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Weighting Multiple Monetary Aggregate Targets

By Bryon Higgins

The view that monetary and financial aggregates are important determinants of economic performance is widely accepted by policymakers, economists, and other analysts. For this reason, there is general agreement that the Federal Reserve System ought to use monetary policy instruments to influence the behavior of these aggregates. There is no consensus, though, regarding which of the aggregates should be emphasized in the conduct of monetary policy. The Federal Reserve has not selected a single aggregate; instead, policy actions are designed to influence the behavior of several monetary aggregates. This article analyzes conditions in which it is desirable to establish target growth rates for more than one monetary aggregate and discusses the implications of following such a practice.

The first section provides a brief description of the current procedure used by the Federal Reserve to implement monetary policy. The second section discusses one possible reason for establishing multiple monetary targets. It is demonstrated that uncertainty about which monetary aggregate is most useful as a guide to the conduct of monetary policy would justify the use of multiple targets. A weighting procedure for establishing consistent monetary targets that reflects this type of uncertainty is then discussed. In the third section, an alternative reason for the use of multiple targets is analyzed. It is shown that targets for more than one monetary aggregate would be appropriate if different types of assets have different effects on the economy. A weighting procedure for setting consistent targets that reflects the relative magnitude of the economic impact of different types of assets. is also analyzed. The article concludes by contrasting the policy implications of the alternative reasons for establishing multiple targets and compares the policy procedures implied by the use of multiple targets to the current method of implementing monetary policy.

THE CURRENT PROCEDURE FOR IMPLEMENTING MONETARY POLICY

In recent years, the Federal Open Market Committee (FOMC) has progressively emphasized the role of monetary aggregates in the implementation of monetary policy. Since early 1975, the FOMC has each quarter established annual growth ranges for M1, M2, and M3 that are believed to be consistent with the economic goals of the Federal Reserve System.[1]

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1 M1 is composed of currency and demand deposits held by the nonbank public. M2 includes time deposits at commercial banks (other than large negotiable certificates of deposit at weekly reporting banks) in addition to the M1 assets. M3 includes M2 assets plus time deposits at thrift institutions.

At the October 1977 FOMC meeting, for example, growth ranges of 4 to 6% per cent for M1, 6% to 9 per cent for M2, and 8 to 10% per cent for M3 were established for the period from the third quarter of 1977 to the third quarter of 1978.

The FOMC attempts to achieve its long-term monetary objectives by providing for financial conditions that keep the monetary aggregates on paths consistent with the long-run growth ranges. The FOMC meets once each month to determine the monetary policy most conducive to the attainment of its long-run monetary objectives. The desired policy is conveyed to the manager of the System open market account in the policy directive issued after each FOMC meeting.

The policy directive as currently formulated includes 2-month growth ranges for M1 and M2 thought to be reasonably consistent with the long-run growth ranges. A Federal funds rate objective is also stipulated in the directive. The Federal funds rate is the primary operational variable used by the account manager to influence monetary growth. Other things being equal, there tends to be an inverse relation between monetary growth rates and the Federal funds rate. The Federal funds rate objective described in the policy directive is the FOMC's estimate of the rate necessary to achieve the desired short-run monetary growth rates.

The Federal funds rate objective contained in the directive sometimes proves to be inconsistent with the short-run M1 and M2 growth ranges, however. New information on the monetary aggregates becomes available to the account manager every week. If the new data indicate that the initial estimates of monetary growth rates resulting from the Federal funds rate specified in the policy directive were mistaken, the account manager must determine how to adjust the funds rate to comply with the wishes of the FOMC. The policy directive contains a rule for adjusting the Federal funds rate within a specified range in response to incoming. 'monetary data. The account manager is authorized to increase the funds rate when monetary growth is significantly above the desired growth and to lower the funds rate when monetary growth is significantly below the desired growth.

Deviations from desired M1 and M2 growth rates are not always of the same magnitude nor in the same direction. The account manager, therefore, must know the relative priorities assigned to attainment of the desired monetary growth rates in order to determine the appropriate policy response. For the past two years, the FOMC has instructed the account manager to give equal weight to M1 and M2 in determining the Federal funds rate that is consistent with policy objectives.

In summary, the Federal Reserve takes account of the behavior of several monetary aggregates in formulating monetary policy, with M1 and M2 receiving the greatest attention. The behavior of monetary aggregates is influenced by taking policy actions to keep the growth rates of M1 and M2 within specified ranges. Although these growth rate ranges are frequently referred to as monetary targets by policy observers, the current procedure for implementing monetary policy is not strictly equivalent to the use of monetary aggregate targets.[2] In precise terms, a policy target is an economic variable whose value is kept on some predetermined path regardless of the behavior of other economic variables. The M1 and M2 growth ranges are not policy targets by this

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2 For a thorough discussion of the current procedure for implementing monetary policy and its resemblance to the use of intermediate targets, see Benjamin M. Friedman, "Targets, Instruments, and Indicators of Monetary Policy," *Journal of Monetary Economics*. Vol. 1, No. 4 (1975).

definition because a number of nonmonetary factors contribute to the Federal Reserve's policy decisions.

Current procedures for implementing monetary policy do resemble the use of monetary targets in many respects, however. Accordingly, the theoretical analysis in the remainder of this article proceeds as if policy were conducted in a manner that conforms precisely to the use of monetary targets, even though the theoretical discussion is not directly applicable to the way the Federal Reserve conducts monetary policy at the present time. Although **M1** and **M2** are frequently thought of as mutually exclusive policy targets, there are a number of reasons for using both in formulating monetary policy. Two alternative reasons for establishing both **M1** and **M2** targets are discussed below. It is then shown how the **M1** and **M2** target growth rates most conducive to attainment of ultimate policy goals might be determined in each case if the Federal Reserve were to adopt procedures that are equivalent to the use of **M1** and **M2** targets as the sole determinants of short-run policy decisions.

ESTABLISHING MULTIPLE TARGETS BECAUSE OF UNCERTAINTY

It might be desirable to establish target growth rates for both **M1** and **M2** if there is uncertainty about which aggregate is the most effective policy guide. For a monetary aggregate to serve as an effective guide for the conduct of monetary policy, it must be closely related to ultimate policy goals. A good summary measure of the numerous goals of monetary policy is the rate of growth of current dollar or nominal gross national product **(GNP).** Achieving a **GNP** growth rate that is consistent with high employment and reasonable price stability may be considered to be the primary goal of monetary policy. For a monetary aggregate to be a useful policy guide, therefore, it must be so closely related to **GNP** that achieving a certain growth rate for the aggregate can be relied upon to result in the desired growth in **GNP.**

A Method for Determining Desirable M1 and M2 Growth Rates

One commonly used method of determining the closeness of the relation between **GNP** and **M1** or **M2** is to estimate empirically the parameters of reduced form equations that include either **M1** or **M2** as an independent variable. A reduced form **GNP** equation directly measures the relation between **GNP** and one or more policy-related variables. A highly simplified reduced form equation with **M1** as an independent variable is:

$$(1) \qquad \dot{GNP} = a_0 + a_1 \dot{M1},$$

where $\dot{GNP}$ is the growth rate of nominal **GNP;** $\dot{M1}$ is the growth rate of **M1,** and a_0 and a_1 are the parameters.

Numerical estimates of the parameters of the reduced form **GNP/M1** equation can be obtained using multiple regression analysis. Having obtained the parameter estimates, the reduced form **equation can** be used to predict the **GNP** growth rate resulting from any given **M1** growth rate. Comparison of actual **GNP** growth rates with those predicted by the equation indicates the closeness of the relation between **M1** and **GNP.** The lower are the magnitude and variability of differences between predicted and actual **GNP** growth rates, the closer is the relation between **M1** and **GNP.** A similar procedure can be used to determine the closeness of the relation between **M2** and **GNP.**

A primary reason why there is uncertainty about whether M1 or M2 is the better policy guide is that studies using the reduced form approach have been unable to demonstrate conclusively that either M1 or M2 is more closely related to GNP in all circumstances.[3] In some time periods, M1 appears to have been more closely related to GNP, while in other periods, M2 appears to have been more closely related to GNP. Thus, the question of whether M1 or M2 is the more useful policy guide remains unresolved. This uncertainty regarding which monetary aggregate is the more effective policy guide provides one possible reason for establishing target growth rates for both M1 and M2.

The reduced form approach can also be used to derive target growth rates for M1 and M2. To illustrate, assume that the desired growth rate of GNP is 12 per cent and that the following estimates of the relations between GNP and M1 and M2 growth rates are relied on in setting targets:[4]

$$(2) \qquad \dot{GNP} = 6.0 + 1.0\ \dot{M1}$$

and

$$(3) \qquad \dot{GNP} = 7.0 + 0.5\ \dot{M2}.$$

[3] Recent estimates of reduced form relations can be found in Michael Hamburger, "Behavior of the Money Stock: Is There a Puzzle?" Journal of Monetary Economics, Vol. 3, No. 3 (1977).

[4] The reduced form relations used throughout this article include only the current value of a monetary aggregate as an independent variable. Most reduced form equations are substantially more complex than this. Regardless of how complex the reduced form equation that is estimated, however, it is always possible to derive a simple relation between the current growth rate of a monetary aggregate and the current growth rate of GNP so long as the values of other explanatory variables are known. Thus, the simple relations assumed in this article involve no loss in generality; the basic procedure analyzed in the article could be used regardless of the complexity of the estimated reduced form equation.

The relation in (2) indicates that a 6 per cent M1 growth rate is required to achieve the desired 12 per cent growth rate in GNP (i.e., 12 = 6.0 + (1.0) (6)). Similarly, the relation in (3) indicates that a 10 per cent M2 growth rate is required (i.e., 12 = 7.0 + (0.5) (10)). These estimates imply that a monetary policy based on target growth rates of 6 per cent for M1 and 10 per cent for M2 would be most conducive to attainment of ultimate policy objectives.

Choosing Targets When M1 and M2 Growth Rates are Interdependent

The analysis of the procedure for establishing M1 and M2 targets outlined above assumed that monetary targets could be chosen independently. This assumption is unwarranted when M1 and M2 growth rates are interrelated, that is, when a particular growth rate in one monetary aggregate tends to be accompanied by a certain growth rate in the other. In these circumstances, the procedure for establishing monetary targets must be amended to allow for the interdependence between M1 and M2 growth rates.

Interdependence between M1 and M2 growth rates arises to the extent that there are an insufficient number of policy instruments available for use in achieving short-run monetary objectives. There are a number of monetary policy instruments, such as reserve requirements and open market operations, that are controlled by the Federal Reserve. Each of these instruments has a somewhat different impact on M1 growth than on M2 growth. It would be possible for the Federal Reserve to achieve independently chosen M1 and M2 growth rates if all of these policy instruments were effective tools of short-run monetary control. Many of the policy instruments, however, are not effective for achieving

short-run monetary objectives. It may be impractical, for instance, to vary reserve requirements on member bank deposits frequently enough for changes in reserve requirements to contribute to short-run monetary control. The adjustment costs incurred by banks in responding to frequent changes in reserve requirements may be considered too high a price to pay for marginal improvement in achieving short-run monetary objectives. Due to the limited short-run effectiveness of many of the policy instruments, the Federal Reserve has relied primarily on open market operations to achieve desired short-run monetary growth rates.

The relative growth rates of M1 and M2 that result from a particular open market operation depend on choices of commercial banks and the public that are largely beyond the control of policy actions. For this reason, open market operations designed to affect the growth rate of one monetary aggregate necessarily affect the growth rate of the other. Thus, there results an interdependence between M1 and M2 growth rates.

When the reason for establishing both M1 and M2 targets is uncertainty as to which is more closely related to GNP, the interdependence between monetary growth rates necessitates a compromise between the M1 and M2 target growth rates that would be established if targets could be chosen independently. The need to compromise can be demonstrated by reference to the example discussed previously. As was demonstrated, the relation in (2) indicates that a 6 per cent M1 growth rate is required to achieve the desired 12 per cent growth rate in GNP, and the relation in (3) indicates that a 10 per cent M2 growth rate is required to achieve the desired GNP growth rate. M1 growth of 6 per cent may not be consistent with M2 growth of 10 per cent, however. Assume, for instance, that the estimated relation between M1 and M2 growth rates is:

$$\dot{M}2 = 4.5 + 1.5\ \dot{M}1. \tag{4}$$

This relation indicates that open market operations necessary to attain a 6 per cent growth rate for M1 would inevitably lead to an M2 growth rate of 13.5 per cent ($\dot{M}2 = 4.5 + 1.5\ \dot{M}1 = 4.5 + (1.5)(6) = 13.5$). Similarly, open market operations necessary to attain a 10 per cent M2 growth rate would yield M1 growth of less than 4 per cent. Since it is impossible to attain the desired combination of M1 and M2 growth rates that are derived from the reduced form relations between GNP and M1 or M2, setting target growth rates for M1 and M2 by using only the reduced form equations would result in inconsistent short-run monetary objectives.

Weighting M1 and M2 to Ensure Consistent Targets

The inconsistency between desired M1 and M2 growth rates may be resolved by using a weighting scheme that reflects the relative importance attached to M1 and M2 as policy guides. Resolution of the inconsistency necessitates a compromise in one or both of the desired monetary growth rates, however. Suppose, for example, the weighting scheme indicates that M1 is considered to be very important and that M2 is believed to have little, if any, significance. In this case, the M1 target would be set equal to the M1 growth rate believed necessary to achieve ultimate policy goals. The corresponding M2 target would necessarily be the M2 growth rate that would result from policy actions necessary to achieve the M1 target. In terms of the previous example, total reliance on M1 as a policy guide would result in an M1 target growth rate of 6

per cent and an M2 target growth rate of 13.5 per cent.[5]

A monetary policy based on exclusive use of M1 as a policy guide would result in attainment of ultimate policy goals if the relation between M1 and GNP proves to be valid in the period for which monetary targets are established. If (2) proves to be an accurate. representation of the relation between GNP and M2 in the period for which targets are established, achieving the 6 per cent target growth rate in M1 would lead to the desired 12 per cent growth in GNP. However, large policy errors would result if the confidence in M1 as a policy guide proves to be unfounded and, instead, the relation between GNP and M2 is valid. The 13.5 per cent growth in M2 that necessarily accompanies M1 growth of 6 per cent would, according to the estimated relation between M2 and GNP in (3), result in GNP growth of 13.75 per cent, substantially above the desired 12 per cent GNP growth rate.

Similarly, exclusive' reliance on M2 as a policy guide would lead to the desired growth in GNP if the relation between M2 and GNP proves to be valid. If the relation between M2 and GNP in (3) accurately represents the influence of policy actions on the economy, achieving a 10 per cent growth rate in M2 would result in the desired 12 per cent growth in GNP. If the relation between M1 and GNP proves. to be accurate, however, large policy errors would result from exclusive reliance :on M2 as .a policy guide. The 3.67 per cent M1 growth rate that necessarily accompanies M2 growth of 10 per cent would lead to GNP growth of only 9.67 per cent according to the relation in (2), well below the desired GNP growth rate of 12 per cent. Thus, exclusive reliance on either M1 or M2 would lead to substantial deviation from the desired GNP growth rate if the confidence in the relation between GNP and the aggregate chosen as a policy guide proves to be unfounded.

As an alternative to exclusive reliance on one aggregate, the weighting procedure used .to ensure the consistency of M1 and M2 targets could reflect partial reliance on each aggregate. In this case, the potential impact of both M1 and M2 on GNP would be taken into account to some degree in establishing targets.[6] The M1 and M2 targets resulting from partial reliance on each aggregate would not be the same as the targets resulting from total reliance on either aggregate. The M1 target resulting from partial reliance on each aggregate would be between the 3.67 per cent target growth rate that would

[5] The M2 target would be supeffluous if the conduct of policy were dictated entirely by the desire to achieve an M1 growth rate believed to be consistent with ultimate policy goals. This example of setting targets for both, aggregates, even though only one of the targets has any significance for the conduct of policy, is discussed for illustrative purposes only. The targets resulting from exclusive reliance on one aggregate provide an interesting contrast to targets resulting from partial reliance on both aggregates, a case that is discussed later.

[6] The same weighting procedure used to establish the monetary targets initially can be used to determine the appropriate policy response to deviations from those targets. In general, a policy response will be elicited if the growth rate of either aggregate differs from its' target growth rate. Open market operations intended to counteract the divergence between the actual and desired growth rates for one aggregate necessarily affect the growth rate of the other aggregate. Thus, the same type of conflict between monetary objectives that necessitated the initial weighting procedure used to establish consistent targets arises when responding to deviations, from the established targets. The same reasoning that leads to weighting M1 and M2 in determining the appropriate set of monetary targets also leads to weighting deviations from those targets in determining the appropriate policy response to unexpected behavior of one or both monetary aggregates. The determinants of the relative weights are also the same in the two cases. The relative priorities assigned to reducing deviations from M1 and M2 targets would be based on the relative confidence in the closeness of their relations to GNP. If M1 were considered a much better policy guide than M2, for example, open market policy would be designed to maintain the M1 growth rate close to its target even though this policy might cause substantial deviation of the M2 growth rate from its target.

be established if total reliance were placed on M2 as a policy guide and the 6 per cent target growth rate that would be established if total reliance were placed on M1 as a policy guide. Similarly, the M2 target resulting from partial reliance on each aggregate would be between the 10 per cent and 13.5 per cent target growth rates that would be established if total reliance were placed on one aggregate or the other. The greater the weight given to M1 relative to M2, for instance, the closer would be the M1 target to 6 per cent and the further would be the M2 target from 10 per cent.

Partial reliance on each aggregate reduces the possibility of major policy errors. To illustrate, suppose the weighting procedure reflecting partial reliance on each aggregate leads to establishing an M1 target growth rate of 5 per cent and an M2 target growth rate of 12 per cent.[7] The relation between M1 and GNP in (2) implies that M1 growth of 5 per cent would result in GNP growth of 11 per cent, slightly lower than the desired GNP growth rate of 12 per cent. The relation between M2 and GNP in (3), on the other hand, implies that M2 growth of 12 per cent would lead to GNP growth of 13 per cent, slightly above the desired rate. Neither the M1 nor the M2 relation indicates that policy actions necessary to achieve growth rates of 5 per cent for M1 and 12 per cent for M2 would result in precisely the GNP growth rate that is desired. Neither of the relations, however, indicates that a policy 'based on this set of targets would lead to errors as great as those that could occur in the case of exclusive reliance on one aggregate. Thus, the possibility of major policy errors is reduced by partial reliance on each of the estimated relations between GNP growth and monetary growth.

Determinants of the Weights for M1 and M2

The relative weights assigned to M1 and M2 would depend on their relative effectiveness as policy guides and on the degree to which policy is designed to avoid large errors. Suppose, for example, that M1 is considered to be a much more effective policy guide than M2 and that the risk of committing major policy errors by disregarding the behavior of M2 is acceptable. In these circumstances, 'exclusive reliance on M1 as a policy guide would be appropriate. If, on the other hand, M1 and M2 are considered equally effective as policy guides and policy is designed to minimize the possibility of substantial deviation from the desired GNP growth rate, equal weighting of M1 and M2 would be appropriate.

As demonstrated above, the degree to which a monetary aggregate would be effective as a policy guide depends on how closely the aggregate is related to GNP. The closeness of the relation between a'monetary aggregate and GNP can be measured by the predictive accuracy of a reduced form GNP equation that

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[7] The combination of a 5 per cent growth rate target for M1 and a 12 per cent growth rate target for M2 results from equal weighting of M1 and M2. If M1 and M2 are considered to be equally effective as policy guides, the best estimate of the GNP growth rate resulting from policy actions necessary to achieve 5 per cent M1 growth and 12 per cent M2 growth is the average of the GNP growth rates indicated by the M1 and M2 relations in (2) and (3). Thus,

$$E(\dot{GNP}) = .5(6.0 + 1.0\,\dot{M1}) + .5(7.0 + 0.5\,\dot{M2}),$$

where $E(\dot{GNP})$ is the expected value of GNP growth resulting from given M1 and M2 growth rates. It can easily be shown from the expression above that the only consistent set of targets that yields an expected GNP growth rate of 12 per cent when M1 and M2 are weighted equally is an M1 growth rate of 5 per cent and an M2 growth rate of 12 per cent. More generally, the expected GNP growth resulting from any set of consistent targets can be determined by weighting the predicted outcomes from each of the reduced form relations by the likelihood of their occurrence. There is, in fact, always some consistent set of targets that leads to expected GNP growth at the desired rate regardless of the relative weights given M1 and M2.

includes the monetary aggregate as an independent variable. Thus, if the prediction errors were about the same for the GNP/M1 equation as for the GNP/M2 equation, equal weights would be given to M1 and M2 in determining the monetary targets most conducive to attainment of ultimate policy goals.

ESTABLISHING MULTIPLE TARGETS TO REFLECT LIQUIDITY

A second possible reason for establishing target growth rates for both M1 and M2 is that a monetary measure based on some combination of M1 and M2 may be a better policy guide than either aggregate individually. One such measure is a monetary aggregate that is defined as a weighted average of M1 and M2, or equivalently, as a weighted average of M1 and the time deposit component of M2.[8] This type of weighted monetary aggregate might be more closely related to GNP than either M1 or M2. If, for example, total liquidity is an important determinant of economic performance, the various components of M1 and M2 would affect the economy in proportion to the degree of liquidity they provide. In these circumstances, a weighted aggregate reflecting the relative liquidity of M1 assets and the time deposit component of M2 might be a better policy guide than either M1 or M2 separately.

A Method for Determining Desirable M1 and M2 Growth Rates

The closeness of the relation between a weighted average monetary aggregate and GNP can be determined by including the weighted aggregate as the monetary measure in a reduced form GNP equation. Having obtained estimates of the parameters, the reduced form relation can be used to derive an estimate of the growth rate of the weighted average monetary aggregate necessary to achieve the desired growth rate of GNP. Assume, for example, that the estimated relation between GNP and the weighted aggregate is:

$$(5) \qquad \dot{GNP} = 6.4 + 0.7\ \dot{MW},$$

where $\dot{MW}$ is the growth rate of the weighted average monetary aggregate.

The relation in (5) implies that an 8 per cent growth rate in the weighted average monetary aggregate is necessary to achieve the desired 12 per cent growth rate in GNP (i.e., 12 = 6.4 + (0.7) (8)). Since the weighted aggregate, MW, is assumed to be a weighted average of M1 assets and the time deposit component of M2, the short-run monetary objectives implied by the use of this type of monetary measure as a policy guide can be expressed as target growth rates for M1 and M2. According to the estimated relation in (5), M1 and M2 target growth rates that yield an 8 per cent growth rate of the weighted average monetary aggregate are most conducive to attainment of ultimate policy goals.

Weighting M1 and M2 to Ensure Consistent Targets

Interdependence between M1 and M2 growth rates must be taken into account in setting targets that would yield the desired growth in liquidity. As in the uncertainty case discussed previously, a weighting procedure can be used to ensure that the M1 and M2 targets are consistent. Unlike the uncertainty case, however, the weighting procedure does not

[8] A good summary of the literature on weighted average monetary aggregates can be found in Alfred Broaddus, "Aggregating the Monetary Aggregates: Concepts and Issues," Federal Reserve Bank of Richmond *Economic* Review, November/December 1975.

require a compromise between the desired M1 and M2 growth rates. A compromise is unnecessary because there are numerous combinations of M1 and M2 growth rates that would yield the desired growth rate in the weighted average monetary aggregate. All of these combinations are equally acceptable as targets. Thus, the weighting procedure in this case is used only to determine which of the acceptable combinations of M1 and M2 growth rates would result in a consistent set of targets.

The example in the preceding section can be used to illustrate how a weighting procedure can be used to determine consistent targets. The relation in (5) indicates that an 8 per cent growth rate in MW would be required to achieve the desired 12 per cent growth rate of GNP. Assume that the weights assigned to M1 and M2 in defining MW imply that the growth rate of MW is equal to the simple average of the M1 and M2 growth rates (MW = .5 M1 + .5 M2). Combinations of M1 and M2 growth rates that yield an 8 per cent growth rate in the weighted aggregate might then include an M1 growth rate of 7 per cent and an M2 growth rate of 9 per cent, an M1 growth rate of 4.6 per cent and an M2 growth rate of 11.4 per cent, and M1 and M2 growth rates of 8 per cent. Each of these combinations—and numerous others—could serve equally well as monetary targets. Only one combination, however, would satisfy the relation posited in (4) which states that there is an interdependence between M1 and M2 growth rates. The only consistent combination of M1 and M2 growth rates that provides the desired 8 per cent growth in MW is an M1 growth rate of 4.6 per cent and an M2 growth rate of 11.4 per cent (i.e., 11.4 = 4.5 + (1.5) (4.6) as required by the relation in (4)). These growth rates would then be the target growth rates chosen. Thus, the interdependence between M1 and M2 growth rates can be taken into account in establishing monetary targets by choosing the unique combination of consistent M1 and M2 growth rates that result in the desired growth in the weighted average monetary aggregate.

Even though a compromise of short-run monetary objectives is not necessary in the case where M1 and M2 targets are established to reflect the relative liquidity of different assets, the interdependence of M1 and M2 growth rates still requires that a weighting procedure be used to determine monetary targets. The weights assigned to the components of M1 and M2 in constructing MW necessarily determine the relative importance given to M1 and M2 in achieving the monetary growth most conducive to attainment of ultimate policy goals. Thus, the weighting procedure used to establish consistent monetary targets is derived from the weighting procedure used to define the weighted aggregate that serves as a policy guide.[9] As in the case of weighting monetary aggregates to reflect the relative confidence in M1 and M2 as policy guides, the weighting procedure used when a weighted average monetary aggregate is the policy guide could be based on exclusive concern with one aggregate or on partial weighting of both M1 and M2 growth rates.

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9 The same weighting procedure that is used to establish M1 and M2 targets can be used in responding to deviations from those targets. Since the monetary targets are assumed to be derived from the desired growth rate of a weighted average aggregate, deviation of either M1 or M2 from its target would result in an undesired change in the growth rate of the weighted average aggregate, unless offset by policy actions. The interdependence between M1 and M2 growth rates does not; however, require a compromise of the liquidity objective. By increasing open-market purchases in response to a slowdown in the growth of one or both aggregates, for example, it is always possible to achieve an average growth of M1 and M2 consistent with the desired growth in the weighted aggregate. The magnitude of offsetting policy actions necessary to compensate for deviations from M1 or M2 targets can be determined by using the same weights for M1 and M2 growth rates as were used in establishing the initial targets.

Determinants of the Weights for M1 and M2

In general, the weights given to M1 and M2 in constructing the weighted average monetary aggregate would depend on the relative liquidity of M1 assets and the time deposit component of M2. Although the relative liquidity of M1 assets and time deposits cannot be measured directly, it can be inferred from the public's reaction to changes in the relative yields on assets. For instance, if individuals consider the interest rate on time deposits to be the opportunity cost of holding demand deposits and currency, the yield on time deposits measures the price of obtaining additional liquidity. The degree to which households and businesses substitute noninterest-bearing assets for time deposits in response to a change in the rate paid on time deposits indicates the public's perception of the relative liquidity of the two types of assets.[10]

CONCLUSION

An important conclusion of the foregoing analysis is that there are numerous circumstances in which it is desirable to consider the behavior of both M1 and M2 in implementing monetary policy. Exclusive focus on either M1 or M2 might lead to incorrect policy actions if there is uncertainty about which aggregate is more closely related to GNP or if a weighted average of M1 and M2 is more closely related to GNP than either aggregate individually. In both cases, policy actions based on targets for both M1 and M2 are more likely to result in attainment of ultimate policy goals than policy actions based on a single target.

Another implication of the analysis is that the evaluation of the economic impact of alternative combinations of M1 and M2 target growth rates and the relative importance assigned to each aggregate depend on the rationale underlying the use of multiple targets.'' If targets are established for both M1 and M2 because of uncertainty as to which is the better policy guide, the potential economic impact of each aggregate is evaluated without reference to the behavior of the other aggregate. The effect of M1 on GNP is evaluated by using a reduced form relation including M1 as the sole monetary variable, and the effect of M2 on GNP is evaluated by using a reduced form relation including M2 as the sole monetary variable. Potential impact of a particular M1 target growth rate, for example, can be determined directly from the M1 reduced form relation and does not depend in any way on the corresponding M2 target. The relative importance attributed to each aggregate in the uncertainty case reflects the relative confidence in the alternative reduced form relations as accurate representations of the effect of policy actions on the economy.

If targets are established for both M1 and M2 because both are believed to contribute to total liquidity, on the other hand, the potential economic impact of a particular target growth rate for one aggregate cannot be evaluated in isolation from the corresponding target growth rate of the other aggregate. When GNP growth is assumed to depend on the growth in total liquidity rather than the growth in either M1 or M2 individually, the economic impact of alternative sets of M1 and M2 growth rates is determined by the combined impact of the M1 and M2 growth rates on the growth in liquidity. Thus, the relative importance attributed to M1 and M2, in these circumstances, depends on

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10 For a comprehensive survey of the studies that have estimated the substitutability between M1 assets and time deposits, see Edgar L Feige and Douglas K. Pearce, "The Substitutability of Money and Near-Monies: A Survey of the Time Series Evidence," *Journal of Economic Literature, Vol.* 15, *No.* 2 (June 1977).

the degree to which each aggregate contributes to the desired growth in total liquidity.

In summary, when short-run monetary policy decisions are based on target growth rates for M1 and M2, the course of monetary policy depends both on the method used to evaluate the economic effects of alternative M1 and M2 growth rates and on the relative importance attributed to each aggregate. Since both of these determinants of policy actions depend on the rationale underlying the use of multiple targets, the policy actions deemed appropriate under the uncertainty rationale might differ from the policy actions deemed appropriate under the liquidity rationale.

Although the current procedure for implementing monetary policy is not precisely equivalent to the use of monetary targets, several interesting comparisons can be made between current methods for implementing monetary policy and those that might be employed if a strict monetary target approach to policy were adopted by the Federal Reserve. The policy implications of the two alternative reasons for establishing targets for both M1 and M2 have been shown to be somewhat different. These differences are relatively minor, however, in comparison to the difference between exclusive reliance on one aggregate and partial reliance on both aggregates. Whether because of uncertainty as to which aggregate is a better policy guide or because both aggregates are believed to contribute to total liquidity, the FOMC has chosen not to rely exclusively on either M1 or M2 in assessing the impact of monetary policy on the economy. Furthermore, the current method of implementing monetary policy is roughly consistent with the method implied by either of the reasons for using multiple targets discussed in this article.[12]

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11 The optimal structure of reserve requirements on bank deposits also depends on the reason for establishing targets for both M1 and M2. The relative magnitude of reserve requirements on demand deposits and time deposits is an important determinant of the degree of monetary control exercised by the Federal Reserve.

Under the assumption that the Federal Reserve uses some reserve aggregate as the instrument of monetary control, it can be shown that M1 growth can most easily be controlled if there are no reserve requirements on time deposits and that M2 growth can most easily be controlled if reserve requirements on time deposits are equal to reserve requirements on demand deposits. When target growth rates are established for both M1 and M2, the structure of reserve requirements most conducive to attainment of the dual monetary objectives would, under the assumption of a reserve aggregate instrument, include reserve requirements on time deposits that are neither zero nor equal to reserve requirements on demand deposits. The optimal relation between reserve requirements on different classes of bank deposits when targets are established for both M1 and M2 depends both on the reason for establishing multiple targets and on the relative weights assigned to those targets. The greater the weight given to M1 relative to M2, *ceteris paribus*, the greater would be reserve requirements on demand deposits relative to reserve requirements on time deposits in both cases, since demand deposits are a larger component of M1 than of M2. For any specified set of relative weights for M1 and M2 growth rates, the differential between reserve requirements on demand deposits and time deposits would be greater if those weights represent the relative confidence in M1 and M2 as policy guides than if those weights represent the relative contribution of the M1 growth rate and the M2 growth rate to the growth rate of total liquidity. Equal weighting of M1 and M2 growth rates, for example, would imply that the optimal ratio of reserve requirements on demand deposits to reserve requirements on time deposits is about 6 in the uncertainty case and 3% in the liquidity case.

It is possible, however, that the structure of reserve requirements most conducive to monetary control would depend on the type of policy instrument used. Therefore, the results in the preceding paragraph might be changed somewhat if it is assumed that something other than a reserve aggregate is used as the instrument of monetary control.

12 It is interesting to note that the existing structure of reserve requirements, too, seems roughly consistent with a monetary policy based on targets for both M1 and M2. The average level of reserve requirements on member bank demand deposits is approximately four times as high as the average level of reserve requirements on member bank time deposits. While this ratio is not conducive to maximum control over either M1 or M2 separately, it might contribute to the ability to achieve desired *combinations* of M1 and M2 growth rates.

Federal Debt Management Policy:

A Re-Examination of the Issues

By V. Vance Roley

Federal debt management policy has been a topic of interest among economists for many years. Among issues currently unresolved are those concerned with the relative desirability and economic effects of alternative debt management policies. Do changes in the maturity composition of the Federal debt affect financial markets and the economy? If so, should policymakers administer the Federal debt with economic stabilization purposes in mind? Or should the main concern be with other objectives such as minimizing interest costs or lengthening the average maturity of the Federal debt? This article examines these issues. The first section defines debt management and discusses the size and composition of the Federal debt in recent years. The second and third sections examine the possible objectives of Federal debt management policy with respect to two broad categories—economic stabilization and interest cost minimization. Federal debt management policies are examined in terms of their economic implications on the financial and nonfinancial sectors of the economy.

THE STRUCTURE OF THE FEDERAL DEBT

Federal debt management policy may be defined as the policy that establishes the Federal debt's maturity composition — the relative supplies of securities with different maturities. In this article, the Federal debt is defined to consist of the outstanding interest-bearing marketable Treasury securities held by private investors. Several features of this definition should be noted. First, the total size of the Federal debt is defined to exclude the noninterest-bearing money liabilities of the Federal Government. Policy concerning the substitution of money for interest-bearing Federal debt, or vice versa, is usually assumed to be in the province of monetary policy.

Second, the portion of the total outstanding Federal debt relevant to debt management policy is the amount held by private investors. Thus, the holdings of Treasury securities by U.S. Government agencies, U.S. Government trusts, and the Federal Reserve System are excluded since they primarily involve intergovernmental transfers.

Finally, debt management policy is jointly determined by the actions of the Treasury and the Federal Reserve System. The Treasury may conduct debt management policy through ordinary refunding of maturing Federal debt and by exercising call options on some outstanding issues. The Federal Reserve System may change the composition of the Federal debt through open marketoperations designed to substitute Treasury securities in its portfolio

Table 1
THE SIZE OF THE FEDERAL DEBT

	1956	1966	1976	1956-66	1966-76
	(Billions of Dollars)			(Average Annual Percentage Change)	
Total interest-bearing Federal debt	274.2	325.0	652.5	1.9	10.1
Nonrnarketable issues	113.8	107.0	231.2	–0.6	11.6
Marketable issues	160.4	218.0	421.3	3.6	9.3
Held by private investors	130.5	159.1	307.8	2.2	9.3
Interest outlays in U.S. budget*	6.3	11.3	34.6	7.9	20.6
		(Per Cent)			
Ratio of the total interest-bearing Federal debt to GNP	65.2	43.2	38.2	–3.4	–1.2
Ratio of marketable issues held by private investors to GNP	31.0	21.1	18.0	–3.2	–1.5
Ratio of interest outlays to total U.S. budget outlays*	8.9	8.4	9.4	–0.6	1.2

*Fiscal years.

SOURCE: **Treasury Bulletin.**

with Treasury securities held by private investors with different maturities. Consequently, when the Federal Reserve System has sufficiently large and 'diverse. holdings of Treasury securities, its potential for producing changes in the composition of the Federal debt equals the wide range of possibilities available to the Treasury.

Marketable interest-bearing Federal debt held by private investors increased from **$130.5** billion in **1956** to **$307.8** billion in **1976.** (See Table **1.)** During the decade beginning in **1956,** the average annual rate of growth was only **2.2** per cent. In contrast, during the more recent **1966-76** period, the rate of growth increased substantially to average **9.3** per cent annually. However, the relative size of the Federal debt has generally decreased during the last two decades. The ratio of the marketable **interest-**bearing Federal debt held by private investors to gross national product **(GNP)** declined from **31.0** per cent in **1956** to **18.0** per cent **in 1976.** Despite the slight average annual rate of decline of **1.5** per cent during the last decade, the value of this ratio increased from **16.7** per cent in **1975** to **18.0** per cent in **1976.**

Interest costs on the Federal debt have increased substantially during the last decade. As indicated in Table **1,** interest outlays by the Federal Government increased from **$11.3** billion in **1%6** to **$34.6** billion in **1976,** growing at an average annual rate of **20.6** per cent. This rise was due both to the increase in absolute size of the Federal debt and to the higher yields on the Treasury securities issued during the period. However, for the entire period

Table 2
THE COMPOSITION OF THE PRIVATELY HELD MARKETABLE INTEREST-BEARING FEDERAL DEBT FOR SELECTED YEARS
(In Per Cent)

Years to Maturity	1956	1966	1976	1956-66	1966-76
				(Changes)	
Within 1 year	34.9	42.1	51.2	7.2	9.1
1 to 5 years	30.6	30.3	33.7	−0.3	3.4
5 to 10 years	12.7	15.4	10.1	2.7	−5.3
10 years and over	21.8	12.2	5.1	−9.6	−7.1
Total	100.0	100.0	100.0	0.0	0.0

SOURCE: Treasury Bulletin.

considered, interest costs as a ratio to total U.S. budget outlays have stayed in the range of **8** to **9** per cent.

The maturity composition of the Federal debt has exhibited significant changes over the past two decades. (See Table 2.) The percentage of securities held by private investors maturing within **1** year has increased from **34.9** per cent in **1956** to **42.1** per cent in **1966,** and to **51.2** per cent in **1976.** In contrast, privately held Treasury securities with **10** years and over to maturity have declined proportionately throughout these periods to **5.1** per cent of the total in **1976.** However, due to the recent emphasis by the Treasury in issuing long-term securities, the percentage of securities with **10** years and over to maturity has increased to **5.8** per cent of the total in the third quarter of **1977.**

ECONOMIC STABILIZATION AS AN OBJECTIVE OF FEDERAL DEBT MANAGEMENT POLICY

This section investigates the potential effectiveness of Federal debt management for economic stabilization. Federal debt management is potentially effective for stabilization if changes in the maturity composition of the debt do, in fact, affect the economy. Two types of effects may be distinguished — the interest rate effect and the liquidity effect.[1] A change in the maturity composition of the Federal debt will have an impact on the economy through the interest rate effect: if two conditions are met. The first condition is that changes in the maturity composition of the Federal debt affect the relative yields on different maturities of Treasury securities, implying that investors view different maturities of Treasury securities as distinct financial assets. Second, given that different maturities of Treasury securities are

[1] **A detailed analysis of the liquidity impact of Federal debt management is beyond the scope of this article. Researchen who have investigated the liquidity impact usually find that a shift from long- to short-term Treasury securities promotes economic expansion. However, in times of full employment and full capacity utilization, a similar shift may propagate inflationary excess aggregate demand. See, for example, Warren L. Smith, "Debt Management in the United States," in Joint Economic Committee, *Study of Employment, Growth, and Rice Levels* (Washington: Government Printing Office, 1960); and James Van Home and David A. Bowers, "The Liquidity Impact of Debt Management," *Southern Economic Journal,* Vol. *34* (April 1968), pp. 526-37.**

distinct, then changes in the maturity composition of the Federal debt affect private security yields which influence the level of economic activity. In particular, a decline in long-term private security yields may increase the incentive to produce capital' goods, and an increase in long-term private security yields may decrease the incentive to produce capital goods.

Federal Debt Management and Treasury Security Yields

There are several competing theories concerning the impact of changes in the maturity composition of the Federal debt on relative yields of different maturities of Treasury securities. Two such theories are the "pure expectations" and "market segmentation" hypotheses.

The "pure expectations" hypothesis implies that a change in the relative supplies of different maturities of Treasury securities *does* not affect their relative yields. The rationale of this theory is that investors are not concerned about the lengths to maturity of different Treasury securities. Instead, investors are concerned only with the expected holding-period yields[2] on securities. For example, if an investor has a 3-month planning horizon, he may compare the current yield on a 3-month Treasury bill with the interest payment and expected capital gain on a long-term Treasury security. If the expected holding-period yield on the long-term Treasury security is greater, the investor will purchase the long-term security, and vice versa. Thus, this theory implies that investors buy and sell securities until all future holding-period yields are expected to be equal,' regardless of the relative amounts supplied in the market.

In contrast,. the "market segmentation" hypothesis asserts that a change in the relative supplies of different maturities of Treasury securities *does* affect their relative yields. The rationale of this theory is that investors have definite preferences for specific maturities of Treasury securities which result from institutional or regulatory factors. For example, since the liabilities of insurance companies and pension funds are committed for long durations, these types of investors may prefer to invest in long-term financial assets. In this case, a difference in the expected 3-month holding-period yields between 3-month Treasury bills and long-term Treasury securities will not induce these investors to shift out of their preferred maturity unless the differential is substantial. Hence, the market yields on securities with different maturities are determined by the approximately independent market demands and supplies for each maturity class of Treasury securities. This implies that the expected holding-period yields for securities with different maturities may not' be identical over a given period, and that shifts in relative supplies affect relative yields by changing the individual supplies in the segmented markets for Treasury securities.'

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2 A security's holding-period yield is defined as the sum of interest payments and capital gain that occurs during the period of measurement as a per cent of its beginning-of-period price. The capital gain, in this 'sense, may be positive, negative, or zero.

3 Other variants of this theory have included risk or liquidity premiums in the yields on long-term securities. This is based on the reasoning that investors may want to hold securities for only relatively short time periods. Thus, if a long-term security was purchased, there would be the risk of having a capital loss. Therefore, in order to persuade investors to purchase long-term securities, they must have higher yields as compensation for their greater risk. See, for example, John R. Hicks, *Value* and *Capital* (London: Oxford University Press, 1939), pp. 141-52.

4 For further' discussion of the market segmentation hypothesis, see J. M. Culbertson, "The Term Structure of Interest Rates," *Quarterly Journal of Economics*. Vol. 71 (November 1957), pp. 485-517.

To summarize, under the pure expectations hypothesis, changes in the relative supplies of different maturities of Treasury securities would be ineffective in changing the term structure of Treasury security-interest rates, and under the market segmentation hypothesis, changes in relative supplies would be effective. However, actual market yields are most likely determined by market forces consisting of a combination of these theories. Thus, the actual extent of the effect on Treasury security yields from a change in the maturity composition of the Federal debt must be resolved empirically.

Previous empirical research tends to support the pure expectations hypothesis.[5] However, the methodologies used in previous research have several shortcomings. First, these studies have not investigated the demand for Treasury securities by separate categories of investors, such as insurance companies, pension funds, and commercial banks. Thus, any influences from partly segmented markets—because of differing portfolio selection behavior among separate categories of investors—have not been included in previous studies. Second, these studies have utilized reduced form equations in describing market-determined Treasury security yields. That is, instead of using supply and demand relationships for various maturities of Treasury securities and finding those interest rates that equate the individual market supplies with the individual market demands, the most common approach has been to try to explain interest rates by using any of the possible variables that may influence investors' demands. While the reduced form procedure is appropriate when it is constrained by the underlying demand relationships, previous empirical research has not imposed this restriction. Finally, many previous studies have neglected the possible implications of cash or wealth flows on the short-run portfolio selection behavior of investors.

The shortcomings outlined above were avoided in recent empirical research where the impact on yields from a change in the relative supplies of different maturities of Treasury securities is analyzed by constructing a disaggregated structural model.[6] The model is designed to explain how yields are determined and to identify the factors that affect yields. In the model, yields on different maturities of Treasury securities are determined by considering the market demands and supplies. The demand for Treasury securities in each maturity category by various categories of investors is determined separately. In addition, special attention is given to short-run portfolio adjustment and to the impact of new cash or

5 A partial list of the empirical research that finds small, if any, effects on the term structures of Treasury security interest rates from a change in the maturity composition of the Federal debt includes Arthur M. Okun, "Monetary Policy, Debt Management, and Interest Rates: A Quantitative Appraisal," in Commission on Money and Credit, *Fiscal and Debt Management Policies* (Englewood Cliffs: Prentice-Hall, 1963), pp. 331-80; Robert Haney Scott. "Liquidity and the Term Structure of Interest Rates," *Quarterly Journal of Economics*, Vol. 79 (February 1965), pp. 135-45; Franco Modigliani and Richard Sutch, "Innovations in Interest Rate Policy," *American Economic Review*, Vol. 56 (May 1966), pp. 178-97; Modigliani and Sutch, "Debt Management and the Term Structure of Interest Rates: An Empirical Analysis of Recent Experience," *Journal of Political Economy*, Vol. 75 (August 1967), pp. 569-89; Michael Hamburger and William L. Silber, "Debt Management and Interest Rates: A Re-examination of the Evidence," *The Manchester School of Economic and Social Studies*, Vol. 39 (December 1971), pp. 261-67; and Richard W. Lang and Robert H. Rasche, "Debt Management Policy and the Own-Price Elasticity of Demand for U.S. Government Notes and Bonds," Federal Reserve Bank of St. Louis *Renew*, September 1977, pp. 8-22. Somewhat larger effects than those indicated in these studies have been found by Gail Pierson. See Pierson, "Effect of Economic Policy on the Term Structure of Interest Rates," *Review of Economics and Statistics*, Vol. 52 (February 1970), pp. 1-11.

6 V. Vance Roley, A *Structural Model of the U.S. Government Securities Market*, Ph.D. dissertation, Harvard University, 1977.

Table 3
DYNAMIC SIMULATION RESULTS FOR THE 3- TO 5-YEAR AND LONG-TERM YIELDS ON TREASURY SECURITIES FOR 1960:I-1975:IV
(In Per Cent)

Yields	Actual Mean	Control Mean	Control RMSE*	Experiment Mean	Experiment Difference from Control
3- to 5-year	5.44	5.43	0.34	5.07	-0.36
Long-term	5.21	5.19	0.20	5.70	+0.51

*RMSE is the root-mean-square error.

wealth flows on the short-run demand for Treasury securities. .

After determining the Treasury security demands for each investor group, the individual demands are totaled across investor groups to arrive at market demands for each maturity category. Total demands along with the outstanding supplies are then used to determine the yields on each maturity category. The investor categories included in the model are commercial banks, households, life insurance companies, mutual savings banks, nonfinancial corporate businesses, other insurance companies, private pension funds, savings and loan associations, state and local government general funds, and state and local government retirement funds. The maturity categories are formed by disaggregating Treasury securities into four weighted maturity classes. Short-intermediate-term and long-term Treasury securities, which roughly correspond to 2 to 5 years and over 10 years to maturity, respectively, are currently included in the model. .

The empirical results of the model indicate that the disaggregated structural model performs well in explaining Treasury security yields with a high degree of accuracy. A control simulation was used to determine the model's performance during the sample period used for estimation (1960:I–1975:IV). The control simulation determines the Treasury security yields predicted by the model.' The results for the control simulation reported in Table 3 indicate that the model has no significant bias in its within-sample predictions—that is, the actual average yields of 5.44. and 5.21 per cent are very close to the predicted average yields of 5.43 and 5.19 per cent for the 3- to 5-year and long-term yields, respectively.' In addition, the model's. within-sample predictive performance is comparable to previous approches on the basis of the reported measure of dispersion (root-mean-square error) on the predicted yields.

More importantly, the empirical results of the model ,indicate that the maturity composition of the Federal debt does affect Treasury security yields. This is shown by an experiment. In the experiment, the structure of

[7] In addition, the control simulation is fully dynamic in the sense that all lagged endogenous variables (i.e., Treasury security yields and demands) take values solved from the model in previous periods.

[8] The fad that there is no significant bias in the results for the control simulation is not a property that necessarily follows from the way the model is constructed. Unlike single equation models that contain constant terms, the mean of the "predicted values does not necessarily equal the mean of the actual values. In addition, the control simulation uses values solved in the model for all lagged endogenous variables included in the model thereby canceling the necessity of the zero bias property even in single equation models.

the Federal debt was changed permanently by shifting $2.5 billion from short-intermediate-term securities to long-term securities beginning in 1959:IV.[9] That is, levels of short-intermediate-term and long-term Treasury securities were made different from their historical values, in the manner indicated above, by $2.5 billion in each period. As reported in Table 3, this shift resulted in a decrease of the 3- to 5-year yield by an average of 36 basis points, and an increase in the long-term yield by an average of 51 basis points over the period beginning in 1960:I and ending in 1975:IV.

The impact of Changes in the Maturity Compositlon of the Federal Debt on Private Security Yields

When considering the effect of debt management on private security yields, it is usually maintained that the impact depends on investors' behavior in making portfolio selections among Treasury and private securities.[10] The analysis of the impact on private security yields, and the role played by investor behavior; may be simplified by assuming that there is only one type of private security — equity. In the simplified model including equity, short-term Treasury securities, and long-term Treasury securities, the link between private security yields and the nonfinancial economy is described in terms of the yield on equity. If, for example, the yield on equity falls (price increases),. then investment in capital goods increases. That is, since the price of equity is the price of a unit of existing physical capital, the higher the price of equity compared to the price (reproduction cost) of a unit of new capital, the greater the incentive to produce new capital goods. Hence, an increase in the price of equity (decrease in yield) stimulates the economy.

Three different types of investors' portfolio selection behavior have been hypothesized. The types differ according to investors' assessments about the degree of substitutability among equity, short-term Treasury securities, and long-term Treasury securities. One type says that short- and long-term Treasury securities are regarded as perfect substitutes since' both have fixed nominal returns and no default risk. The empirical results presented earlier make it possible to reject this type of investor portfolio selection behavior. In particular, the ability to change the spread between short- and long-term Treasury security yields is contradictory to the perfect substitutes hypothesis which implies that the yield spread would remain constant.

A second'type of portfolio selection behavior says that long-term Treasury securities and equity are regarded as perfect substitutes since both are long-term financial assets. This second type also may be questioned because it implies that investors do not distinguish between other characteristics of long-term Treasury securities and equity. In particular, since the return on equity depends on the earnings of private corporations and the return on long-term Treasury securities includes a fixed nominal interest payment, investors probably view these assets as imperfect substitutes.

'The third type of portfolio selection behavior says that equity, short-term Treasury securities,

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9 These changes correspond to a 6 per cent average change for short-intermediate-term securities, and a 14 per cent average change for long-term securities.

10 See, for example, Earl R. Rolph, "Principles of Debt Management," American Economic Review. Vol. 47 (June 1957), pp. 302-20; James Tobin, "An Essay on the Principles of Debt Management," in Commission on Money and Credit, Fiscal and Debt Management Policies (Englewood Cliffs: Prentice-Hall, 1963), pp. 143-218; and O. H. Brownlee and I. O. Scott, "Utility, Liquidity, and Debt Management," *Econometrica,* Vol. 32 (July 1963), pp. 349-62.

and long-term Treasury securities are imperfect substitutes because of either their differing time to maturity or risk characteristics. Based on the above criticisms of the other two types, this third type appears to provide the most accurate description of actual investor behavior. In addition, the third type of investor portfolio selection behavior implies that changes in the maturity composition of the Federal debt affect private security yields. For example, a shift in Treasury security supplies from long- to short-term Treasury securities would leave investors wanting to purchase long-term Treasury securities, and sell short-term Treasury securities to restore the previous asset composition of their portfolios. However, with the change in the supplies of short- and long-term Treasury securities, investors on the whole cannot. restore the original asset composition of their portfolios. Since total investor demand for long-term Treasury securities is greater than supply, and total investor demand for short-term Treasury securities is less than supply, the price of long-term Treasury securities is bid up (yield falls) and the price of short-term Treasury securities is bid down (yield rises). Furthermore, during this process, investors are also evaluating the desirability of holding equity relative to the separate amounts of short- and long-term Treasury securities. Since the yield on long-term Treasury, securities has decreased, investors desire to hold more equity; but since the yield on short-term Treasury securities has risen, investors desire to hold less equity. When all yields have adjusted to the point where investors are content to hold the existing supplies of assets, the ultimate impact of equity yields depends on which Treasury security yield had the strongest effect on the demand for equity. Thus; equity yields will have changed, although the direction may be uncertain.

To summarize, this discussion suggests that a change in the maturity composition of the Federal debt affects the term structure of Treasury security interest rates, and that there may be further effects on private security yields which directly influence nonfinancial economic activity. Thus, Federal debt management could possibly be used to affect and help stabilize the economy. For example, if a debt management policy that is consistent with the stimulation of the economy is desired, then the relative supplies of different maturities of Treasury securities should consist of the combination that maximizes the prices (minimizes the yields) of private securities. This combination of Treasury securities most likely consists of more short-term than long-term Treasury securities held by private investors since the demand for equity depends more on the price of long-term Treasury securities than on the price of short-term Treasury securities. Thus, it is desirable to keep the price of long-term Treasury securities high (yields low) in order to stimulate the demand for equity. However, if the price of short-term Treasury securities becomes too low (yield too high), then investors would increase their demand for short-term Treasury securities and reduce their demand for equity. Therefore, a suitable balance between the relative supplies of short- and long-term Treasury securities must be maintained, but the best combination most likely has more short-term than long-term Treasury securities.

At other times, however, it may be desirable for debt management policy to provide a restrictive impact on the economy. For example, during times of inflationary excess aggregate demand, the most desirable debt management policy may be to reduce the prices of private securities (raise the yields) to help eliminate the possibility of inflation. Thus, if the existing composition of the Federal debt

causes the price of equity to be at its maximum, then it may be desirable to increase the supply of long-term relative to short-term Treasury securities to reduce the price (raise the yield) of equity.

INTEREST COST MINIMIZATION

The reduction of interest costs on the privately held Federal debt may be an additional objective for Federal debt management policy. It may be desirable to reduce interest costs when considering two factors. First, the transfer of funds from taxpayers to holders of the Federal debt may involve disproportionate effects on individuals in different income or wealth classes. That is, there may be a transfer of funds from lower to upper income classes. Second, on the portion of the Federal debt held by foreign investors, there is a net outflow of funds. That is, if taxation is used to finance the interest costs on the Federal debt, the net result is to transfer funds from U.S. taxpayers to foreign investors.

Interest costs may be minimized in the short run or the long run. A short-run cost minimization strategy could imply that the interest costs are minimized on a period-by-period basis—each month or each quarter, etc. Thus, when refunding maturing debt, or when making outright substitutions between different maturity classes, the policymakers would examine actual prevailing market yields to calculate the composition of the Federal debt that has the lowest total interest cost during the period. In most periods, since short-term yields are usually below long-term yields, this would imply a very short average maturity for the Federal debt.

A short-run interest cost minimization strategy could call for policy actions that are opposite to those desired for purposes of economic stabilization. First, this strategy would imply issuing long-term Treasury securities when long-term yields are below short-term yields, and such a yield structure has sometimes occurred during recessionary periods. Based on the analysis in the previous section, issuing long-term Treasury securities during a recession may not provide stimulation to the economy. Second, in times of full employment, the short-run strategy could lead to excessive liquidity with possible inflationary consequences.

A long-run cost minimization strategy would involve a planning horizon in which maturing short-term debt would be rolled over several times. Thus, in this case, there is a choice between issuing long-term securities with maturity equal to the length of the planning horizon, or a series of short-term securities with uncertain average interest costs that must be forecasted. An optimal policy might be formulated by considering the expected interest costs and their estimated dispersions for alternative combinations, and then making a policy choice based on the subjective trade-off between these two factors.

A long-run interest cost minimization strategy could also call for policy actions that are opposite to those desired for purposes of economic stabilization. Under a long-run strategy, it is again possible that a large amount of long-term Treasury securities would be issued during a recession, and vice versa during expansions. This is the case since long-term yields have sometimes been below short-term yields during recessionary periods, and both yields may be expected to rise during the economic expansion that could shortly follow. Thus, the long-run interest cost minimization strategy may not provide stimulation to the economy during some recessions. In addition, there is a greater incentive to issue long-term Treasury securities at all times with this strategy since "short-term

or floating debt is said to leave the government at the mercy of impatient lenders."[11] That is, by issuing long-term debt the interest costs can be stabilized over longer periods.

CONCLUSION

This article's analysis suggests that Federal debt management policy should recognize the trade-off between economic stabilization and interest cost minimization. Previous empirical research has supported the "pure expectations" hypothesis of Treasury security yield determination thereby implying that changes in the maturity composition of the Federal debt would be ineffective for economic stabilization. However, there are several methodological shortcomings in previous research which make the results questionable. Many of these shortcomings were avoided in the empirical results reported in this article by using a disaggregated structural model of the Treasury securities market. Using the model, an experiment suggests that debt management may have a significant impact on the relative yields of different maturities of Treasury securities. Thus, even if debt management is not actively used to stabilize the economy, the resultant maturity composition of the Federal debt may have implications for the overall level of economic activity. Furthermore, because of the impact on the economy from changes in the maturity composition of the Federal debt, interest cost minimization should not be the sole objective of debt management policy.

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11 Richard A. Musgrave, *The Theory of Public Finance* (New York: McGraw-Hill Book Company, Inc., 1959), p. 599.