity and issues a new security in equal volume, it lengthens the term structure of the federal debt. The private sector holds an unchanged volume of federal interest-bearing obligations, but the disappearance of the old issue and the sale of the new one alters relative supplies of debt of different lengths. The mere passage of time shortens the debt in the absence of Treasury action.

The concept of debt management is usually applied to the handling of the maturity structure (and other characteristics) of a public debt of given size. It is thus distinguished from fiscal policy which may involve a change in the magnitude of the public debt over time through surplus or deficit operations. Fiscal actions do have distinct balance-sheet effects which are relevant to the determination of interest rates. If the Treasury markets additional new securities to the private sector with the intention of financing a deficit, the sale immediately raises private holdings of federal interest-bearing securities. It simultaneously lowers, by an equal amount, private holdings of federal demand obligations, since payment for the bonds reduces the volume of Federal Reserve deposits of member banks and currency. As the Treasury spends the proceeds of the borrowings the volume of member bank deposits and currency is restored. The net effect on balance sheets of Treasury deficit-financing is thus like a Federal Reserve open market sale in expanding the volume of interest-bearing obligations held by the public. But while the Federal Reserve trades bonds for money, the Treasury, in effect, makes payments to the public with bonds, thus increasing the volume of government liabilities to the private sector. Treasury surplus-financing has opposite effects.

The open market operations of the Fed and the debt management operations of the Treasury alter the composition of Federal debts to the public. In principle, actions undertaken which have the same balance-sheet effects on the private sector can be viewed as identical whether they are carried out by the Treasury or by the Fed. The market has little reason to care whether a billion dollars of extra bonds are being offered by the Treasury or the central bank. The market does have every reason to try to anticipate future moves of the Treasury and the Fed. For this reason, there may be instances where a relatively small move by either agency could be given great significance as a harbinger of future actions. The quantitative effect of any transaction on interest rates may be ultimately dependent on how much it surprises the market and how it alters expectations. However, the effects on expectations are likely to be complicated and to depend on the specific circumstances surrounding each policy decision: they cannot be adequately handled by lumping actions of the Fed together and separately combining all actions undertaken by the Treasury. Consolidation of the Fed and the Treasury appears to be the optimal strategy for evaluating monetary and debt policy.

The combined debts of the Fed and the Treasury to the public consist of non-interest-bearing demand obligations and interest-bearing dated obligations. The former category consists of cash assets: the components are Treasury and Federal Reserve currency held outside the federal government, and deposits of member banks and others (excluding the Treasury) in Federal Reserve Banks. These cash obligations of the government are designated as federal demand debt. Federal demand debt is the foundation of the money supply -- the currency items are themselves money, while the deposits in the Fed are the basis for the creation of demand deposits by the commercial banks. Open market operations change the supply of demand debt and the supply of interest-bearing debt in opposite directions by equal amounts. Changes in reserve requirements may be viewed as shifting commercial bank demand functions for federal demand debt. Changes in the discount rate alter the price at which commercial banks can directly acquire federal demand debt by borrowing from the Fed. Treasury debt actions (and Federal Reserve open market "swaps") alter the maturity composition of federal interest-bearing debt. Treasury surplus or deficit financing acts to alter the volume of federal interest-bearing debt.

The monetary authorities have direct control over the volume of private holdings of interest-bearing federal debt; because of member bank borrowing, they have less complete control over the quantity of demand debt; they have only imperfect and indirect control over the volume of money. The indirect route by which policy actions affect the money supply raises a problem of strategy in the explanation of how these actions influence interest rates. A quantitative explanation of interest rates in terms of components of private balance sheets does not provide a direct estimate of the way interest rates are affected by particular policy actions. Another quantitative link is needed to relate the private balance sheet items to the variables under policy control. E.g., suppose the reduction in interest per billion dollar increase in the money supply is known; then the determination of the effect on interest of a discount rate decline of one percent requires the further knowledge of how large an increase in the stock of money is induced by the change in the discount rate. A two-stage explanation emerges, running from policy action to private liquidity and then from private asset-holdings to interest rates. An alternative approach would seek to consolidate the two steps and relate interest rates to variables directly under public control, ignoring the money supply and other balance sheet items that are not completely controlled by public authority. Both of these approaches will be explored below.

The Multiplicity of Financial Assets

The existence of a large variety of heterogeneous earning assets constitutes another important difference in reality from the world of the simple Keynesian model. All of the yields reported on the financial pages of the press are candidates for explanation. Presumably their yields are all interdependent and dependent on the supplies of each type of asset. In principle, this difficulty can be met. The liquidity preference function can be generalized into a set of demand curves for financial assets. Cash, bonds of various types, and equities compete for their shares in the portfolios of investors. Some pairs of these alternative securities are clearly close substitutes, and one would expect a change in the supply of one type to have substantial cross-effects on the yield of the other. In general, the demand for any type of asset can be expressed as a function of: a.) Income; b.) Wealth; c.) Its own yield; and d.) The yield of related assets. From such a system, one could determine the yield of each asset from information on the supplies of all assets and the level of income.

Similarly, for given changes in the supply of any asset, changes in yields could be estimated for all assets.

While the procedure can be readily described, the empirical formulation and estimation of such a general equilibrium system of financial markets is a huge task. It is far beyond the scope of this paper. Certainly, everything depends on everything else in financial markets. However, progress can be made by focussing on a small set of key variables. Yields on marketable obligations of the federal government stand out as worthy of particular attention. In dollar volume, federal debt is far greater than any other single type of marketable claim in the postwar American economy. Furthermore, monetary policy deals in federal debts to achieve its objectives. All federal security issues share the exclusive property of being absolutely free of default risk; since the United States government can print money, it can always meet its legal obligations to redeem matured securities for currency. Interest-bearing marketable claims on the Treasury differ among themselves only by having individual maturity dates. The interest rates on three-month Treasury bills and on long-term federal bonds stand at extreme ends of the maturity spectrum for governments. The principal emphasis of this paper will be on these two interest rates.

Claims against private borrowers differ in degree of default risk from one another and from governments. The differential in yield between any one of them and a government obligation of equal maturity will vary as the compensation required for assuming default risk is consistently revalued in financial markets. Despite the varying differentials, it will be shown below that the explanation of government yields accounts for the major portion of the variation in private yields as well.

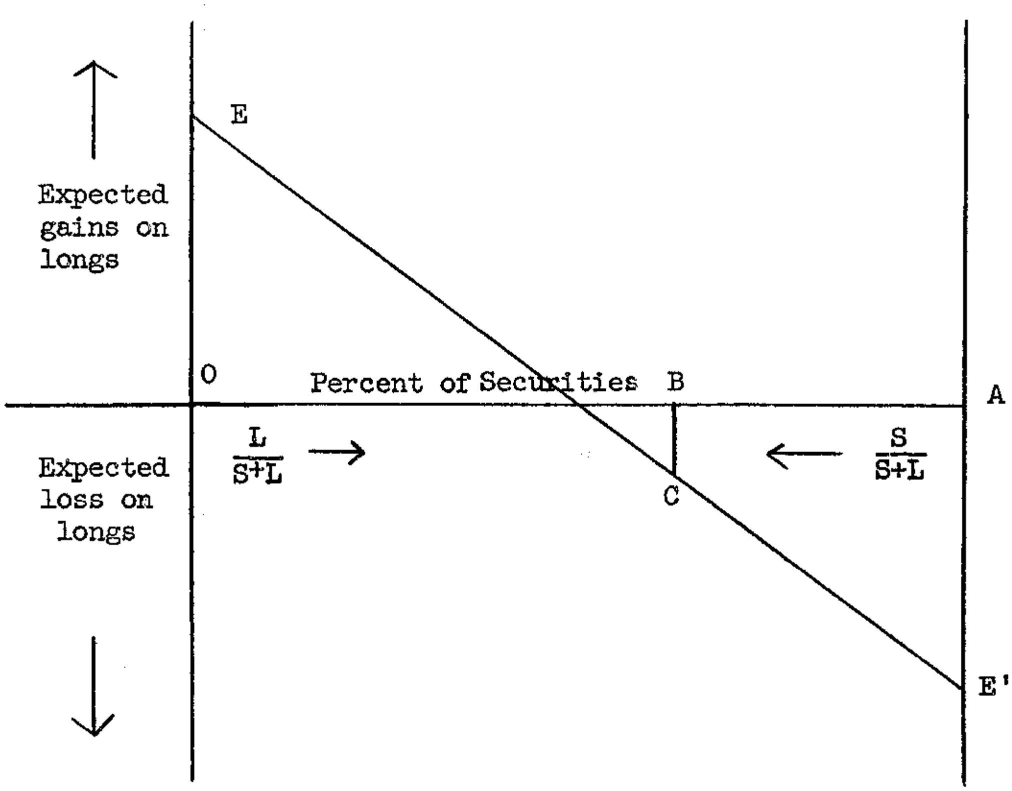
The simple Keynesian theoretical model suggests that the yields on governments should be related to the stock of money and the level of income. The general equilibrium view of financial markets suggests that the stocks of all other financial assets should be considered as possible determinants of the interest rates on federal debt. The approach adopted here is an intermediate one. There are strong *a priori* reasons for believing that the size and composition of the federal debt will have considerable influence on Treasury bond and bill yields; these supplies are used as explanatory variables for the selected interest rates. On the other hand, the magnitudes outstanding of particular types of private obligations are excluded. These are potential substitutes for governments and may well affect the government rate: an autonomous change which doubled the supply of corporate AAA bonds would be expected to raise government long-term yields. However, the volume of private assets is considered in this paper only by the inclusion of total private wealth as a possible explanatory variable. Thus, income, the supply of money, the volume and composition of federal debt, and total wealth are the tentative explanatory variables for government interest rates. Other possible influences will be discussed subsequently.

Interest Rates and Maturity

The dependence of long and short rates on the term structure of the Federal debt follows from theoretical reasoning. Only if bills and bonds could be viewed as perfect substitutes would their yields be independent of their relative supplies. In a world of perfect foresight, no investment costs, and complete shiftability, the long rate would be purely an average of future short-term rates;[5] arbitrage would guarantee that the two rates could not be affected by changes in the term structure of the public debt. Any modification of these extreme assumptions will, however, provide a role to the composition of debt.

Suppose that foresight is not perfect but that investors are risk-neutral and thus act to maximize expected return. Then each investor chooses between long and short securities by balancing the expected return on long bonds with the expected return on bills. If the relevant period is taken as the three-month lifetime of bills, the expected short yield is certain: it is simply the market interest rate on bills. The expected return on bonds, however, differs from the market interest rate by any expected capital gain on bonds over the three-month interval. People anticipating a rise in the long rate must deduct an expected capital loss in their estimates of the return from long securities. On the other hand, those investors who anticipate a decline in long rates will have expected returns greater than the current market long rate. The equilibrium market differential will then, in general, depend on the relative supplies of longs and shorts. On Figure 1, investors are ordered according to the size of their expected capital gain (or loss) on bonds, expressed as a percentage per year. Those with the largest expected capital gain are farthest to the left; each investor is weighted by the magnitude of his demand for longs and shorts combined. The horizontal axis is scaled as fractions of the total outstanding supply of long plus short securities with the distance OA representing 100% . Given the expected gain curve EE', if the outstanding securities are split into OB percent of longs and BA percent of shorts, the equilibrium market long-rate must exceed the short-rate by BC , just enough to offset the expected capital loss of the marginal long investor. People on the EC portion of the expectation

Figure 1



curve will hold longs while those along CE' hold shorts. If the long-term fraction of the total security supply exceeded OB, a larger rate differential would be required; a smaller relative supply of longs would be associated with a decrease in the excess of the long rate over the short rate. The slope of the EE' curve depends on the extent to which investors differ in their estimates of future long rates. The greater the unanimity of opinion, the less difference relative supplies make in the market. So long as there are different views, even in the world of no risk-aversion and no investment costs, relative supplies do matter.

Once attitudes towards risk and costs of transactions are considered, additional support is found for the dependence of rates on relative supplies. At equal expected returns, longs and shorts would not be equally attractive to every investor; furthermore, individual investors might well choose to mix longs and shorts in their portfolios. Because a bill is always close to its maturity date, the price of a short security is unlikely to vary substantially; the bill offers little danger of capital loss and slight hope of capital gain. Capital-value risk is thus small for a bill but large for a long security. To a risk-averting investor, this would be a feature favoring the holding of short-term securities. On the other hand, an investor who continually held short securities would incur large transactions costs as he was forced to reinvest his proceeds each time his short holdings matured; the economy of investment costs is a characteristic in favor of long-term securities. Furthermore, each time the investor acquired a new crop of shorts, he would be subject to the whims of the market. At any point in time, he would be assured of the level of his interest income for only a brief interval in the future. The short portfolio has substantial income risk.[6] The holder of longs gains assurance of a steady flow of interest income over the long run by sacrificing safety on the market value of his portfolio in the near future. The security-holder who is able to stay with his holdings for a long period is thus encouraged to go into bonds. Hence, long-term securities typically are preponderant in the portfolios of universities and insurance companies. The differing features of short and long securities lead to the conclusion that these two assets should be viewed as imperfect though close substitutes like tea and coffee; they are not well conceived of as perfect substitutes like nickels and dimes. Theoretical reasoning suggests that relative supplies will affect relative yields; only quantitative empirical research can determine how much of an effect will exist.

The Empirical Framework

The following decisions of strategy emerge from the discussion above:

1.- The market yields of Treasury bills and of long-term government bonds are the two key dependent variables to be investigated.

2.- The balance sheets of the Treasury and the Federal Reserve System are to be consolidated; all other economic units are aggregated into a single private sector.

3.- The volume and composition of the interest-bearing federal debt should be treated as possible determinants of the yields on governments.

4.- Measures of income and wealth will also be included as potential explanatory variables.

5.- Some measure of money supply is required as an explanatory variable. If the traditional notion of demand deposits plus currency is employed, a further link is needed to relate money to policy variables. Alternatively, use could be made of some measure of money supply directly controlled by public authorities.

Certain of these decisions require further implementation. The volume of federal interest-bearing debt is taken as the dollar maturity value of marketable issues held outside of government agencies and the Fed. (Savings bonds are thus omitted.) This total is divided into three categories:

S - issues maturing within one year,

I - issues maturing in one to five years,

L - issues maturing in five years or more.

The classification depends only on the distance of a security to its maturity date at the particular point in time considered. It does not consider the original length-to-maturity of an existing issue. A bond may have a fifteen year term when it is originally sold by the Treasury, but fourteen years later it is a short-term one year obligation and presumably will be so evaluated in the market. Call provisions are uniformly ignored: the procedure which takes the term of an issue to run only to its call date when its price exceeds par is rejected because it makes maturity dependent on bond prices.

The principal limitation to this (or any other) categorization procedure is that it produces abrupt changes in the classes at discrete points in time. The aging of bonds is continuous: a bond changes character gradually when it moves toward its maturity date from 61 months away to 60 months and then to 59 months. But these two movements are reflected very differently in the data. As a 60-month issue, the security remains in the long category; at 59 months, it shifts into the intermediate class. A mean maturity variable (T) for the long category is introduced to mitigate this problem. The T variable expresses the mean length to maturity of all obligations with maturity dates 60 or more months away. Thus, when a security falls into the intermediate class with the passage of time, the reduced volume of the L group is potentially offset by the rise in T. Obviously, the mean maturity of the long category is increased by the disappearance of a 60-month issue from that class.

The income variable is designed to reflect private transactions demand for liquidity. Since government needs for cash balances should not be included, there is an argument for omitting government outlays from Gross National Product. However, government purchases from business require transactions balances in the private sector. For this reason, the income variable selected is Gross Private Product (GNP less compensation of government employees). Since state and local governments are part of the "private sector," the logic would argue that only federal compensation to employees should be deducted, but the quarterly data do not permit this distinction to be made.

The wealth variable is Net Private Wealth. It differs from National Wealth by including all government liabilities and excluding all assets of the government. This is the same wealth variable relevant to the Pigou effect; it is sometimes designated Patinkin wealth.[7]

The data employed are quarterly observations for the period 1946-59. All stocks are measured at the end of the quarter. The bill rate is taken as the yield on newly-issued Treasury three-month bills during the last month of the quarter; the long rate is the average yield to maturity for the last month of the quarter on a group of long-term government bonds due in more than ten years. The bonds included in the long-term rate index change occasionally, and the maturity length of the sample covered is not held constant; however, since all the components of the sample are very long issues, the variation in maturity does not seem important.

The functional forms by which interest rates are explained are all linear. There are strong reasons to believe that non-linearities will exist; the Keynesian liquidity preference function is usually drawn convex to the origin. It seemed that the most convenient way to introduce non-linearity was to transform the dependent variable from r to the reciprocal of r or to $(r + \text{constant})^{-1}$; The independent variables would then remain in linear form. However, experimentation with such transformations of the interest variables produced discouraging results and led to the decision to restrict the regression equations to linear forms. Thus, the equations explaining the long rate (r) and the bill rate (b) take the following form:

$$1) \quad r(\text{or } b) = a_0 + a_1 \cdot \text{Money} + a_2 \cdot S + a_3 I + a_4 L + a_5 T + a_6 Y + a_7 W$$

An alternative approach assumes that interest rates are homogenous of degree zero in all stocks and income: a doubling of income, wealth, all types of federal debt, and money would be expected to leave rates unaffected. This hypothesis leads to equations of the following type:

$$2) \quad r(\text{or } b) = c_0 + c_1 \frac{\text{Money}}{Y} + c_2 \frac{S}{Y} + c_3 \frac{I}{Y} + c_4 \frac{L}{Y} + c_5 T + c_6 \frac{W}{Y}$$

The variables S , I , L are the three categories of federal debt, while T is the maturity variable; Y and W represent income and wealth, as defined above. The money variable has not yet been defined. An obvious choice is the conventional definition of money, namely demand deposits adjusted plus currency outside of banks. An alternative choice was suggested by Gurley's study of liquidity in the postwar period.[8] There, Gurley explains interest rates by the volume of all liquid assets, appropriately weighted, in relationship to income. He argues that the demand for money may be reduced by expansion of the supply of non-monetary liquid assets; therefore the traditional liquidity preference function should be generalized to include money-substitutes. Interest rates are determined by the supply of liquidity relative to income, as in the original Keynesian view; but, according to Gurley, liquidity must be measured as a weighted total of all liquid assets, not merely media of exchange. The resulting view of the liquidity function is that the rate of interest depends on the volume of all liquid assets, appropriately weighted in relation to the level of income.

Liquid assets are defined as "claims held by nonfinancial sectors of the economy that are ... fixed in price and redeemable into money on demand."[9] Gurley adopts a weight for all non-monetary liquid assets (N) equal to one-half the weight for money (M'), where money is given its usual meaning of adjusted demand deposits plus currency. The measure of aggregate liquidity is thus $Q = (M' + \frac{N}{2})$, and the aggregate liquidity-income ratio is taken as the ratio of Q to Gross National Product (Y_g). Gurley's empirical support for his thesis rests on the close negative relationship found between Q/Y_g and the interest rate in annual postwar United States data. The relationship holds for both the yield on corporate BAA bonds and the prime commercial paper rate.

Empirical explorations with the Gurley liquidity ratio were disappointing, however. In the quarterly data for 1946-59, the ratio of money to income (M'/Y_g) provides a better explanation of both the long government rate and the bill rate than the ratio Q/Y_g. The addition of one-half the volume of non-monetary liquid assets worsens the fit. Calculated results for the long rate are:

3) $r = -5.3\, Q/Y_g + 6.4 \; ; \; R^2 = .56$

4) $r = -7.4\, M'/Y_g + 5.5 \; ; \; R^2 = .66$

For the short rate, the findings are:

5) $b = -9.6\, Q/Y_g + 8.3 \;;\; R^2 = .60$

6) $b = -12.7\, M'/Y_g + 6.4 \;;\; R^2 = .62$

When the ratio of non-monetary liquid assets to income (N/Y_g) is used as a second independent variable with M/Y_g to explain r and b, positive coefficients surprisingly emerge for N/Y_g : the implication is that, for any given M'/Y_g, interest rates will be higher for higher N/Y_g. There is no obvious reason why an expansion of non-monetary liquid assets should raise interest rates; it could mean that the volume of N reflects the strength of demand for money and responds positively to the tightness of financial markets. Also, it might be a spurious result: the positive coefficient is statistically significant only in the equation for r. In any case, these data give no support to the view that the rapid postwar growth of non-monetary liquid assets has held down interest rates. On these grounds, the volume of non-monetary liquid assets was discarded as a potential explanatory variable.

In addition to the conventional definition of money, consideration was given to other candidates for the money variable that are more directly controlled by public policy. The discussion above enumerated the various possible slippages between a central bank action and the resulting change in the supply of money. There is only one open link in the Fed's control over the volume of demand debt; that lies in possible changes in member bank borrowing from the Fed. Subject to its ability to offset autonomous fluctuations in borrowings, the monetary authority can regulate the volume of federal demand debt. On these grounds, one can take the volume of demand debt (M) in relation to the required reserve ratio (R) as a measure of the money supply permitted by the central bank. If there were no currency and no excess reserves and if all demand debt were utilized to back demand deposits of the private sector, the money supply would be M/R . This volume of money is a <u>maximum</u> <u>maximorum</u> relative to the government balance sheet. The actual supply will never reach M/R , but that magnitude can serve as one measure of potential money. Furthermore, if given fractions of demand debt were absorbed by excess reserves, currency, foreign deposits in the Fed, and backing against time deposits, it could still be argued that fluctuations in M/R were associated with proportionate changes in the volume of demand deposits. The M/R variable would be a good gauge of the conditions under which the monetary authority allowed commercial banks to create demand deposits for their customers.

The data suggests that currency has absorbed a variable proportion of demand debt over time in the postwar period. On these grounds, it may be preferable to view the demand for currency as exogenous, and to treat $\frac{(M-C)}{R}$ as potential demand deposits. Here, the actual volume of currency (rather than a zero volume) is taken as a benchmark; and potential demand deposits are viewed as the portion of demand debt which is not absorbed in currency divided by the required reserve ratio. The concept of potential money which then emerges is the sum of potential demand deposits plus actual currency or $\left(\frac{M-C}{R} + C\right)$. Here, currency includes holdings of commercial banks since these absorb federal demand debt. In measuring M', currency in commercial banks is excluded.

Results are reported below with the money variable defined in three ways:

1. -- Currency plus demand deposits, i.e., the actual stock of money;

2. -- Demand debt divided by the required reserve ratio, i.e., maximum potential money;

3. -- Potential deposits plus actual currency, where potential deposits equal demand debt exclusive of currency divided by the required reserve ratio.

It was pointed out above that income could reasonably be treated as a separate independent variable, as in equation 1); or as a divisor of all the stock variables, as in equation 2). Empirical findings strongly suggest the use of the separate treatment. When the divided-through form was used, the reciprocal of income was highly significant statistically as an additional variable, carrying a negative coefficient. This led to the rejection of the homogeneity hypothesis. It implies that a doubling of income and of all stocks will affect interest rates; they are raised by this event. It is not clear why this should be the case -- if anything, economies of scale in the handling of cash-balances lead to the possibility that rates would be reduced by an equiproportionate increase in income and all assets. The empirical results here imply the opposite behavior of interest rates. The assumption of homogeneity does not stand up, and equation 2) is therefore the form adopted. An alternative possibility involves using the divided form, as in equation 1), with the addition of another independent variable, $1/Y$. While this form differs from equation 2) only slightly, it does not fit so well.

Further empirical experimentation showed that the wealth variable produced insignificant results. It was expected that the coefficient of wealth would be negative: larger wealth totals for given supplies of money and government securities mean that claims on the federal government are a smaller fraction of private net worth. As such, a lower yield should be required to induce the holding of this volume of government debt. In general, the expanded size of portfolios has a wealth effect which should raise the demand for governments and thus reduce their yield. The wealth variable, however, offered no assistance whatsoever in explaining the long rate. It did consistently have a negative coefficient in various formulations explaining the bill rate, but the coefficient was never as large as twice its standard error. Because it could not meet conventional criteria for statistical significance, the wealth variable was dropped. Theoretically, it is a relevant variable. Its failure may be attributable to a number of factors. Wealth is highly correlated with income, for one thing. Secondly, the empirical formulation does not consider the changing composition of wealth, which may overshadow the growth of the total.

The three-way categorization of federal interest-bearing marketable debt (S, I, and L) also ran into difficulties. The coefficient of I (one to five year intermediate-term issues) proved quite unstable with respect to the choices of functional form and auxiliary variables. In certain cases, it exceeded substantially the coefficients of both S and L ; in others, it was the smallest of the three by far. Much more reasonable and more stable results were obtained when I was combined with S to form just two categories of federal debt: (S+I) represents those issues maturing within five years, and L is the category of those having five or more years to run. The judgment was therefore made to present all results in terms of this two-way classification.

Because of varying seasonal demands for liquidity combined with stock variables that are not seasonally adjusted, suspicion arose that a seasonal factor would distort the regression equations. Tests showed that this suspicion was well-founded in the case of the bill rate, but not for the long rate. Consequently, a quarterly seasonal dummy variable was inserted into all equations explaining the bill-rate. In effect, there is a separate intercept for each quarter of the year. In the first quarter, $Q_1 = 1$ while Q_2 and Q_3 are set equal to zero. In the second quarter, Q_2 alone has a unity value. In the fourth quarter, Q_1 , Q_2 and Q_3 are all equal to zero.

It was repeatedly found that T , the mean maturity of long debt, was not significant in explaining b although it was typically a significant explanatory variable for r . This is quite reasonable: a change in the age composition of long-term government bonds will affect the yield of a given long-term issue but will not noticeably influence the bill rate. On these grounds, T was retained in the r equations but dropped from the b equations.

Empirical Results

At last, fitted equations are given in Table 1; there are three pairs, using the alternative "money" variables. The actual money supply (M') is the least successful in explaining the bill rate by a wide margin. The coefficient of determination in equation 10) is .819, in contrast with .899 and .904 for equations 11) and 12), respectively. M' is not significant in explaining r, even though equation 7) matches 8) and 9) in terms of R^2. The goodness of fit criterion offers no grounds for choosing between the two potential money variables: maximum potential money is superior by a slight margin in explaining the long rate, while potential demand deposits plus actual currency wins by an equally small margin in the bill rate equation. The standard errors of estimate (σ_u) are about 1/3 of one percentage point for the bill rate and only half as large for the long-term interest rate. The coefficient of determination is higher for the long rate; the variance of r is smaller and a larger percentage of that variance is explained by the selected independent variables.

As expected, the coefficients of (S+I), L, T, and Y are

TABLE 1

Alternative Equations Explaining Bond and Bill Yields

	Dependent Variable	Type of Money Variable	Coefficients										
			"Money"	S+I	L	T	Y	Constant	Q_1	Q_2	Q_3	R^2	σ_u
7)	r	M'	-.0072	+.0159	+.0138	+.0047	+.0091	-1.92	--	--	--		
			(.0084)	(.0040)	(.0023)	(.0028)	(.0016)	(1.14)				.929	.158
8)	r	M/R	-.0066	+.0219	+.0197	+.0046	+.0105	-2.21	--	--	--		
			(.0021)	(.0042)	(.0029)	(.0023)	(.0014)	(.69)				.935	.152
9)	r	$\frac{M-C}{R} + C$	-.0127	+.0168	+.0141	+.0045	+.0096	-1.31	--	--	--		
			(.0058)	(.0037)	(.0022)	(.0024)	(.0014)	(.95)				.929	.158
10)	b	M'	-.0976	+.0217	+.0139	--	+.0252	-3.93	-.83	-.76	-.49		
			(.0483)	(.0115)	(.0070)		(.0068)	(5.49)	(.34)	(.31)	(.28)	.819	.459
11)	b	M/R	-.0370	+.0576	+.0410	--	+.0227	-1.57	-.62	-.47	-.21		
			(.0051)	(.0074)	(.0068)		(.0025)	(.65)	(.14)	(.13)	(.13)	.899	.340
12)	b	$\frac{M-C}{R} + C$	-.1067	+.0287	+.0128	--	+.0241	+6.37	-.80	-.72	-.35		
			(.0139)	(.0066)	(.0045)		(.0025)	(1.31)	(.15)	(.14)	(.13)	.904	.331

positive, and each of the money variables has a negative coefficient. The quarterly dummy variables in the b equations indicate that the bill rate would rise substantially in the third and fourth quarters if additional cash was not provided to meet seasonal demands for greater liquidity. This is reasonable, and corresponds with the adjustment factors used to eliminate seasonality from government time-series for currency.

Surprisingly, the coefficient of (S+I) exceeds that of L in each of the r equations: this means that an increase in the supply of long-term debt would raise the long rate by less than an equal increase in the supply of bills or other short-term securities. The difference between these coefficients is trivial -- both by statistical criteria and in terms of the magnitudes of economic effects. An increase of one billion dollars in the supply of long-term securities (with average maturity for the L category) coupled with a decrease of one billion dollars of shorts produces an estimated decline of .002 or .003 percentage points in the yield on long-term bonds. The calculated effect is miniscule and its direction cannot be taken seriously. The result is further qualified by the positive coefficient on the maturity variable, T : a lengthening of the Federal debt is estimated to increase the long rate insofar as it raises the mean maturity of issues with more than five years to run. Thus, a sale of 10-year bonds by the Fed coupled with a purchase of an equal volume of 20-year bonds has an estimated positive influence on r . If this is the case, surely a sale of bills accompanied by a purchase of 10-year bonds should have a similar effect. Perhaps, in retrospect, the inclusion of a mean maturity variable for short and intermediate securities would have helped to isolate this effect. Despite all these necessary qualifications, a principal conclusion of this study is that the long rate is relatively insensitive to changes in the maturity composition of the public debt. This finding, discussed in detail below, emerged consistently with a variety of functional forms and alternative sets of independent variables that were used to explain bond yields.

Standard errors of the coefficients in Table I are shown in parentheses below the estimated coefficients; as presented, most of the estimates differ significantly from zero at the one percent level. However, many possible variables--like wealth--were discarded when they did not pass standard tests of statistical significance. Since statistical significance was one of the criteria employed in the selection of explanatory variables, it is hardly surprising that most of the survivors passed this test. The "mining" of the data through experimentation detracts from the statistical evaluation of the results. This is no catastrophe, however, since the study is designed to develop optimal point estimates rather than to test hypotheses.

Further attempts were made to refine the results shown in Table I. A number of lagged stock variables and first differences in stocks were tested as possible additional explanatory variables. The use of end-of-quarter stocks in the equations of Table I implies that the bond market adjusts immediately and completely to the supplies which are offered to the public.

On the other hand, in most qualitative discussions of the behavior of interest rates, the bond market is viewed as imperfect by financial experts.

References to the "thinness" of the bond market imply that a large increase in the supplies of securities will raise yields sharply in the process of being absorbed by bond-holders. An "overshoot" theory of interest rate determination emerges: a given new issue will raise yields initially by more than will be maintained when the issue is safely committed to portfolios. Indeed, if investors are exceedingly reluctant to trade securities and concentrate mainly on the allocation of new cash-inflow in their investment decisions, the flow of net new issues--rather than the total existing stock--would be the principal determinant of interest rates. To the extent that there is any widespread reluctance to review portfolios or to engage in trading because of transactions costs, net new issues would be expected to influence yields.

In this event, changes in stocks of securities should bear positive coefficients when they are inserted into the equations of Table I as additional independent variables. In fact, quarterly changes in the volume of federal long debt (ΔL) and other debt ($\Delta [S + I]$) are not significant in explaining either r or b . These are not ideal variables: they record changes in $(S + I)$ and L due to certain issues crossing the 60-month dividing line between maturity categories as equivalent to changes attributable to open market operations, Treasury new issues, and maturing securities. As an alternative, gross new issues of governments by the Treasury was tried with a similar lack of success. Nor did the inclusion of new corporate issues with the new governments improve the results. Gross new issues also is a faulty variable: it omits open market actions and ignores the volume of maturing securities. Still, the consistency of negative findings with the various flow variables is striking.

It would be most rash to conclude that the bond market is and has been sufficiently perfect in the postwar era to make "thinness" a myth. A more reasonable view is that the imperfection of the market is not evident in the data because the monetary authorities have confined themselves to rather modest quarterly flows of net new issues and net acquisitions in the open market. The Fed and the Treasury have kept their net transactions in any quarterly period small relative to the size of the outstanding public debt. Partly because the monetary authorities subscribe to an overshoot theory of the bond market, no large sudden shifts are observed in the volume of federal debt. If larger shifts occurred, perhaps evidence of thinness would emerge. In private discussion of these findings, my colleague Henry Wallich suggested the following analogy. The monetary authorities have consistently viewed the bond market as thin ice and they have therefore skated with great care. According to the data, they have never fallen through the ice. Yet, it cannot be justifiably concluded that the ice is solid and the caution gratuitous.

Pressing the skating analogy a bit further, one does not even find evidence that the ice cracked or showed any warning signs in the postwar period. Perhaps, therefore, the skaters could afford to display more boldness while watching carefully for indications of danger. If, however, the ice of the bond market would suddenly break under the rash skater with no warning, any counsel of relaxed caution would be misguided.

Other experiments with the equations of Table I were directed toward the incorporation of cyclical influences. Suppose that the levels of Gross Private Product were identical in two quarters five years apart and that the combined Treasury-Fed balance sheets were also identical for these two periods. Each of the equations presented in Table I would estimate identical values of r (or, of b) for these two quarters. Obviously, however, the later period would be marked by depressed economic activity and widespread unemployment. With continued secular advances in productivity and the labor force, constant output would be associated with increasing slack over time. On _a priori_ grounds, one might well believe that interest rates on government securities would be lower in the later, depressed period because unfavorable expectations and slump psychology would raise demands for relatively safe assets. Such a possible effect could be investigated if secular and cyclical changes in income are distinguished.

This distinction was most successfully accomplished by the inclusion of a variable reflecting the full-employment level of output in addition to the actual output variable. If full-employment is taken to mean a four percent rate of unemployment, the potential level of GNP at full utilization can be estimated through an adjustment of actual GNP for any excess or shortfall of the unemployment rate from four percent. Each percentage point difference in unemployment is associated with a much more than proportionate difference in GNP because hours worked per man, the size of the labor force, and man-hour productivity all vary with the level of resource utilization. Statistical analysis, recently conducted by the Council of Economic Advisers, suggests that a 3.2 percent increment in GNP accompanies a one percentage point decrement in the unemployment rate.[10] This yields the following estimate of potential GNP (P):

$$P = \text{Actual GNP} \cdot (1 + .032\ [\text{Actual Unemployment Percentage} - 4]).$$

When both actual and potential output variables are included, the potential variable reflects secular forces, leaving the actual variable free to register cyclical factors. For any given potential output, actual Gross Private Product shows the strength of private demand in the economy. There is a possible objection to the inclusion of government payrolls in the potential variable when it is excluded from actual Y, but the alternative of constructing a concept of potential Gross Private Product seemed even less appealing.

Table II shows the results obtained when P is added to the independent variables of equations 8), 9), 11), and 12). These were the equations of Table I that used M/R and $\left(\frac{M-C}{R} + C\right)$ as money variables. The coefficients of P are all negative as hypothesized: for given Y, the more slack in the economy, the lower interest rates will be. In equations 15) and 16), P is significantly negative. The coefficient of determination of .916 in 15) may be compared with the .899 for equation 11) which is identical in all respects except for the inclusion of P. The R^2 of .928 for equation

Table II

Alternative Equations Explaining Bond and Bill Yields
With Inclusion of Potential GNP

Rate	Money Variable	Coefficients										R^2	σ_u
		"Money"	S+I	L	T	Y	P	Constant	Q_1	Q_2	Q_3		
13) r	M/R	-.0051 (.0027)	+.0223 (.0042)	+.0192 (.0030)	+.0046 (.0023)	+.0119 (.0022)	-.0018 (.0021)	-2.41 (.73)	-	-	-	.936	.152
14) r	$\frac{M-C}{R} + C$	-.0080 (.0064)	+.0195 (.0040)	+.0153 (.0023)	+.0045 (.0024)	+.0125 (.0022)	-.0032 (.0019	-1.99 (1.02)	-	-	-	.933	.155
15) b	M/R	-.0218 (.0064)	+.0601 (.0069)	+.0342 (.0066)	--	+.0345 (.0042)	-.0161 (.0048)	-3.65 (.85)	-.43 (.14)	-.31 (.13)	-.09 (.13)	.916	.313
16) b	$\frac{M-C}{R} + C$	-.0705 (.0152)	+.0431 (.0064)	+.0181 (.0041)	--	+.0363 (.0038)	-.0160 (.0040)	+1.69 (1.65)	-.58 (.14)	-.50 (.14)	-.21 (.12)	.928	.289

16) similarly corresponds to a value of .904 for equation 12). The explanation of b is substantially improved by the inclusion of P .

The explanation of r is, in contrast, assisted only slightly by the P variable. The estimated coefficients of P in equations 13) and 14) do not differ significantly from zero, although the decision is a close one in equation 14). The rise in R^2 over the corresponding equations of Table I is trivial. On empirical grounds, P has fully earned a place in the b equations but not in the r equations. Yet, from analytical reasoning, the cyclical effect should emerge in long as well as short yields.

The coefficient of Y is increased by the inclusion of P . This is a plausible finding: a rise in Y is now purely a cyclical increase at a point in time with a greater impact on expectations. However, the estimated coefficients of the money variables are uniformly lowered in absolute value by the inclusion of P and this is a less plausible finding. In particular, the money coefficients in both r equations are no longer statistically significant, in contrast with the results in Table I. No analytical support can be invoked to explain why the inclusion of P should reduce the estimated effect of a change in demand debt on the long rate.

These considerations leave doubt as to whether the equations of Table I or those of Table II should be accepted as the basic estimates. My judgment calls for a sacrifice of symmetry in following the empirical results by employing equations 15) and 16), which include P , for b , and using equations 8) and 9) , excluding P , for r .

The cyclical-secular distinction was also aimed at eliminating the significantly positive serial correlation of residuals that occurred for the equations of Table I. That objective was not achieved: positive autocorrelation remains in the equations of Table II. If r (or b) is above the value estimated by the equation in one quarter, it is likely to exceed its calculated value again in the next quarter. The serial correlation coefficients run in the neighborhood of one-half. Also, there is positive covariance of the r and b residuals: when the long rate is above its estimated value, the bill rate also tends to have a positive error.

Estimated Effects of Policy

The equations set forth above provide estimates of the effects on interest rates of hypothetical policy actions that might be undertaken by the monetary authorities. Table III sets forth these estimates for six actions and for a change in Y . For certain of the actions, the estimated changes in rates depend on the initial values of some of the variables. Therefore, a benchmark period must be adopted for specific calculations. The fourth quarter of 1959 was selected, and values of the relevant variables in that quarter are shown in the table. The effects are estimated with the assumptions that income, currency-holdings in the private sector, and member-bank borrowings are constant, i.e., that they are not altered by the policy action. These restrictions will be relaxed subsequently. In the last example, the change in Y is supposed to occur instantaneously and to be independent of any action of the Treasury or Fed.

Table III

Estimated Effects on r and b of Hypothetical Policy Actions
(Percentage-point change)

Example	Estimated change in r: Equation 8) (M/R)	Estimated change in r: Equation 9) $(\frac{M-C}{R} + C)$	Estimated change in b: Equation 15) (M/R)	Estimated change in b: Equation 16) $(\frac{M-C}{R} + C)$
An open market sale of $1 billion of bills, notes, or other short-term issues	+.064	+.099	+.202	+.501
An open market sale of $1 billion of 20 year bonds	+.073	+.106	+.176	+.476
A rise in reserve requirements by one percentage point	+.135	+.096	+.447	+.537
A decline in reserve requirements by one percentage point	-.154	-.110	-.509	-.610
Retirement of $1 billion of 5 year bonds and simultaneous issue of $1 billion of 20 year bonds	+.020	+.019	0	0
Retirement of $1 billion of bills or certificates and simultaneous issue of $1 billion of 20 year bonds	+.010	+.007	-.026	-.026
A rise in Y of $1 billion	+.010	+.010	+.034	+.036

Variables in 1959-4: M = 51.8; C = 32.6; R = .154; L = 42.3; T = 150.5

Two sets of estimates for each rate are shown in Table III, corresponding to the two money variables M/R and $\left(\frac{M-C}{R} + C\right)$. The estimates for r are based on equations 8) and 9) of Table I; those for b rely on equations 15) and 16) of Table II, including the potential GNP variable. Open market sales or "swaps" can also be interpreted as Treasury new issues or refundings. Changes in reserve requirements are shown separately for increases and decreases, since the legal reserve ratio enters the equations non-linearly. In all other cases, a reversal of the action (e.g., from sale to purchase) simply changes the sign of the estimated effect without altering its magnitude.

A sample calculation is offered herewith for any reader who might wish to roll his own. Consider the effect on b of a $1 billion open market sale of shorts, as estimated by equation 16). The sale raises outstanding (S + I) by $1 billion and lowers M by $1 billion. The estimated effect of the Δ (S + I) is .0431 percentage points, applying the coefficient of (S + I). The Δ M must be divided by the required reserve ratio, .154, to get the decline in $\left(\frac{M-C}{R} + C\right)$. Then that figure, -6.494 , multiplied by the relevant coefficient, -.0705 , has a product of +.4578. The .501 figure shown in the Table is the sum of .0431 and .4578.

Intuitive feelings about the magnitude of effects on rates are so rare and so weak that it is difficult to get a subjective judgment on the plausibility of these estimates. Nobody who has seen these results has been prepared to call them implausible, but that may simply reflect caution and courtesy. One obvious test is the consistency of the two sets of estimates for each rate. The only cases in which these are distressingly far apart are the effects of open market actions on the bill rate. A sale of $1 billion of bills (Example A) is expected to raise the bill yield by 20 basis points according to equation 15), while 50 basis points is the estimate from equation 16). On the other hand, the two estimates of the effects on r resulting from open market sales are fairly close together and so are the pairs of estimated effects due to changes in reserve requirements.

The much greater volatility of short-term rates is clearly reflected in the estimates. Changes in reserve requirements and open market sales are expected to have three to five times as much effect on bill yields as on long-term yields. Comparison of Examples A and B reveals that an open market sale of very long securities has an estimated effect on r only about ten percent greater than an equal sale of bills. Similarly, sales of shorts affect <u>b</u> only slightly more than do equal sales of bonds. As a result, the estimated changes in the cases of trades (Examples E and F) are uniformly small. Since T was not included in the b equations, a change in the maturity composition of the long category has a zero estimated effect on the bill rate. A comparison of Examples E and F for the long rate reveals incredible results, which occur because the coefficients of (S + I) were slightly greater than those of L in the r equations. Certainly no one can believe that the long rate is increased to a greater extent when very long securities are sold to acquire five-year bonds than when the very longs are traded in exchange for bills. The important conclusion is that both examples have small effects. Example G shows that income changes lead to an estimated Δb that is over three times the corresponding Δr. When A and F are compared, it appears that an open market purchase of bills of $100 to $160 million is required to hold r constant when Y rises $1 billion. The corresponding estimates for holding b constant in that event is $70 to $170 million.

The results of Table III reveal the limitations of a linear function. Since the estimated effect of an open market purchase of bills is simply proportional to the volume of the purchase, large purchases could have estimated effects which would turn rates negative.

Interest rates influence the level of income and yet here Y is treated as an exogenous variable. As a result, the estimated regression coefficients are biased. To remove the bias would require the construction and estimation of a complete aggregative econometric model, a task which is obviously beyond the scope of this paper.

Thus far, member bank borrowings have been taken as constant regardless of monetary policy. However, suppose the bill rate rises as a result of sales of securities by the monetary authorities. If the discount rate was unchanged, there would be increased incentive for borrowing by member banks. Any increase in borrowing would raise Federal demand debt and thereby modify the increase in rates. The net effect of a sale on demand debt would then be less than the amount of the sale. The quarterly data for 1946-59 confirm the hypothesis that member bank borrowings (B) are positively related to the bill rate and negatively related to the discount rate (d):

$$17)\qquad B = \underset{(.118)}{.188} + \underset{(.120)}{.487b} \underset{(.152)}{-.306d}; \qquad R^2 = .535, \quad \sigma_u = .249$$

Borrowings rise by an estimated \$487 million for each percentage point increase in b , with d constant.

This result can be used to adjust the estimates shown in Table III. Since additions to B are increases in M , the amount by which b is altered by a unit change in M (denoted as a_M) is also the effect on b of a unit change in B . So Δb^* (adjusted for changes in B) will differ from Δb , as shown in Table III, by $a_M \Delta B$: $\Delta b^* = \Delta b + a_M \Delta B$. In turn, from 17) , ΔB is estimated as .487 times the true (or adjusted) Δb^* . Therefore,

$$18)\qquad \Delta b^* = \frac{\Delta b}{1 - .487 a_M}$$

With the legal reserve ratio equal to .154, the value of a_M derived from equation 15) is -.142 $\left(\text{or } \frac{-.0218}{.154}\right)$, while equation 16) gives a value of a_M of -.458. The final conclusion is that, for estimates based on equation 15), $\Delta b^* = .935 \Delta b$; while, for those derived from equation 16), $\Delta b^* = .818 \Delta b$. Borrowing by member banks acts as a stabilizer on interest rates. According to the equation which uses $\left(\frac{M-C}{R} + C\right)$ as the money variable, they are a rather important influence, curtailing changes in the bill-rate by nearly one-fifth. The M/R equation attributes much less influence to the induced change in borrowings.

By the same reasoning, a correction for the estimates of Δr is required. Even though borrowings are assumed to depend solely on short rates, any change in B affects r . The adjusted change in r (Δr^*) from any event is:

19) $$\Delta r^* = \Delta r + .487 \; a'_M \, \Delta b^* ,$$ where Δr is the estimate made on the assumption of constant B ; a'_M is the estimated effect of a unit ΔM on r ; and Δb^* is the adjusted change in the bill rate due to the event in question. The estimated adjustment from equation 8) is :

19a) $$\Delta r^* = \Delta r - .021 \, \Delta b^* .$$

The adjustment from equation 9) is:

19b) $$\Delta r^* = \Delta r - .040 \, \Delta b^* .$$

One further adjustment is in order for the estimated effects of a change in Y from equations employing $\left(\frac{M-C}{R} + C\right)$ as the money variable. To the extent that the demand for currency may be viewed as a pure transactions demand, it is reasonable to take C as independent of interest rates, but it cannot be independent of Y . By raising transactions demand for money, an increase in Y should expand C . In fact, the data confirm this hypothesis:

20) $$C = \underset{(4.40)}{23.68} + \underset{(.0014)}{.0185}\ Y\ ; \quad R^2 = .774\ ; \quad \sigma_u = .753$$

The expansion in C , in turn, has a multiplied effect in reducing potential demand deposits and therefore lowers $\left(\frac{M-C}{R} + C\right)$ for given M . It should reinforce the effect of an increase of Y in raising interest rates. However, the income-effect on C , while highly significant in statistical terms, is very small -- less than $20 million per $1 billion increase in Y . Hence, this adjustment makes very little difference in the estimated effect of a change in Y .

Table IV repeats the examples of Table III with the estimates adjusted for changes in B and C . Except for reducing somewhat the wide gap between the alternative estimates of Δ b in a few cases, the adjustment does not alter the results of Table III markedly. Table IV also includes estimated effects of a change in the discount rate. According to equation 17), a rise in the discount rate of one percentage point will reduce B and hence M by $306 million. The table shows the resulting changes estimated for b and r . Again, the two estimates are far apart quantitatively but they agree in attributing little potency to the discount rate as an instrument of monetary policy. An open market sale of $250 million has about as large an estimated influence as an increase of one percentage point in the discount rate. Of course, the discount rate may have an important influence on expectations by signaling the attitude of the Federal Reserve System. Such effects would not be reflected in the estimates shown. Furthermore, the Fed reacts to rates and the level of borrowings in deciding whether

Table IV

Estimated Effects on r and b of Hypothetical Policy Actions - Adjusted for Estimated Change in B (Percentage-point Change)

Example	Estimated Change in r: Equation 8)	Estimated Change in r: Equation 9)	Estimated Change in b: Equation 15)	Estimated Change in b: Equation 16)
A - An open market sale of $1 billion of bills, notes, or other short-term issues	+.060	+.083	+.189	+.410
B - An open market sale of $1 billion of 20 year bonds..................	+.070	+.090	+.165	+.389
C - A rise in reserve requirements by one percentage point	+.126	+.088	+.418	+.439
D - A decline in reserve requirements by one percentage point	-.144	-.090	-.476	-.499
E - Retirement of $1 billion of 5 year bonds and simultaneous issue of $1 billion of 20 year bonds	+.020	+.019	0	0
F - Retirement of $1 billion of bills or certificates and simultaneous issue of $1 billion of 20 year bonds	+.010	+.007	-.024	-.021
G - A rise in Y of $1 billion	+.010	+.010	+.032	+.030
H - A rise in the discount rate by one percentage point	+.013	+.025	+.043	+.140

to change the discount rate. If the observations reflect high values of d that result from high levels of B , the true deterrent effect of the discount rate on borrowing would be underestimated by the regression equation. It is precisely because d has frequently followed b rather than leading it, that the discount rate was not employed as an explanatory variable for b . The Federal Reserve System obviously controls the discount rate but it has apparently used this instrument at times to follow the bill market. As a result, it is particularly difficult to quantify the causal influence of the discount rate on the bill market.

Interest Rates on Private Assets

The monetary authorities are dealers in Federal debt, but their actions influence yields of private assets. In fact, monetary policy affects aggregate demand for output by altering the cost and availability of funds to private borrowers. The relative importance of changing rates and changing availability need not be evaluated here. Even if availability was all important, changes in interest rates on marketable securities would be an unfailing symptom of variations in the tightness of financial markets. Hence, regardless of doctrinal differences on the mechanism by which monetary actions ultimately influence the demand for output, the effect of policy on private interest rates is significant.

Interest rates on key private assets are related to one another and to government yields in Table V. No attempt is made here to explain these other yields by their basic stock and flow determinants. Table V is designed

TABLE V. SIMPLE CORRELATIONS AMONG VARIOUS INTEREST RATES
(Based on 55 quarterly observations from 1946-1 to 1959-3)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1.	1	.855	.714	.556	.220	-.501	.852	.213	.641	.743	.816	.955	.841	-.463
2.		1	.938	.824	.476	-.604	.863	.486	.829	.880	.910	.868	.930	-.631
3.			1	.959	.732	-.470	.887	.731	.913	.901	.877	.736	.815	-.584
4.				1	.826	-.315	.812	.823	.896	.847	.790	.589	.705	-.482
5.					1	.090	.654	.948	.757	.631	.511	.223	.265	-.175
6.						1	-.358	-.025	-.364	-.447	-.521	-.544	-.621	.825
7.							1	.658	.882	.895	.890	.847	.723	-.498
8.								1	.839	.716	.598	.262	.257	-.329
9.									1	.978	.936	.694	.673	-.583
10.										1	.983	.792	.764	-.624
11.											1	.861	.825	-.649
12.												1	.851	-.520
13.													1	-.531
14.														1

(Data sources given in Appendix Table A-1.)

1. Treasury Bills
2. Long-Term U.S. Bonds
3. Corporate Aaa Bonds
4. Corporate Baa Bonds
5. Dividend Yields-Preferred
6. Dividend Yields-Common
7. Prime Commercial Paper
8. Bank Loan Rate $1-10 Th
9. " " " $10-100 Th
10. " " " $100-200 Th
11. " " " $200 and up
12. Discount Rate
13. High Grade Municipals
14. Earnings/Price Ratio-Common

to show the extent to which various rates have moved together in the postwar years. Fourteen interest rates are considered, and those make up both the rows and columns of the table. Entered in the table are the simple correlation coefficients among various pairs of yields for 55 quarterly observations from 1946 through the third quarter of 1959. Since each rate is, of necessity, perfectly correlated with itself, all the diagonal elements of the matrix are unity. Because the correlation of y with x is identical to the correlation of x with y, only half of the off-diagonal elements need to be filled.

The concept of an interest rate structure gets support from the close relationships among corporate bonds, municipal bonds, prime commercial paper, larger bank loans, and governments. Generally, the correlation coefficients between pairs of these yields exceed .8. On the other hand, both dividend and earnings yields on common stocks typically show negative correlations with the yields of debt issues. Yields on preferred stock and the rate on small bank loans ($1,000 - $10,000) display relatively low correlations with other rates but a surprisingly close relationship to each other.

Table V also points to the rate on long-term governments as the pivotal yield in the interest structure. Every one of the eleven private yields is more closely related to the long rate than to the bill rate. This would have been expected for corporate and municipal bonds, but it seems surprising for short-term private debts like bank loans. Even the prime commercial paper rate maintains the unanimity, although by an insignificant margin. And the negative relationship with common stock yields is close for the long rate. These findings suggest that, if monetary policy influences the long-rate in the ways indicated in earlier sections of this paper, it will also alter yields on private assets. This conclusion gives a causal interpretation to the correlations of Table V, implying that other yields have moved because of changes in the government yield. The data, of course, show only association and not causation. It could be argued that common forces have typically acted in the same direction on yields of both government and private debt, but that concerted monetary policy actions to alter government yields would not be transmitted to private securities. This argument gains support from the fact that the negative correlation between equity returns and the government rate is clearly not causal. The usual *a priori* view is that a tightening of monetary policy depresses equity prices, thus raising their yield just as it raises the yield on governments. The data are, however, dominated by the fact that cyclical forces change the relative demands for equities as opposed to claims. When profits and the price level seem headed upwards, investors will accept lower current returns on common stock and will demand higher compensation for holding bonds. But the Fed does not promote bullishness on Wall Street by a large open market sale of governments.

While a non-causal interpretation must be supplied for this negative correlation, that does not discredit the positive relationship among yields of debt issues. Marked changes in the relative preferences of investors among claims are not likely to occur; if they did happen during the postwar period, the positive correlations are understated. It seems reasonable to use the high positive correlations to approximate the effects of a change in the government yield attributable to public policy. Then, the slopes of simple regressions of various private yields on governments can be used to estimate the change in other interest rates accompanying a given change in r .

Table VI

Estimated Slopes of Regressions of Various Interest Rates on Long-Term U.S. Bond Yield

Yield	Slope on r
Corporate Aaa	.961
Corporate Baa	1.018
Dividend Yields - Preferred	.470
Prime Commercial Paper	1.577
Bank Loan Rate $1-10 Thousand	.692
" $10-100 "	1.124
" $100-200 "	1.398
" $200 + "	1.567
High Grade Municipals	1.240

(55 quarterly observations from 1946-1 to 1959-3.)

These slopes are shown in Table VI. In each case, the long-government rate is the independent variable and a private rate is dependent. The coefficients in the table show the estimated change in the private rate accompanying a change in r of one percentage point. The estimated changes for corporate and municipal bonds are about equal to Δr; those for large bank loans and commercial paper are about one and a half times as large. Only for small bank loans and yields on preferred stock is the slope much below unity. These results suggest that changes effected in the yield of long-term governments will be transmitted without diminution to private rates.

Conclusions: Summary of Empirical Findings

1. The interest rates on long-term government bonds (r) and Treasury bills (b) are both positively related to the following independent variables:

(S + I) - The volume of Federal debt with maturity of less than five years held outside government agencies and the Federal Reserve System.

L - The volume of Federal debt with maturity of five years or more held outside government agencies and the Federal Reserve System.

Y - Gross Private Product, i.e., GNP minus government payrolls.

In addition, r is positively related to the mean maturity (T) of long debt. Quarterly dummy variables affect b significantly, reflecting a seasonal pattern, but they do not influence r . The bill rate is negatively affected by deficiencies in aggregate demand as reflected by a potential GNP variable used in conjunction with actual output; the same effect was expected but could not be empirically established for the long rate.

Two alternative "money" variables are negatively related to both r and b . One of these consists of Federal demand debt divided by the legal revenue ratio (M/R): it represents the hypothetical maximum volume of money that could exist with the given combined balance-sheets of the Treasury and Federal Reserve System in the absence of currency, time-deposits, and excess reserves. The other "money" variable takes the actual volume of currency outside the Treasury and Fed and adds to that the remainder of demand debt divided by the legal reserve ratio. The resulting variable is the sum of actual currency plus potential demand deposits, where the potential would be reached only if time deposits and excess reserves were both zero.

2. Both of the hypothetical money variables are more successful in explaining interest rates than is the actual volume of money. Furthermore, the addition of private near-monies to the money supply does not aid the explanation of rates. The hypothetical variables reflect the conditions established by the monetary authorities under which commercial banks can create demand deposits. There is little ground for choice between M/R and

$\left(\frac{M-C}{R} + C\right)$ on either analytical grounds or criteria of empirical success.

3. The resulting equations account for 92 to 93 percent of the variance of b and r in 56 quarterly observations covering 1946 to 1959. The residuals of the equations, however, display significantly positive autocorrelation of residuals.

4. Net private wealth was expected to influence rates negatively, but the data did not confirm this hypothesis.

5. Changes in stocks of the public debt and flows of new securities could not be established as influences on b and r . This finding undoubtedly depends on the relatively small magnitudes of quarterly changes in the postwar period. Nevertheless, extreme views -- or extreme fears -- that attribute great imperfection to the government bond market get no support from the evidence.

6. As expected, the bill rate is much more sensitive than the long rate to given changes in Federal debt and in the level of income.

7. Open market purchases and sales and changes in reserve requirements have estimated effects on b and r which are substantial in magnitude. Monetary policy can affect rates markedly. In a few cases, the effect of a given action estimated from the M/R equation differs substantially from the estimate relying on $\left(\frac{M-C}{R} + C\right)$. It is obviously important whether an open market sale of $1 billion is likely to raise b by 20 or 40 basis points. Yet, neither estimate can be rejected on the grounds of subjective implausibility. If 20 and 40 seem equally sensible to monetary economists,

one must conclude that the profession has done very little quantitative thinking in this area. Much more needs to be done to refine the highly tentative and speculative estimates advanced above.

8. The estimated effects of open market actions are very similar, whether they are conducted by means of bills or of long bonds. The sale of very long bonds will produce an estimated increment in r only about ten percent higher than that associated with an equal sale of bills. Similarly, a bill sale has only a slightly larger estimated influence on b than an equal sale of bonds.

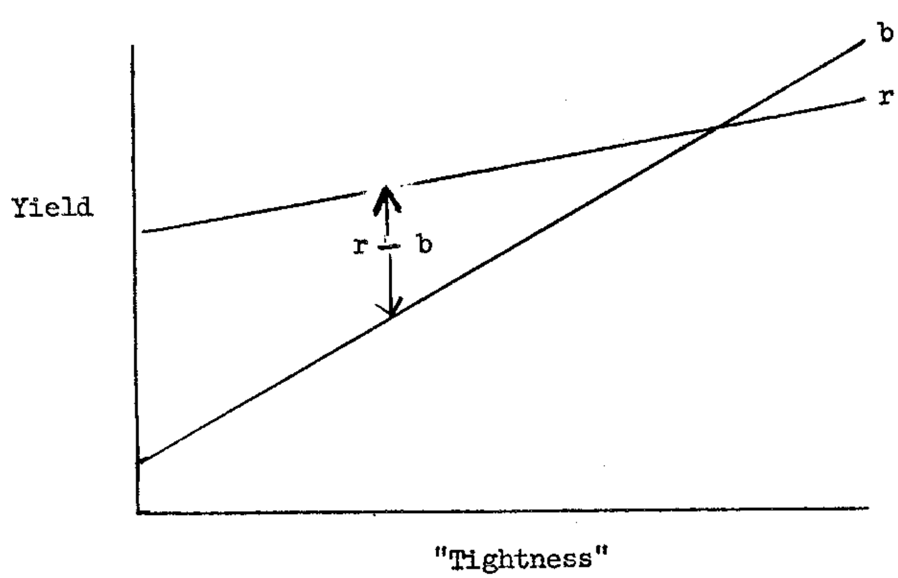
9. The effects of changes in the discount rate can be evaluated only insofar as they alter the volume of member bank borrowings. The discount rate appears to be a rather weak instrument of monetary policy in contrast with changes in reserve requirements or with open market sales and purchases. The estimate does not reflect any impact of the discount rate on expectations. Still, there is no apparent reason why a movement in the discount rate should be a more dramatic signal to investors than altered reserve requirements or large open market actions.

10. It is estimated that changes effected in the yield of long-term U. S. bonds are transmitted without diminution and without any substantial time-lag to corporate bonds, municipal bonds, and most bank loan rates.

Conclusions: Implications for Theory and Policy

According to the empirical findings of this study, the long rate, the short rate, and the differential between them are all determined principally by the balance sheet of the monetary authorities, the legal reserve ratio, and the level of income. When the demand debt of the Federal Government is large relative to interest-bearing government debt and to the level of income, financial markets reflect the ease of monetary policy in low rates of interest for both short-term and long-term government securities and in a large excess of the long rate over the short rate. A smaller volume of demand debt, more interest-bearing debt or higher income raises the yields of all government securities, but has a particularly strong effect on the short rate. Thus, greater tightness reduces the excess of r over b. The rate differential fluctuates widely; it depends principally on the overall tightness of financial markets. This is shown schematically in Figure 2.

Figure 2



The greater sensitivity of b to the degree of tightness makes (r-b) dependent on the overall state of financial markets. If monetary conditions are sufficiently stringent, the bill rate is estimated to lie above the long rate. To account for the much greater volatility and sensitivity of the short rate, one must invoke inelastic expectations concerning future rates. If any change in the short rate altered expected future short rates by an equal amount, there could scarcely be a consistently smaller change in the long rate. The expected returns from longs and shorts would be kept in equilibrium only by an equally large change in the long rate. If, however, there are inelastic expectations, expected short rates through the future are altered by only a fraction of the current change in the short rate, and then the long rate should display a smaller change. Yet the *a priori* case for inelastic expectations is not compelling.[11] Nor is there any means of obtaining direct evidence on this score. All one can say is that inelastic expectations would account satisfactorily for the greater volatility of the short rate and they are the only basis of an adequate explanation. Culbertson has advanced an interesting alternative non-expectational explanation.[12] He argues that short rates may be more volatile because the volume of outstanding private short-term debt declines by a far greater proportion in a recession than does long-term debt. Hence, if many investors have strong preferences for holding short-term claims, they will accept much smaller returns on those short assets which are available. Because no adequate quarterly series of private debts by maturity category could be assembled, no direct test of the Culbertson thesis was made in this study. But Culbertson's emphasis on relative supplies of long and short private debt seems inconsistent with the small significance that relative supplies of long and short public debt had in my findings. Furthermore, Culbertson's explanation would not account for the greater sensitivity of b to changes in the volume of Federal demand debt. In my judgment, the explanation must rest on inelastic expectations of future interest rates.

The insensitivity of the rate differential to relative supplies of longs and shorts suggests that the expectation curve shown back in Figure 1 should be drawn flat. Investors cannot differ greatly in their best guesses about future long rates, for, if they did, relative supplies would play a greater role. Furthermore, one can infer that, to a substantial group of investors, bills and bonds are very close substitutes. This group presumably does not have a strong intrinsic preference for shorts versus longs and is willing to alter the maturity composition of portfolios in response to small changes in the yield differential, given the state of market expectations. I cannot identify this important group of arbitragers. This is one of the many areas where my results need to be investigated and appraised at a micro-economic level.

The slight significance attributed to relative supplies suggests that changes in the maturity structure of Federal debt will not have dramatic effects on the rate structure. The managers of the debt will reduce $(r-b)$ if they retire long bonds and issue bills, but the magnitude of the estimated effects is small. By the same reasoning, these findings imply that controversy over recent monetary policy has vastly exaggerated the importance of "bills only" as a determinant of the structure of interest rates. If the results of this paper are anywhere near the mark, how much the Fed buys (or sells) is far and away more important than what issue it chooses to deal in. This does not mean that "bills only" was wise policy, or that it was foolish policy. It does imply that it was not a vital policy. The furor over whether the Fed tied one hand behind its back in adopting "bills only" has obscured the crucial issue of how it used the hand that was unquestionably free.

These conclusions are fully consistent with the events of early 1961 when the abandonment of "bills only" had trivial effects on the rate structure.

Monetary policy can alter both long and short rates. While the redirection of a given open market action between longs and shorts will not accomplish much, large purchases (or sales) and changes in reserve requirements can have decisive effects. To alter the long rate substantially as an aid to stabilization policy, the Federal Reserve System must be prepared to take strong measures in varying the magnitude of its security holdings and the legal reserve ratio. Vigor is indispensable in the conduct of effective monetary policy.

FOOTNOTES

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2. John Maynard Keynes, The General Theory of Employment Interest and Money, (New York: Harcourt Brace, 1936), pp. 201-202.

3. James Tobin, "Liquidity Preference As Behavior Towards Risk," Review of Economic Studies, XXV (February 1958), 65-86.

4. See the following:

   A. J. Brown, "Interest, Prices, and the Demand Schedule for Idle Money," Oxford Economic Papers, (May 1939), 46-69;

   M. Kalecki, "The Short-term Rate of Interest and the Velocity of Cash Circulation," Review of Economics and Statistics, XXIII (May 1941), 97-99;

   James Tobin, "Liquidity Preference and Monetary Policy," Review of Economics and Statistics, XXIX (May 1947), 124-131;

   A. M. Khusro, "Investigation of Liquidity Preference," Yorkshire Bulletin of Economic and Social Research, IV (January 1952), 1-20;

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   Martin Bronfenbrenner and Thomas Mayer, "Liquidity Functions in the American Economy," Econometrica, XXVIII (October 1960), 810-834.

5. Friedrich A. Lutz, "The Structure of Interest Rates," Readings in the Theory of Income Distribution, (Philadelphia: Blakiston, 1946), pp. 499-504;

   J. R. Hicks, Value and Capital, Second Ed., (Oxford: Clarendon, 1953), pp. 141-145;

   Joseph W. Conard, An Introduction to the Theory of Interest, (Berkeley: University of California, 1959), pp. 290-301.

FOOTNOTES (Cont'd)

6. Joan Robinson, "The Rate of Interest," The Rate of Interest and Other Essays, (London: Macmillan, 1952), pp. 5-10.

7. James Tobin, "Asset Holdings and Spending Decisions," American Economic Review, XLII (May 1952), 110-120.

8. John G. Gurley, "Liquidity and Financial Institutions in the Postwar Economy," Study of Employment, Growth, and the Price Levels, prepared for the U.S. Congress, Joint Economic Committee, (Washington: U.S. Government Printing Office, 1960).

9. Ibid., p. 3.

10. Council of Economic Advisers, "The American Economy in 1961: Problems and Policies," Hearings on the January 1961 Economic Report of the President, Joint Economic Committee, (Washington: U.S. Government Printing Office, 1961), pp. 327-329, 373-377.

11. See Hicks, op. cit., pp. 262, 281.

12. John M. Culbertson, "The Term Structure of Interest Rates," Quarterly Journal of Economics, LXXI (November 1957), 485-517.

Table A-1. YIELDS ON FINANCIAL ASSETS

Yr.	Qtr.	(1) Short-term U.S.Bills	(2) Long-term U.S.Bonds	(3) High Grade Municipal Bonds	(4) Corporate AAA Bonds	(5) Corporate BAA Bonds	(6) Dividend Yields Preferred Stock	(7) Dividend Yields Common Stock	(8) Discount Rate
1946	1	.375%	2.09%	1.49%	2.47%	2.94%	3.45%	3.42%	.50%
	2	.375	2.16	1.55	2.49	3.03	3.46	3.41	1.00
	3	.375	2.28	1.75	2.58	3.10	3.57	4.24	1.00
	4	.375	2.24	1.97	2.61	3.17	3.76	4.41	1.00
1947	1	.376	2.19	2.02	2.55	3.15	3.72	4.80	1.00
	2	.376	2.22	1.92	2.55	3.21	3.76	5.09	1.00
	3	.791	2.24	1.92	2.61	3.23	3.72	5.21	1.00
	4	.948	2.39	2.35	2.86	3.52	4.07	5.41	1.00
1948	1	.997	2.44	2.52	2.83	3.53	4.12	5.58	1.25
	2	.998	2.41	2.26	2.76	3.34	4.04	5.30	1.25
	3	1.087	2.45	2.46	2.84	3.45	4.20	6.06	1.50
	4	1.153	2.44	2.26	2.79	3.53	4.15	6.78	1.50
1949	1	1.162	2.38	2.21	2.70	3.47	4.07	6.88	1.50
	2	1.158	2.38	2.28	2.71	3.47	3.98	7.22	1.50
	3	1.061	2.22	2.22	2.60	3.37	3.85	6.39	1.50
	4	1.102	2.19	2.13	2.58	3.31	3.88	6.58	1.50
1950	1	1.138	2.27	2.07	2.58	3.24	3.81	6.40	1.50
	2	1.174	2.33	2.09	2.62	3.28	3.85	6.35	1.50
	3	1.315	2.36	1.88	2.64	3.21	3.85	6.45	1.75
	4	1.367	2.39	1.77	2.67	3.20	3.89	6.89	1.75
1951	1	1.422	2.47	1.87	2.78	3.23	4.00	6.66	1.75
	2	1.499	2.65	2.22	2.94	3.49	4.17	6.79	1.75
	3	1.646	2.56	2.05	2.84	3.46	4.16	6.03	1.75
	4	1.731	2.70	2.10	3.01	3.61	4.28	5.56	1.75
1952	1	1.658	2.70	2.07	2.96	3.51	4.16	5.54	1.75
	2	1.700	2.61	2.10	2.94	3.50	4.04	5.48	1.75
	3	1.786	2.71	2.33	2.95	3.52	4.12	5.63	1.75
	4	2.126	2.75	2.40	2.97	3.51	4.11	5.14	1.75
1953	1	2.082	2.89	2.61	3.12	3.57	4.23	5.36	2.00
	2	2.231	3.13	2.99	3.40	3.86	4.47	5.60	2.00
	3	1.876	3.01	2.88	3.29	3.88	4.30	5.76	2.00
	4	1.630	2.79	2.59	3.13	3.74	4.20	5.54	2.00
1954	1	1.053	2.53	2.38	2.86	3.51	4.04	5.07	1.75
	2	.650	2.55	2.48	2.90	3.49	4.05	4.74	1.50
	3	1.007	2.52	2.29	2.89	3.47	3.98	4.31	1.50
	4	1.174	2.59	2.33	2.90	3.45	3.93	4.09	1.50
1955	1	1.335	2.78	2.45	3.02	3.48	4.01	4.18	1.50
	2	1.432	2.82	2.48	3.05	3.51	3.98	3.71	1.75
	3	2.086	2.92	2.63	3.13	3.59	4.06	3.76	2.25
	4	2.564	2.91	2.71	3.15	3.62	4.05	3.92	2.50
1956	1	2.310	2.93	2.69	3.10	3.60	4.01	3.68	2.50
	2	2.527	2.93	2.75	3.27	3.75	4.17	3.82	2.75
	3	2.850	3.21	3.07	3.56	4.07	4.39	4.04	3.00
	4	3.230	3.40	3.44	3.75	4.37	4.63	3.90	3.00
1957	1	3.140	3.26	3.32	3.66	4.43	4.46	4.16	3.00
	2	3.316	3.58	3.75	3.91	4.63	4.69	3.79	3.00
	3	3.578	3.66	3.90	4.12	4.93	4.79	4.27	3.50
	4	3.102	3.30	3.47	3.81	5.03	4.49	4.58	3.00
1958	1	1.354	3.25	3.45	3.63	4.68	4.42	4.35	2.25
	2	.881	3.19	3.26	3.57	4.55	4.28	3.98	1.75
	3	2.484	3.75	3.96	4.09	4.87	4.58	3.54	2.00
	4	2.814	3.80	3.84	4.08	4.85	4.63	3.17	2.50
1959	1	2.852	3.92	3.76	4.13	4.85	4.48	3.28	3.00
	2	3.247	4.09	4.04	4.16	5.04	4.79	3.09	3.50
	3	3.998	4.26	4.13	4.52	5.18	4.80	3.13	4.00
	4	4.572	4.27						4.00

Table A-1. (Continued)

		(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
		Prime Commercial	Bank Rates: 19 Cities Size of Loan (thousands of dollars)				Common Stock		
Yr.	Qtr.	Papers	1-10	10-100	100-200	200 and over	Price per Share	Earnings per Share	Earnings - Price Ratio
1946	1	.75%	4.10%	3.10%	2.30%	1.70%	$ 52.00	$ 1.32	2.54%
	2	.75	4.20	3.10	2.20	1.70	53.70	3.22	6.00
	3	.81	4.00	3.10	2.10	1.70	44.38	3.97	8.95
	4	1.00	4.40	3.20	2.10	1.80	46.03	5.61	12.19
1947	1	1.00	4.30	3.10	2.50	1.80	45.67	4.74	10.38
	2	1.00	4.10	3.10	2.60	1.80	45.93	4.93	10.73
	3	1.06	4.10	3.10	2.40	1.80	45.85	5.39	11.76
	4	1.19	4.10	3.20	2.50	1.80	47.34	6.22	13.13
1948	1	1.38	4.20	3.30	2.50	2.10	46.60	6.35	13.63
	2	1.38	4.49	3.47	2.70	2.16	50.77	6.85	13.49
	3	1.56	4.53	3.58	2.92	2.29	46.87	7.25	15.47
	4	1.56	4.50	3.58	2.97	2.34	46.33	7.65	16.51
1949	1	1.56	4.62	3.64	2.89	2.42	46.21	6.60	14.28
	2	1.56	4.63	3.70	3.04	2.44	43.48	6.00	13.80
	3	1.38	4.62	3.64	2.98	2.31	48.18	6.75	14.01
	4	1.33	4.53	3.61	2.98	2.35	52.28	7.05	13.49
1950	1	1.31	4.45	3.54	2.94	2.31	53.76	6.59	12.26
	2	1.31	4.50	3.65	2.94	2.39	55.56	8.66	15.59
	3	1.66	4.51	3.63	2.95	2.34	61.27	9.44	15.41
	4	1.72	4.60	3.37	3.10	2.57	64.46	9.08	14.09
1951	1	2.04	4.68	3.88	3.27	2.76	67.40	7.62	11.31
	2	2.31	4.73	3.93	3.32	2.81	66.75	7.42	11.12
	3	2.19	4.74	3.99	3.36	2.78	74.09	6.36	8.58
	4	2.30	4.78	4.05	3.49	3.03	74.24	8.09	10.90
1952	1	2.38	4.85	4.16	3.66	3.24	75.63	6.79	8.98
	2	2.31	4.90	4.21	3.72	3.29	77.01	6.61	8.58
	3	2.31	4.91	4.22	3.74	3.27	74.58	6.76	9.06
	4	2.31	4.88	4.21	3.77	3.29	80.89	8.54	10.56
1953	1	2.36	4.89	4.25	3.75	3.32	77.64	7.26	9.35
	2	2.75	4.98	4.38	3.91	3.53	74.28	7.76	10.45
	3	2.74	5.01	4.40	3.93	3.54	72.09	7.76	10.76
	4	2.25	4.98	4.39	3.96	3.57	77.06	8.08	10.48
1954	1	2.00	4.99	4.37	3.94	3.52	85.53	7.97	9.32
	2	1.56	4.97	4.35	3.89	3.37	94.34	8.49	9.00
	3	1.31	4.99	4.32	3.82	3.32	102.88	7.63	7.42
	4	1.31	4.92	4.29	3.84	3.31	115.64	9.43	8.15
1955	1	1.69	4.93	4.29	3.83	3.30	117.61	9.70	8.25
	2	2.00	4.92	4.29	3.83	3.30	133.41	10.80	8.10
	3	2.54	4.98	4.44	3.99	3.56	138.21	9.94	7.19
	4	2.99	5.01	4.52	4.14	3.75	145.67	11.60	7.96
1956	1	3.00	5.05	4.55	4.13	3.74	155.90	10.75	6.90
	2	3.38	5.18	4.69	4.34	3.97	151.11	10.50	6.95
	3	3.50	5.30	4.86	4.52	4.19	145.06	8.70	6.00
	4	3.63	5.32	4.90	4.63	4.20	150.74	11.45	7.60
1957	1	3.63	5.38	4.94	4.59	4.21	141.98	11.12	7.83
	2	3.79	5.37	4.94	4.61	4.23	155.23	10.65	6.86
	3	4.00	5.67	5.29	5.01	4.69	138.73	9.40	6.78
	4	3.81	5.66	5.29	5.01	4.71	128.38	9.90	7.71
1958	1	2.33	5.55	5.10	4.75	4.29	134.17	7.35	5.48
	2	1.54	5.45	4.88	4.40	3.95	144.74	7.30	5.04
	3	2.93	5.45	4.90	4.47	4.00	161.34	8.10	5.02
	4	3.33	5.49	5.06	4.68	4.33	177.75	10.70	6.02
1959	1	3.35	5.53	5.09	4.74	4.32	174.47	10.30	5.90
	2	3.83	5.68	5.33	5.06	4.72	187.48	11.60	6.19
	3	4.63	5.91	5.65	5.43	5.15	184.64	8.00	4.33

NOTES TO TABLE A-1: Based on descriptions of series in Business Statistics, 1959 ed., U. S. Dept. of Commerce.

Col. (1) Yield on short-term U. S. Government bills.
Source: Federal Reserve Bulletin

Yield on 3 month bills. Data for 1946 represent average rates on issues announced within the period; thereafter, on new bills issued within the period. Data are for last month of quarter.

Col. (2) Yield on long-term U. S. Government bonds.
Source: Federal Reserve Bulletin

The data are averages of daily figures computed, beginning with April 1953, on the basis of the closing bid quotations on the over-the-counter market; prior thereto, on the basis of the mean of the closing bid and asked quotations. The series includes bonds as follows: Beginning April 1953, fully taxable marketable bonds due or callable in 10 years and over; from April 1952 through March 1953, fully taxable marketable bonds due or first callable after 12 years; prior thereto, bonds due or first callable after 15 years. Data are for the last month of quarter.

Col. (3) Yield on High Grade Municipal Bonds.
Source: Standard and Poor's Corporation

The series is an arithmetic average of yields to maturity of 15 high-grade domestic municipal bonds. The yields are based on Wednesday closing prices and the monthly figures are averages of the four or five weekly figures for the month. Data are for the last month of the quarter.

Cols. (4) and (5) Yields on Corporate AAA and Corporate BAA bonds.
Source: Moody's Investors Service

These averages were set up in 1928 to include 10 bonds of each rating for each group (railroad, public utility, and industrial). There has not uniformly been a full set of 10 bonds in some rating classifications because of the limited number of suitable issues. On Sept. 1, 1958 there were 6 AAA and 10 BAA bonds in the railroad group; 10 AAA and 10 BAA bonds in the public utility group; and 7 AAA and 10 BAA bonds in the industrial group.

Occasional substitutions in the bond list have been made. Suitable adjustments (usually small) which are gradually amortized, are introduced to prevent such substitution from impairing the comparability of the series. No convertible or other unusual issues are included. The average maturity on September 1, 1958 was 25 years.

Averages are computed as follows: A daily yield based on the closing price for each individual bond is first computed and then unweighted arithmetic averages of these yields are compiled for the different rating classifications. The monthly series are averages of daily figures. Data are for the last month of the quarter.

NOTES TO TABLE A-1(Cont'd)

Col. (6) Dividend Yields on Preferred Stocks.
Source: Standard and Poor's Corporation

Yields are computed for each of 14 high grade non-callable issues (15 prior to April 1948), including public utility as well as industrial preferred stocks. The group yield is currently determined from the average of the 8 median yields (formerly 9). The indexes are based on one price weekly (as of Wednesday's close) with the monthly index computed from the average of the four or five weekly indexes of the month. Data are for last month of the quarter.

Cols. (7) (14) and (15) Dividend Yields, Price per Share and Earnings per Share of 125 industrial common stocks.
Source: Moody's Investors Service

Dividends are at annual rates (without adjustment for seasonal variation) and are determined at the end of each month on the basis of each company's most recent declaration. These dividends are multiplied by the number of each company's common shares outstanding and the products are added to obtain aggregate values which are divided by the total number of shares outstanding, free from the effects of stock splits and stock dividends, to obtain per share figures.

Individual stock prices at the end of each month are used as a basis for deriving per-share prices. Earnings are net after taxes and contingencies less preferred dividend requirements (whether actually paid or not). Data represent quarterly earnings -- partly estimated -- at annual rates. There is no adjustment for seasonal variation. The method of computing price per share is similar to the method of computing dividends per share described above.

Yields are obtained by dividing per-share dividends by per-share prices.

Yield and price data are for the last month of the quarter. Earnings data are quarterly totals at annual rates.

Col. (8) Discount Rate .
Source: Federal Reserve Bulletin

Data are discount rate in effect on last day of quarter.

NOTES TO TABLE A-1(Cont'd)

Col. (9) Interest Rate on Prime Commercial Paper 4-6 Months.
Source: Federal Reserve Bulletin

Beginning with 1951, the data represent averages of daily quotations; prior thereto the figures are averages of weekly prevailing rates.

Data are for the last month of the quarter.

Cols. (10), (11), (12) and (13) Bank Rates on Short-term Business Loans in 19 Large Cities.
Source: Federal Reserve Bulletin

Data represent averages of rates charged on loans maturing in 1 year or less to business in the specified cities.

Since June 1948 data were reported on forms that call for the amount of the loans and the interest rate actually charged for each new loan or renewal made in the first half of March, June, September and December by a selected sample of banks (mainly large ones) in 19 leading cities.

Col. (16) Col. 15 ÷ Col. 14.

Table A-2. MONEY SUPPLY

	Qtr.	(1) Member Bank Reserves	(2) Other Deposits	(3) Currency Outside Gov't	(4) Federal Demand Debt	(5) Required Reserve Ratio	(6) Excess Reserves	(7) Member Bank Borrowings	(8) Currency Outside Banks	(9) Demand Deposits Adjusted
	4	15,915	1,308	28,515	45,738	.183	1,364	334	26.5	75.9
	1	14,853	1,212	27,879	43,944	.183	971	683	26.1	75.0
	2	16,123	1,250	28,245	45,618	.183	867	119	26.5	79.5
	3	15,910	1,069	28,507	45,486	.183	824	141	26.5	81.4
	4	16,139	822	28,952	45,913	.183	872	193	26.7	83.3
47	1	15,264	971	28,230	44,465	.183	739	153	26.1	80.4
	2	16,112	881	28,297	45,290	.183	741	114	26.0	82.5
	3	16,784	842	28,567	46,193	.183	884	98	26.3	84.1
	4	17,899	961	28,868	47,728	.183	939	262	26.5	87.1
48	1	16,639	1,000	27,781	45,420	.190	732	304	25.6	81.5
	2	17,389	859	27,903	46,151	.196	765	97	25.6	82.7
	3	19,986	843	28,118	48,947	.216	768	328	25.7	83.9
	4	20,479	1,189	28,224	49,892	.216	782	139	25.7	85.8
49	1	19,118	1,154	27,439	47,711	.216	579	208	25.1	81.1
	2	17,867	940	27,493	46,300	.202	616	130	25.0	82.2
	3	15,947	1,050	27,412	44,409	.176	685	192	24.9	83.1
	4	16,568	1,517	27,600	45,685	.176	773	52	25.0	86.7
50	1	15,657	1,133	27,042	43,832	.176	600	253	24.6	83.2
	2	15,934	1,431	27,156	44,521	.176	640	51	24.6	85.4
	3	16,709	1,374	27,161	45,244	.176	603	140	24.5	88.0
	4	17,681	1,460	27,741	46,882	.176	851	283	25.0	93.2
51	1	19,014	1,323	27,119	47,456	.196	524	374	24.4	89.0
	2	19,020	1,261	27,809	48,090	.196	561	211	25.0	89.5
	3	19,391	1,127	28,288	48,806	.196	669	195	25.4	92.0
	4	20,056	889	29,206	50,151	.196	815	551	26.3	98.1
	1	19,733	845	28,473	49,051	.196	1,130	138	25.7	94.8
	2	19,381	845	29,026	49,252	.196	700	189	26.0	95.8
	3	20,066	881	29,419	50,366	.196	1,094	282	26.6	96.4
	4	19,950	1,005	30,433	51,388	.196	858	1,703	27.5	101.5
53	1	19,322	878	29,754	49,954	.196	605	924	26.9	97.4
	2	19,561	703	30,125	50,389	.196	1,154	281	27.1	97.2
	3	19,309	864	30,275	50,448	.183	564	318	27.5	97.7
	4	20,160	916	30,781	51,857	.183	813	211	27.8	103.3
54	1	19,194	857	29,707	49,758	.183	732	175	26.9	96.7
	2	19,011	922	29,922	49,855	.180	839	138	27.1	98.1
	3	18,676	883	29,985	49,544	.170	588	78	26.9	101.2
	4	18,876	871	30,509	50,256	.170	621	243	27.4	106.7
55	1	18,283	798	29,800	48,881	.170	490	652	26.7	102.4
	2	18,066	822	30,229	49,117	.170	490	402	27.1	103.2
	3	18,423	764	30,422	49,609	.170	483	888	27.2	104.9
	4	19,005	956	31,158	51,119	.170	683	753	27.9	109.8
56	1	18,799	748	30,339	49,886	.170	572	1,196	27.2	104.4
	2	18,443	977	30,715	50,135	.170	595	756	27.5	105.0
	3	18,831	610	30,768	50,209	.170	503	705	27.4	105.4
	4	19,059	758	31,790	51,607	.170	704	641	28.5	110.8
57	1	18,629	615	30,585	49,829	.170	609	819	27.4	105.2
	2	18,399	757	31,082	50,238	.170	546	1,003	27.8	105.6
	3	19,034	598	31,073	50,705	.170	547	1,100	27.8	105.5
	4	18,532	602	31,834	50,968	.170	652	781	28.9	109.1
58	1	18,532	644	30,666	49,842	.163	688	164	27.4	104.6
	2	18,784	689	31,172	50,645	.154	668	99	27.8	105.7
	3	18,147	653	31,245	50,045	.154	593	433	27.9	108.1
	4	18,504	663	32,193	51,360	.154	656	790	28.7	115.5
59	1	18,192	695	31,250	50,137	.154	458	600	27.9	110.3
	2	17,640	657	31,914	50,211	.154	457	876	28.3	110.7
	3	17,760	760	31,848	50,368	.154	220	721	28.5	111.4
	4	18,174	1,039	32,591	51,804	.154	464	928	29.4	115.4

NOTES TO TABLE A-2:

Source: All data are taken from the Federal Reserve Bulletin

Col. (1) Member bank reserves (millions of dollars):

"Statement of Condition of the Federal Reserve Banks." Data as of the end of the quarter.

Col. (2) Other deposits in Federal Reserve Banks (millions of dollars):

Sum of "Foreign deposits" and "Other deposits."

Col. (3) Currency outside the government (millions of dollars):

Currency in circulation outside the Treasury and Federal Reserve Banks. Data as of the end of the quarter.

Col. (4) Federal Demand Debt (millions of dollars):

Sum of Cols. (1) + (2) + (3).

Col. (5) Reserve requirements index:

Weighted average of reserve requirements for central reserve city banks, reserve city banks, and country banks on net demand deposits at the end of the quarter. The weights are .32 (central reserve city banks), .40 (reserve city banks) and .28 (country banks).

Col. (6) Excess reserves (millions of dollars)

Excess reserves of all member banks, average of daily figures for last week of the quarter.

Col. (7) Borrowings (millions of dollars)

Borrowings at Federal Reserve Banks of all member banks, average of daily figures for last week in last month of the quarter. Figures for the fourth quarter of 1945 is monthly average.

Col. (8) Currency outside banks (billions of dollars, not seasonally adjusted)

Data as of last Wednesday of quarter.

Col. (9) Demand deposits adjusted (billions of dollars, not seasonally adjusted)

Data as of last Wednesday of quarter.

Table A-3. FEDERAL DEBT, INCOME, AND WEALTH

	Qtr.	(1) S	(2) I	(3) S + I	(4) L	(5) T	(6) Y_g	(7) Gov't. Pay-rolls	(8) Y	(9) Net National Wealth	(10) W
	1	46,077	16,259	62,336	104,975	191.6	198.0	24.9	173.1	584.4	740.1
	2	39,187	18,320	57,507	101,413	189.8	206.3	20.2	186.1	598.3	749.3
	3	38,025	12,604	50,629	103,037	188.3	217.1	18.8	198.3	649.8	796.1
	4	31,715	16,635	48,350	98,496	187.8	221.2	18.5	202.7	700.9	842.4
'47	1	28,277	18,591	46,868	96,528	187.2	226.0	17.9	208.1	736.4	872.8
	2	28,295	15,557	43,852	97,441	184.2	230.0	17.4	212.6	758.9	890.2
	3	30,958	17,689	48,647	92,456	188.9	235.6	16.9	218.7	807.7	933.9
	4	27,886	21,615	49,501	88,310	187.5	245.1	17.4	227.7	843.5	964.5
'48	1	33,701	15,667	49,368	85,392	184.5	249.5	17.7	231.8	867.4	985.1
	2	32,981	14,995	47,976	85,474	181.5	257.7	18.1	239.6	888.3	1002.7
	3	28,935	25,255	54,190	75,108	189.4	264.0	19.2	244.8	914.8	1025.9
	4	30,382	27,340	57,722	70,825	190.7	265.9	20.0	245.9	928.4	1036.3
'49	1	28,215	29,170	57,385	70,826	189.3	259.8	20.1	239.7	935.7	1044.9
	2	32,860	31,499	64,359	65,945	198.6	256.4	20.3	236.1	934.1	1044.7
	3	35,747	30,450	66,197	65,938	195.6	258.8	20.6	238.2	923.5	1035.4
	4	36,709	36,669	73,378	57,608	209.6	257.0	21.0	236.0	932.0	1045.3
'50	1	32,792	40,323	73,115	58,263	206.6	265.8	21.0	244.8	957.4	1067.6
	2	25,362	49,207	74,569	56,937	208.5	274.4	21.2	253.2	981.9	1089.0
	3	33,940	37,668	71,608	57,106	207.2	293.2	22.4	270.8	1034.8	1138.8
	4	30,379	40,420	70,799	55,568	205.4	304.3	24.3	280.0	1067.1	1168.1
'51	1	27,348	41,358	68,706	53,743	202.4	317.8	26.4	291.4	1105.7	1204.8
	2	29,387	40,407	69,794	44,462	186.2	326.4	28.2	298.2	1133.6	1230.7
	3	30,592	39,667	70,259	44,437	183.2	333.8	30.2	303.6	1147.4	1242.6
	4	33,692	38,563	72,255	44,381	180.2	338.1	30.8	307.3	1164.6	1257.8
'52	1	33,985	37,640	71,625	44,870	175.5	341.0	32.1	308.9	1184.5	1277.1
	2	33,339	37,649	70,988	44,085	171.2	341.3	32.9	308.4	1199.6	1291.6
	3	39,108	30,450	69,558	48,125	160.3	347.0	33.4	313.6	1204.6	1296.0
	4	42,071	30,479	72,550	48,052	157.2	358.6	33.6	325.0	1214.1	1305.0
'53	1	44,035	27,532	71,567	47,177	155.8	364.5	33.7	330.8	1227.6	1319.7
	2	48,921	25,726	74,647	44,482	167.2	368.8	34.0	334.8	1242.6	1335.9
	3	50,735	28,864	79,599	44,462	164.2	367.1	33.9	333.2	1253.6	1348.1
	4	56,088	23,020	79,108	46,056	159.5	361.0	33.9	327.1	1259.3	1355.1
'54	1	48,392	16,902	65,294	56,519	146.3	360.0	34.0	326.0	1267.8	1363.5
	2	43,736	21,453	65,189	56,583	143.3	358.9	34.3	324.6	1280.8	1376.4
	3	44,829	25,783	70,612	55,603	142.4	362.0	34.6	327.4	1291.2	1386.7
	4	43,342	26,382	69,724	59,694	138.8	370.8	34.8	336.0	1306.3	1401.7
'55	1	34,399	30,182	64,581	61,464	145.6	384.3	35.1	349.2	1325.9	1419.7
	2	32,224	34,216	66,440	61,436	142.6	393.0	36.1	356.9	1349.7	1441.9
	3	39,335	30,382	69,717	62,175	143.5	403.4	36.2	367.2	1371.9	1462.5
	4	39,467	36,320	75,787	58,443	145.4	408.9	36.6	372.3	1401.9	1491.0
'56	1	37,329	35,481	72,810	58,450	142.4	410.6	37.1	373.5	1432.4	1517.5
	2	37,545	30,410	67,955	58,349	139.4	415.0	37.7	377.3	1464.3	1545.4
	3	42,814	28,874	71,688	56,111	139.2	421.0	38.5	382.5	1488.2	1565.3
	4	45,516	39,940	85,456	44,998	153.3	430.0	38.9	391.1	1518.2	1591.3
'57	1	45,700	40,875	86,575	44,975	150.3	437.7	39.4	398.3	1546.5	1617.0
	2	49,649	37,293	87,942	40,237	157.4	442.4	39.9	402.5	1584.0	1651.9
	3	50,395	41,843	92,238	40,211	154.1	447.8	40.7	407.1	1610.3	1675.6
	4	51,705	43,334	95,039	38,576	159.0	442.3	40.7	401.6	1629.6	1692.3
'58	1	50,045	38,276	88,321	44,420	155.7	431.0	41.8	389.2	1639.6	1702.5
	2	43,873	38,492	82,365	52,226	148.0	434.5	42.9	391.6	1658.3	1721.4
	3	45,584	45,482	91,066	45,016	157.4	444.0	44.0	400.0	1667.1	1730.4
	4	50,900	46,741	97,641	44,977	154.4	457.1	44.3	412.8	1702.3	1765.9
'59	1	47,168	54,920	102,088	41,843	160.6	470.4	44.6	425.8	1734.4	1798.6
	2	51,341	51,253	102,594	42,389	157.2	484.8	45.4	439.4	1766.1	1830.9
	3	54,194	52,917	107,111	42,345	157.2	478.6	46.1	432.5	1782.6	1848.0
	4	58,765	53,176	111,941	42,285	150.5	483.5	46.7	436.8	1793.8	1859.9

NOTES TO TABLE A-3:

Cols. (1) - (4) U.S. Government Debt (millions of dollars).

All marketable and convertible direct public securities, excluding those held by Federal agencies and trust funds and the Federal Reserve Banks. Classified according to maturity.

Sources: Treasury Bulletin 1946 through first quarter of 1953; Federal Reserve Bulletin second quarter of 1953 through fourth quarter of 1959. Beginning with the September 1953 issue of the Federal Reserve Bulletin, the basis for classifying bonds with optional call dates was changed from a first call to a final maturity date.

Col. (1) S: Short term U. S. Government Debt -- securities maturing within one year.

Col. (2) I: Intermediate term U. S. Government Debt -- securities maturing from one to five years.

Col. (3)S+I: Sum of Cols. (1) and (2).

Col. (4) L: Long term U. S. Government Debt -- securities maturing in five years or more.

Col. (5) T: Maturity of U. S. Government Debt due in five years or more (in months).
Source: Calculations from Federal Reserve Bulletin

Maturity is a weighted average of the maturity of marketable and convertible direct public securities outstanding at the end of each quarter which are due in five years or more.

Col. (6) Y_g: Gross National Product, seasonally adjusted quarterly totals at annual rates, current prices, (billions of dollars).

Source: U. S. Income and Output (1946-1955) Survey of Current Business, July 1959 and May 1960 (1956-1959)

Col. (7) Gov't. Payrolls: Government Civilian and Military Salaries and Wages, seasonally adjusted quarterly totals at annual rates, current prices (billions of dollars).

Source: Ibid.

Col. (8) Y: Gross Private Product: Col. (6) less Col. (7).

NOTES TO TABLE A-3 (Cont'd)

Col. (9) Net National Wealth: U. S. Net National Wealth (Goldsmith), current prices (billions of dollars).

The quarterly series was constructed by interpolating a quarterly series on net private domestic investment constructed from U. S. Department of Commerce data into annual estimates of total national wealth excluding military wealth constructed by Goldsmith. Goldsmith's estimates of wealth from 1945 to 1958 were taken from an unpublished table. The estimates pertain to the end of the year. The figures for wealth in 1959 were extrapolated according to a formula given below.

The first step in the interpolation was to compute quarterly net private domestic investment in constant dollars. To do this, it was necessary to construct a constant dollars depreciation series to deduct from gross private domestic investment in constant dollars. The depreciation series was constructed by deflating capital consumption allowances by a weighted average of the new construction and producers durable equipment implicit price deflators. A weight of .6 was assigned to the new construction deflator, and a weight of .4 was assigned to the producers durable equipment deflator.

The second step was to express net investment in each quarter as a percent of net investment during the year; e.g., investment in the first quarter of 1947 was divided by net investment in 1947.

The third step was to apply the percentage of annual investment per quarter to Goldsmith's estimates of the annual increment to wealth in constant dollars. For example, Commerce data shows that 25% of net investment in 1947 occurred in the first quarter. Therefore it is estimated that 25% of the increment in real Goldsmith wealth between December 1946 and December 1947 occurred in the first quarter of 1947.

The final step was to convert the quarterly wealth series from constant dollars to current dollars. To do this it was necessary to construct a quarterly wealth deflator. This was done by taking the first difference of the capital consumption allowance deflator; expressing the first difference as a percent of the change in the deflator over one year; computing a Goldsmith wealth deflator (wealth in current dollars divided by wealth in constant dollars); taking the first difference of the Goldsmith wealth deflator (annual increment in the price of wealth); and applying the percentage of annual increase in the capital consumption allowance deflator per quarter to the annual increase in the Goldsmith wealth deflator. For 1959 the Goldsmith wealth deflator was carried forward by the percentage change -- quarter to quarter -- of the capital consumption allowance deflator.

NOTES TO TABLE A-3 (Cont'd)

Col. (10) W: U. S. Net Private Wealth in current prices (billions of dollars).

Private wealth is defined as national wealth minus the net worth of the public sector. The quarterly series on private wealth was constructed by computing an annual (fourth quarter) series and making a straight line interpolation of annual increments in the net worth of the public sector.

Net worth of the public sector is equal to:

Net public debt
plus Gold certificates
plus Treasury currency
less U. S. deposits in Federal Reserve and commercial banks.
less Public assets.

Sources: Net public debt; Survey of Current Business, July 1960.
Gold certificates and Treasury currency, Federal Reserve Bulletin.
U. S. deposits, President's Economic Report for 1960, Table D-40.
Public Assets, Goldsmith, unpublished table; sum of public civilian structures, public producers durables, public land and monetary metals.