The following article is reprinted from the November 1968 Federal Reserve Bank of St. Louis Review.

Monetary and Fiscal Actions: A Test of Their Relative Importance in Economic Stabilization

Leonall C. Andersen and Jerry L. Jordan

HIGH employment, rising output of goods and services, and relatively stable prices are three widely accepted national economic goals. Responsibility for economic stabilization actions to meet these goals has been assigned to monetary and fiscal authorities. The Federal Reserve System has the major responsibility for monetary management. Fiscal actions involve federal government spending plans and taxing provisions. Governmental units involved in fiscal actions are the Congress and the Administration, including the Treasury, the Bureau of the Budget, and the Council of Economic Advisers.

This article reports the results of recent research which tested three commonly held propositions concerning the relative importance of monetary and fiscal actions in implementing economic stabilization policy. These propositions are: the response of economic activity to fiscal actions relative to that of monetary actions is (1) greater, (2) more predictable, and (3) faster. Specific meanings, for the purposes of this article, of the broad terms used in these propositions are presented later.

The authors give special thanks for helpful comments on earlier drafts to: Robert Basmann, Karl Brunner, James Buchanan, Albert Burger, Keith Carlson, David Fand, Milton Friedman, Gary Fromm, Michael Levy, Thomas Mayer, A. James Meigs, David Meiselman, Allan Meltzer, Richard Puckett, David Rowan, James Tobin, Robert Weintraub, and William Yohe. The authors are, of course, solely responsible for the analyses and results presented in this article.

This article does not attempt to test rival economic theories of the mechanism by which monetary and fiscal actions influence economic activity. Neither is it intended to develop evidence bearing directly on any causal relationships implied by such theories. More elaborate procedures than those used here would be required in order to test any theories underlying the familiar statements regarding results expected from monetary and fiscal actions. However, empirical relationships are developed between frequently used measures of stabilization actions and economic activity. These relationships are consistent with the implications of some theories of stabilization policy and are inconsistent with others, as will be pointed out.

A brief discussion of the forces influencing economic activity is presented first. Next, with this theory as a background, specific measures of economic activity, fiscal actions, and monetary actions are selected. The results of testing the three propositions noted above, together with other statements concerning the response of economic activity to monetary and fiscal forces, are then presented. Finally, some implications for the conduct of stabilization policy are drawn from the results of these tests.

A THEORETICAL VIEW OF ECONOMIC ACTIVITY

Our economic system consists of many markets. Every commodity, service and financial asset is viewed as constituting an individual market in which a

particular item is traded and a price is determined. All of these markets are linked together in varying degrees, since prices in one market influence decisions made in other markets.

About a century ago, Leon Walras outlined a framework for analyzing a complex market economy. Such an analysis includes a demand and a supply relationship for every commodity and for each factor of production. Trading in the markets results in prices being established which clear all markets, i.e., the amount offered in a market equals the amount taken from the market. According to this analysis, outside occurrences reflected in shifts in demand and supply relationships cause changes in market prices and in quantities traded. These outside events include changes in preferences of market participants, in resource endowments, and in technology. Financial assets were not viewed as providing utility or satisfaction to their holders and were therefore excluded from the analysis.

Later developments in economic theory have viewed financial assets as providing flows of services which also provide utility or satisfaction to holders. For example, a holder of a commercial bank time deposit receives liquidity service (ease of conversion into the medium of exchange), store of value service (ability to make a future purchase), risk avoidance service (little risk of loss), and a financial yield. According to this later view, economic entities incorporate choices among goods, services, *and* financial assets into their decision-making processes.

The fact that economic entities make choices in both markets for goods and services and markets for financial assets requires the addition of demand and supply relationships for every financial asset. Market interest rates (prices of financial assets) and changes in the stocks outstanding of most financial assets are determined by the market process along with prices and quantities of goods and services.

These theoretical developments have enlarged the number of independent forces which are regarded as influencing market-determined prices, interest rates, quantities produced of commodities and stocks outstanding of financial assets. Government and monetary authorities are viewed as exerting independent influences in the market system. These influences are called fiscal and monetary policies or actions. Random events, such as the outbreak of war, strikes in key industries and prolonged drought, exert other market influences. Growth in world trade and changes in foreign prices and interest rates, relative to our own, influence exports and therefore are largely an outside influence on domestic markets.

Exhibit 1

Classification of Market Variables

Dependent Variables

Prices and quantities of goods and services.
Prices and quantities of factors of production.
Prices (interest rates) and quantities of financial assets.
Expectations based on:
a. movements in dependent variables.
b. expected results of random events.
c. expected changes in fiscal and monetary policy.

Independent Variables

Slowly changing factors:
a. preferences.
b. technology.
c. resources.
d. institutional and legal framework.
Events outside the domestic economy:
a. change in total world trade.
b. movements in foreign prices and interest rates.
Random events:
a. outbreak of war.
b. major strikes.
c. weather.
Forces subject to control by:
a. fiscal actions.
b. monetary actions.

Market expectations have also been assigned a significant factor in markets, but these are not viewed as a distinctly independent force. Expectations result from market participants basing their decisions on movements in market-determined variables, or they are derived from market responses to the expected results of random events, such as the outbreak of a war or the anticipation of changes in fiscal or monetary policy.

These dependent and independent market variables are summarized in exhibit 1. The dependent variables are determined by the interplay of market forces which results from changes in the independent variables. Market-determined variables include prices and quantities of goods and services, prices and quantities of factors of production, prices (interest rates) and quantities of financial assets, and expectations. Independent variables consist of slowly changing factors, forces from outside our economy, random events and forces subject to control by fiscal and monetary authorities. A change in an independent

variable (for example, a fiscal or a monetary action) causes changes in many of the market-determined (dependent) variables.

MEASURES OF ECONOMIC ACTIVITY AND OF MONETARY AND FISCAL ACTIONS

Three theoretical approaches have been advanced by economists for analyzing the influence of monetary and fiscal actions on economic activity. These approaches are the textbook Keynesian analysis derived from economic thought of the late 1930s to the early 1950s, the portfolio approach developed over the last two decades, and the modern quantity theory of money. Each of these theories has led to popular and familiar statements regarding the direction, amount, and timing of fiscal and monetary influences on economic activity. As noted earlier, these theories and their linkages will not be tested directly, but the validity of some of the statements which purport to represent the implications of these theories will be examined. For this purpose, frequently used measures of economic activity, monetary actions, and fiscal actions are selected.

Economic Activity

Total spending for goods and services (gross national product at current prices) is used in this article as the measure of economic activity. It consists of total spending on final goods and services by households, businesses and governments plus net foreign investment. Real output of goods and services is limited by resource endowments and technology, with the actual level of output, within this constraint, determined by the level of total spending and other factors.

Monetary Actions

Monetary actions involve primarily decisions of the Treasury and the Federal Reserve System. Treasury monetary actions consist of variations in its cash holdings, deposits at Federal Reserve banks and at commercial banks, and issuance of Treasury currency. Federal Reserve monetary actions include changes in its portfolio of Government securities, variations in member bank reserve requirements, and changes in the Federal Reserve discount rate. Banks and the public also engage in a form of monetary actions. Commercial bank decisions to hold excess reserves constitute a monetary action. Also, because of differential reserve requirements, the public's decisions to hold varying amounts of time deposits at commercial banks or currency relative to demand deposits are a form of monetary action, but are not viewed as stabilization actions. However, they are taken into consideration by stabilization authorities in forming their own actions. Exhibit 2 summarizes the various sources of monetary actions related to economic stabilization.

The monetary base[1] is considered by both the portfolio and the modern quantity theory schools to be a strategic monetary variable. The monetary base is under direct control of the monetary authorities, with major control exerted by the Federal Reserve System. Both of these schools consider an increase in the monetary base, other forces constant, to be an expansionary influence on economic activity and a decrease to be a restrictive influence.

The portfolio school holds that a change in the monetary base affects investment spending, and thereby aggregate spending, through changes in market interest rates relative to the supply price of capital (real rate of return on capital). The modern quantity theory holds that the influence of the monetary base works through changes in the money stock which in turn affect prices, interest rates and spending on goods and services. Increases in the base are reflected in increases in the money stock which in turn result directly and indirectly in increased expenditures on a whole spectrum of capital and consumer goods. Both prices of goods and interest rates form the transmission mechanism in the modern quantity theory.

The money stock is also used as a strategic monetary variable in each of the approaches to stabilization policies, as the above discussion has implied. The simple Keynesian approach postulates that a change in the stock of money relative to its demand results in a change in interest rates. It also postulates that investment spending decisions depend on interest rates, and that growth in aggregate spending depends in turn on these investment decisions. Similarly, in the portfolio school of thought, changes in the money stock lead to changes in interest rates, which are followed by substitutions in asset portfolios; then

[1]The monetary base is derived from a consolidated monetary balance sheet of the Federal Reserve and the Treasury. See Leonall C. Andersen and Jerry L. Jordan, "The Monetary Base: Explanation and Analytical Use," in the August 1968 issue of this *Review*. Since the uses of the base are bank reserves plus currency held by the public, it is often called "demand debt of the Government." See James Tobin, "An Essay on Principles of Debt Management," in *Fiscal and Debt Management Policies*, The Commission on Money and Credit, Prentice-Hall, Inc., Englewood Cliffs, N.J., 1963. In some analyses, Tobin includes short-term government debt outstanding in the monetary base.

Exhibit 2
Stabilization Actions and Their Measurement

Stabilization actions

1. Monetary Actions

Federal Reserve System
- a. open market transactions.
- b. discount rate changes.
- c. reserve requirement changes.

Treasury
- a. changes in cash holdings.
- b. changes in deposits at Reserve banks.
- c. changes in deposits at commercial banks.
- d. changes in Treasury currency outstanding.

2. Fiscal Actions

Government spending programs.
Government taxing provisions.

Frequently used measurements of actions

1. Monetary Actions

Monetary base.[1]
Money stock, narrowly defined.[1]
Money plus time deposits.
Commercial bank credit.
Private demand deposits.

2. Fiscal Actions

High-employment expenditures.[1]
High-employment receipts.[1]
High-employment surplus.[1]
Weighted high-employment expenditures.
Weighted high-employment receipts.
Weighted high-employment surplus.
National income account expenditures.
National income account receipts.
Autonomous changes in government tax rates.
Net government debt outside of agencies and trust funds.

[1]Tests based on these measures are reported in this article. The remaining measures were used in additional tests. These results are available on request.

finally, total spending is affected. Interest rates, according to this latter school, are the key part of the transmission mechanism, influencing decisions to hold money versus alternative financial assets as well as decisions to invest in real assets. The influence of changes in the money stock on economic activity, within the modern quantity theory framework, has already been discussed in the previous paragraph.[2]

The monetary base, as noted, plays an important role in both the portfolio and the modern quantity theory approaches to monetary theory. However, there remains considerable controversy regarding the role of money in determining economic activity, ranging from "money does not matter" to "money is the dominant factor." In recent years there has been a general acceptance that money, among many other influences, is important. Thomas Mayer, in a recent book, summarizes this controversy. He concludes:

> All in all, much recent evidence supports the view that the stock of money and, therefore, monetary policy, has a substantial effect. Note, however, that this reading of the evidence is by no means acceptable to all economists. Some, professor Friedman and Dr. Warburton for example, argue that changes in the stock of money do have a dominant effect on income, at least in the long run, while others such as Professor Hansen believe that changes in the stock of money are largely offset by opposite changes in velocity.[3]

The theories aside, changes in the monetary base and changes in the money stock are frequently used as measures of monetary actions. This article, in part, tests the use of these variables for this purpose. Money is narrowly defined as the nonbank public's holdings of demand deposits plus currency. Changes in the money stock mainly reflect movements in the monetary base; however, they also reflect decisions of commercial banks to hold excess reserves, of the nonbank public to hold currency and time deposits, and of the Treasury to hold demand deposits at commercial banks. The monetary base reflects monetary actions of

[2]Also see Leonall C. Andersen and Jerry L. Jordan, "Money in a Modern Quantity Theory Framework" in the December 1967 issue of this *Review*. For an excellent analysis of these three monetary views see David I. Fand, "Keynesian Monetary Theories, Stabilization Policy and the Recent Inflation," a paper presented to the Conference of University Professors, Ditchley Park, Oxfordshire, England, Sept. 13, 1968.

[3]Thomas Mayer, *Monetary Policy in the United States*, Random House, NY, 1968, pp. 148–49.

the Federal Reserve, and to a lesser extent, those of the Treasury and gold flows. But changes in the base have been found to be dominated by actions of the Federal Reserve.[4]

Other aggregate measures, such as money plus time deposits, bank credit and private demand deposits, are frequently used as monetary indicators (exhibit 2). Tests using these indicators were also made. The results of these tests did not change the conclusions reached in this article; these results are available on request. Market interest rates are not used in this article as strategic monetary variables since they reflect, to a great extent, fiscal actions, expectations, and other factors which cannot properly be called monetary actions.

Fiscal Actions

The influence of fiscal actions on economic activity is frequently measured by federal government spending, changes in federal tax rates, or federal budget deficits and surpluses. The textbook Keynesian view has been reflected in many popular discussions of fiscal influence. The portfolio approach and the modern quantity theory suggest alternative analyses of fiscal influence.

The elementary textbook Keynesian view concentrates almost exclusively on the direct influence of fiscal actions on total spending. Government spending is a direct demand for goods and services. Tax rates affect disposable income, a major determinant of consumer spending, and profits of businesses, a major determinant of investment spending. Budget surpluses and deficits are used as a measure of the net direct influence of spending and taxing on economic activity. More advanced textbooks also include an indirect influence of fiscal actions on economic activity through changes in market interest rates. In either case, little consideration is generally given to the method of financing expenditures.

The portfolio approach as developed by Tobin attributes to fiscal actions both a direct influence on economic activity and an indirect influence. Both influences take into consideration the financing of government expenditures.[5] Financing of expenditures by issuance of demand debt of monetary authorities (the monetary base) results in the full Keynesian multiplier effect. Financing by either taxes or borrowing from the public has a smaller multiplier effect on spending. Tobin views this direct influence as temporary.

The indirect influence of fiscal actions, according to Tobin, results from the manner of financing the government debt, that is, variations in the relative amounts of demand debt, short-term debt, and long-term debt. For example, an expansionary move would be a shift from long-term to short-term debt or a shift from short-term to demand debt. A restrictive action would result from a shift in the opposite direction. As in the case of monetary actions, market interest rates on financial assets and their influence on investment spending make up the transmission mechanism.

The modern quantity theory also suggests that the influence of fiscal actions depends on the method of financing government expenditures. This approach maintains that financing expenditures by either taxing or borrowing from the public involves a transfer of command over resources from the public to the government. However, the net influence on total spending resulting from interest rate and wealth changes is ambiguous. Only a deficit financed by the monetary system is necessarily expansionary.[6]

High-employment budget concepts have been developed as measures of the influence of fiscal actions on economic activity.[7] In these budget concepts, expenditures include both those for goods and services and those for transfer payments, adjusted for the influence of economic activity. Receipts, similarly adjusted, primarily reflect legislated changes in federal government tax rates, including Social Security taxes.

---

[4]For a discussion of these points, see: Karl Brunner, "The Role of Money and Monetary Policy," in the July 1968 issue of this *Review*.

[5]Tobin, pp. 143–213.

[6]The importance of not overlooking the financial aspects of fiscal policy is emphasized by Carl F. Christ in "A Simple Macroeconomic Model with a Government Budget Restraint," *Journal of Political Economy*, Vol. 76, No. 1, January/February 1968, pp. 53–67. Christ summarizes (pages 53 and 54) that "the multiplier effect of a change in government purchases cannot be defined until it is decided how to finance the purchases, and the value of the multiplier given by the generally accepted analysis [which ignores the government budget restraint] is in general incorrect . . . (the) multiplier effect of government purchases may be greater or less than the value obtained by ignoring the budget restraint, depending on whether the method of financing is mainly by printing money or mainly by taxation."

[7]See Keith M. Carlson, "Estimates of the High-Employment Budget: 1947–1967," in the June 1967 issue of this *Review*. The high-employment budget concept was used in the *Annual Report of the Council of Economic Advisers* from 1962 to 1966. For a recent analysis using the high-employment budget, see "Federal Fiscal Policy in the 1960s," *Federal Reserve Bulletin*, September 1968, pp. 701–18. According to this article, "the concept does provide a more meaningful measure of the Federal budgetary impact than the published measures of actual Federal surplus or deficit taken by themselves."

The net of receipts and expenditures is used as a net measure of changes in expenditure provisions and in tax rates. These high-employment concepts are used in this article as measures of fiscal actions (exhibit 2). Tests were also made alternatively using national income account government expenditures and receipts, a series measuring autonomous changes in government tax rates, a weighted high-employment expenditure and receipt series, and a series of U. S. government debt held by the public plus Federal Reserve holdings of U. S. government securities. These tests did not change the conclusions reached in this article. Results of these tests are available on request.

Other Influences

Measures of other independent forces which influence economic activity are not used in this article. Yet this should not be construed to imply that these forces are not important. It is accepted by all economists that the non-monetary and non-fiscal forces listed in exhibit 1 have an important influence on economic activity. However, recognition of the existence of these "other forces" does not preclude the testing of propositions relating to the relative importance of monetary and fiscal forces. The analysis presented in this study provides indirect evidence bearing on these "other forces." The interested reader is encouraged to read the technical note presented in the appendix to this article before proceeding.

TESTING THE PROPOSITIONS

This section reports the results of testing the three propositions under consideration. First, the concept of testing a hypothesis is briefly discussed. Next, the results of regression analyses which relate the measures of fiscal and monetary actions to total spending are reported. Finally, statistics developed from the regression analyses are used to test the specific propositions.

The Concept of Testing a Hypothesis

In scientific methodology, testing a hypothesis consists of the statement of the hypothesis, deriving by means of logic testable consequences expected from it, and then taking observations from past experience which show the presence or absence of the expected consequences. If the expected consequences do not occur, then the hypothesis is said to be "not confirmed" by the evidence. If, on the other hand, the expected consequences occur, the hypothesis is said to be "confirmed."

It is important to keep the following point in mind. In scientific testing, a hypothesis (or conjecture) may be found "not confirmed" and therefore refuted as the explanation of the relationship under examination. However, if it is found to be "confirmed," the hypothesis cannot be said to have been proven true. In the latter case, however, the hypothesis remains an acceptable proposition of a real world relationship as long as it is found to be "confirmed" in future tests.[8]

The results presented in this study all bear on what is commonly called a "reduced form" in economics. A reduced-form equation is a derivable consequence of a system of equations which may be hypothesized to represent the structure of the economy (i.e., a so-called structural model). In other words, all of the factors and causal relations which determine total spending (GNP) are "summarized" in one equation. This reduced-form equation postulates a certain relationship over time between the independent variables and the dependent variable — total spending. Using appropriate statistical procedures and selected measures of variables, it is possible to test whether or not the implications of the reduced-form equation have occurred in the past. If the implied relationships are not confirmed, then the relationship asserted by the reduced-form equation is said to have been refuted. However, not confirming the reduced form does not necessarily mean that the whole "model," and all of the factors and causal relations contained in it, are denied. It may be only that one or more of the structural linkages of the model is incorrect, or that the empirical surrogates chosen as measures of monetary or fiscal influence are not appropriate.[9]

Frequently one encounters statements or conjectures regarding factors which are asserted to influence economic activity in a specific way. These statements take the form of reduced-form equations, and are sometimes attributed to various theories of the determination of economic activity. As stated previously, this study does not attempt to test the causal linkages by which fiscal and monetary actions influence total spending, but is concerned only with the confirma-

[8]For a detailed discussion of testing hypotheses in reference to monetary actions, see Albert E. Burger and Leonall C. Andersen, "The Development of Testable Hypotheses for Monetary Management," a paper presented at the annual meeting of the Southern Finance Association, November 8, 1968. It will appear in a forthcoming issue of the *Southern Journal of Business*, University of Georgia, Athens, Georgia.

[9]A more specific statement relating to these considerations is presented in the appendix.

tion or refutation of rival conjectures regarding the strength and reliability of fiscal and monetary actions based on frequently used indicators of such actions.

Measuring the Empirical Relationships

As a step toward analyzing the three propositions put forth earlier, empirical relationships between the measures of fiscal and monetary actions and total spending are established. These relationships are developed by regressing quarter-to-quarter changes in GNP on quarter-to-quarter changes in the money stock (M) and in the various measures of fiscal actions: high-employment budget surplus (R-E), high-employment expenditures (E), and high-employment receipts (R). Similar equations were estimated where changes in the monetary base (B) were used in place of the money stock.

Changes in all variables were computed by two methods. Conventional first differences were calculated by subtracting the value for the preceding quarter from the value for the present quarter.[10] The other method used is an averaging procedure used by Kareken and Solow called central differences.[11] The structure of lags present in the regressions was estimated with use of the Almon lag technique.[12] The data are seasonally adjusted quarterly averages for the period from the first quarter of 1952 to the second quarter of 1968.[13]

As discussed previously, statements are frequently made from which certain relationships are expected to exist between measures of economic activity on the one hand and measures of monetary and fiscal actions on the other hand. Such relationships consist of a direct influence of an action on GNP and of an indirect influence which reflects interactions among the many markets for real and financial assets. These interactions work through the market mechanism determining the dependent variables listed in exhibit 1. The postulated relationships are the total of these direct and indirect influences. Thus, the empirical relationship embodied in each regression coefficient is the *total* response (including both direct and indirect responses) of GNP to changes in each measure of a stabilization action, assuming all other forces remain constant.

The results presented here do not provide a basis for separating the direct and indirect influences of monetary and fiscal forces on total spending, but this division is irrelevant for the purposes of this article. The interested reader is referred to the appendix for further elaboration of these points.

Using the total response concept, changes in GNP are expected to be positively related to changes in the money stock (M) or changes in the monetary base (B). With regard to the high-employment surplus (receipts minus expenditures), a larger surplus or a smaller deficit is expected to have a negative influence on GNP, and conversely. Changes in high-employment expenditures (E) are expected to have a positive influence and changes in receipts (R) are expected to have a negative influence when these variables are included separately.

Considering that the primary purpose of this study is to measure the influence of a few major forces on changes in GNP, rather than to identify and measure the influences of all independent forces, the results obtained are quite good (table 1). The R^2 statistic, a measure of the percent of the variance in changes in GNP explained by the regression equation, ranges from .53 to .73; these values are usually considered to be quite good when first differences are used rather than levels of the data. All of the estimated regression coefficients for changes in the money stock or the monetary base have the signs implied in the above discussion (equations 1.1 to 2.4 in table 1) and have a high statistical significance in most cases. The estimated coefficients for the high-employment measures of fiscal influence do not have the expected signs in all cases and generally are of low statistical significance.

[10]Changes in GNP, R, and E are quarterly changes in billions of dollars measured at annual rates, while changes in M and B are quarterly changes in billions of dollars. Changes in GNP, R, and E are changes in flows, whereas changes in M and B are changes in a stock. Since all of the time series have strong trends, first differences tend to increase in size over time. Statistical considerations indicate that percent first differences would be more appropriate. On the other hand, regular first differences provide estimates of multipliers which are more useful for the purposes of this study. Test regressions of relative changes were run and they did not alter the conclusions of this article.

[11]John Kareken and Robert M. Solow, "Lags in Monetary Policy" in *Stabilization Policies* of the research studies prepared for the Commission on Money and Credit, Prentice-Hall, Inc., 1962, pp. 18–21.

[12]Shirley Almon, "The Distributed Lag Between Capital Appropriations and Expenditures," *Econometrica*, Vol. 33, No. 1, January 1965, pp. 178–96.

[13]As a test for structural shifts, the test period was divided into two equal parts and the regressions reported here were run for each sub-period and for the whole period. The Chow test for structural changes accepted the hypothesis that the sets of parameters estimated for each of the sub-periods were not different from each other or from those estimated for the whole period, at the five percent level of significance. As a result, there is no evidence of a structural shift; consequently, the whole period was used.

Table 1

Regression of Changes in GNP on Changes in Monetary and Fiscal Actions

First Differences	(Equation 1.1) ΔM	(Equation 1.1) Δ(R-E)	(Equation 1.2) ΔM	(Equation 1.2) ΔE	(Equation 1.2) ΔR	(Equation 1.3) ΔM	(Equation 1.3) ΔE	(Equation 1.4) ΔB	(Equation 1.4) ΔE	(Equation 1.4) ΔR
t	1.57*	−.15	1.51*	.36	.16	1.54*	.40	1.02	.23	.52
	(2.17)	(.65)	(2.03)	(1.15)	(.53)	(2.47)	(1.48)	(.49)	(.67)	(1.68)
t-1	1.94*	−.20	1.59*	.53*	−.01	1.56*	.54*	5.46*	.37	.02
	(3.60)	(1.08)	(2.85)	(2.15)	(.03)	(3.43)	(2.68)	(3.37)	(1.36)	(.07)
t-2	1.80*	.10	1.47*	−.05	−.03	1.44*	−.03	6.48*	−.21	−.17
	(3.37)	(.55)	(2.69)	(.19)	(.10)	(3.18)	(.13)	(4.10)	(.84)	(.64)
t-3	1.28	.47*	1.27	−.78*	.11	1.29*	−.74*	3.05	−.93*	.14
	(1.88)	(1.95)	(1.82)	(2.82)	(.32)	(2.00)	(2.85)	(1.54)	(3.10)	(.39)
Sum	6.59*	.22	5.84*	.07	.23	5.83*	.17	16.01*	−.54	.51
	(7.73)	(.45)	(6.57)	(.13)	(.32)	(7.25)	(.54)	(5.67)	(.89)	(.67)
Constant	1.99*		2.10			2.28*		1.55		
	(2.16)		(1.88)			(2.76)		(1.22)		
R^2	.56		.58			.60		.53		
SE	4.24		4.11			4.01		4.35		
DW	1.54		1.80			1.78		1.71		

Central Differences	(Equation 2.1) ΔM	(Equation 2.1) Δ(R-E)	(Equation 2.2) ΔM	(Equation 2.2) ΔE	(Equation 2.2) ΔR	(Equation 2.3) ΔM	(Equation 2.3) ΔE	(Equation 2.4) ΔB	(Equation 2.4) ΔE	(Equation 2.4) ΔR
t	1.50	−.24	1.58*	.53	.32	1.54*	.63*	.61	.28	.87*
	(1.84)	(.91)	(2.01)	(1.52)	(1.05)	(2.45)	(2.21)	(.28)	(.73)	(2.55)
t-1	2.11*	−.23	1.57*	.60*	−.04	1.63*	.59*	5.42*	.50	−.07
	(3.61)	(1.16)	(2.78)	(2.44)	(.17)	(3.57)	(2.61)	(3.16)	(1.87)	(.27)
t-2	1.89*	.15	1.41*	−.15	−.11	1.43*	−.16	6.87*	−.27	−.33
	(3.18)	(.81)	(2.45)	(.60)	(.47)	(3.16)	(.71)	(3.92)	(1.04)	(1.31)
t-3	1.06	.52	1.26	−.96*	.18	1.13	−.86*	3.51	−1.26*	.35
	(1.36)	(1.90)	(1.72)	(3.15)	(.48)	(1.71)	(3.07)	(1.71)	(3.65)	(.87)
Sum	6.56*	.21	5.80*	.02	.34	5.74*	.19	16.41*	−.75	.82
	(8.16)	(.47)	(7.57)	(.04)	(.54)	(8.45)	(.77)	(6.95)	(1.37)	(1.16)
Constant	2.02*		2.00*			2.30*		1.24		
	(2.48)		(2.14)			(3.55)		(1.14)		
R^2	.66		.72			.73		.67		
SE	3.35		3.03			2.97		3.26		
DW	.88		1.14			1.13		1.05		

Note: Regression coefficients are the top figures, and their "t" values appear below each coefficient enclosed by parentheses. The regression coefficients marked by an asterisk (*) are statistically significant at the 5 percent level. R^2 are adjusted for degrees of freedom. SE is the standard error of the estimate, and DW is the Durbin-Watson statistic.

These regression results are discussed in greater detail below.

Money and the monetary base — The total response of GNP to changes in money or the monetary base distributed over four quarters is consistent with the postulated relationship (i.e., a positive relationship), and the coefficients are all statistically significant. The coefficients of each measure of monetary action may be summed to provide an indication of the overall response of GNP to changes in monetary actions. These summed coefficients are also statistically significant and consistent with the postulated relationships. The results obtained for measures of monetary actions were not affected significantly when measures of fiscal actions other than those reported here were used in the regressions.

High-employment budget surplus — As pointed out previously, the high-employment surplus or deficit is often used as a measure of the direction and strength of fiscal actions. Equation 1.1 summarizes the total response of GNP to changes in money and changes in the high-employment surplus. The coef-

ficients of the high-employment surplus estimated for the contemporaneous and first lagged quarter have the expected sign, but the coefficients are of very low statistical significance and do not differ significantly from zero. The signs of the coefficients estimated for the second and third lagged quarters are opposite to the expected signs. The sum of the coefficients (total response distributed over four quarters) is estimated to have a positive sign (opposite the postulated sign) but is not statistically significant. These results provide no empirical support for the view that fiscal actions measured by the high-employment surplus have a significant influence on GNP. In principle, these results may have occurred either because the high-employment surplus was not a good measure of fiscal influence, or because fiscal influence was not important during the sample period.[14]

Expenditures and receipts — Simple textbook Keynesian models of income determination usually demonstrate, theoretically, that changes in tax rates exert a negative influence on economic activity, while changes in government expenditures exert a positive influence. Equations 1.2 and 1.3 provide tests of these propositions. The signs of the coefficients estimated for tax receipts are the same as the hypothesized signs for only the first and second lagged quarters. However, since these coefficients (individually and the sums) are of low statistical significance, no importance can be attached to this variable. Inclusion of changes in receipts (ΔR) in equation 1.2 does not improve the overall results, in terms of R^2 and the standard error of estimate, compared with equation 1.3 from which receipts are excluded.

These results provide no support for theories which indicate that changes in tax receipts due to changes in tax rates exert an overall negative (or any) influence on economic activity. The results are consistent with theories which indicate that if the alternative to tax revenue is borrowing from the public in order to finance government spending, then the influence of spending will not necessarily be greater if the funds are borrowed rather than obtained through taxation. They are also consistent with the theory that consumers will maintain consumption levels at the expense of saving when there is a temporary reduction in disposable income.

The signs of the coefficients estimated for high-employment expenditures in equations 1.2 and 1.3 indicate that an increase in government expenditures is mildly stimulative in the quarter in which spending is increased and in the following quarter. However, in the subsequent two quarters this increase in expenditures causes offsetting negative influences. The overall effect of a change in expenditures distributed over four quarters, indicated by the sum, is relatively small and not statistically significant. These results are consistent with modern quantity theories which hold that government spending, taxing, and borrowing policies would have, through interest rate and wealth effects, different impacts on economic activity under varying circumstances.[15]

Three Propositions Tested

The empirical relationships developed relating changes in GNP to changes in the money stock and changes in high-employment expenditures and receipts are used to test the three propositions under consideration. The results of testing the propositions using changes in the money stock are discussed in detail in this section. Similar results are reported in the accompanying tables using changes in the monetary base instead of the money stock. Conclusions drawn using either measure of monetary actions are similar.

Proposition I states that fiscal actions exert a larger influence on economic activity than do monetary actions. A test of this proposition involves an examination of the size of the regression coefficients for high-employment expenditures relative to those for money and the monetary base.[16] Proposition I implies that the

[14]It was suggested to the authors that a weighted high-employment budget surplus might be a better measure of fiscal influence than the usual unweighted series. For an elaboration of such a weighted series, see Edward M. Gramlich, "Measures of the Aggregate Demand Impact of the Federal Budget," in *Staff Papers of the President's Commission on Budget Concepts*, U.S. Government Printing Office, Washington, D.C., October 1967. Gramlich provided weights from the FRB-MIT model of the economy for constructing a weighted series. It was further suggested that the level of the high-employment budget surplus was a more appropriate measure of fiscal actions. Coefficients of fiscal influence were estimated using both changes in the weighted series, and levels of the high-employment surplus. The results did not change any of the conclusions of this article.

[15]John Culbertson points out that in a financially constrained economy (i.e., no monetary expansion to finance government expenditures), expenditures by the government financed in debt markets in competition with private expenditures can very possibly "crowd out of the market an equal (or conceivably even greater) volume that would have financed private expenditures." He asserts that it is possible to have a short-lived effect of government spending on total spending if the financial offsets lag behind its positive effects. The results obtained for ΔE in this article are consistent with his analysis. See John M. Culbertson, *Macroeconomic Theory and Stabilization Policy*, McGraw-Hill, Inc., New York, 1968, pp. 462–63.

[16]Since little response of GNP to ΔR was found, further discussions consider only ΔE.

Table 2
Measurements of the Relative Importance of Monetary and Fiscal Actions

	Beta Coefficients						Partial Coefficients of Determination					
Quarter	ΔM	ΔE	ΔR	ΔB	ΔE	ΔR	ΔM	ΔE	ΔR	ΔB	ΔE	ΔR
First Differences (equations 1.2 and 1.4)												
t	.24	.14	.05	.06	.09	.16	.07	.02	.01	*	.01	.05
t-1	.26	.20	*	.31	.14	.01	.14	.08	*	.18	.03	*
t-2	.24	−.02	−.01	.37	−.08	−.05	.12	*	*	.24	.01	.01
t-3	.20	−.30	.03	.17	−.36	.04	.06	.13	*	.04	.16	*
Sum	.94	.02	.07	.91	−.21	.16	.45	*	*	.38	.02	.01
Central Differences (equations 2.2 and 2.4)												
t	.26	.20	.09	.04	.11	.25	.07	.04	.02	*	.01	.11
t-1	.26	.23	−.01	.31	.19	−.02	.13	.10	*	.16	.06	*
t-2	.23	−.06	−.03	.40	−.10	−.09	.11	.01	*	.23	.02	.03
t-3	.20	−.36	.05	.20	−.47	.10	.05	.16	*	.05	.21	.01
Sum	.95	.01	.10	.95	−.27	.24	.53	*	.01	.49	.04	.03

*Less than .005.

coefficients for ΔE would be larger, without regard to sign, than those for ΔM and ΔB.

The coefficients presented in table 1 are not appropriate for this test because the variables have different time dimensions and are a mixture of stocks and flows. An appropriate measure is developed by changing these regression coefficients to "beta coefficients" which eliminate these difficulties (table 2). These coefficients take into consideration the past variation of changes in each independent variable relative to the past variation of changes in GNP.[17] The size of beta coefficients may be, therefore, directly compared as a measure of the relative contribution of each variable to variations in GNP in the test period.

According to table 2, the beta coefficients for changes in money are greater than those for changes in high-employment expenditures for the quarter in which a change occurs and during the two following quarters. The coefficients for changes in the monetary base are greater for the two quarters immediately following a change in the base. In the lagged quarters in which the beta coefficients for ΔE are largest, a negative sign is associated with the regression coefficient, indicating a lagged contractionary effect of increased expenditures. As a measure of the total contribution over the four quarters, the sum of the beta coefficients for changes in money and the monetary base are much greater than those for changes in expenditures.

Proposition I may also be tested by the use of partial coefficients of determination. These statistics are measures of the percent of variation of the dependent variable remaining after the variation accounted for by all other variables in the regression has been subtracted from the total variation. Proposition I implies that larger coefficients should be observed for fiscal actions than for monetary actions. Table 2 presents the partial coefficients of determination for the variables under consideration. For the quarter of a change and the subsequent two quarters, these coefficients for ΔM are much greater than those for ΔE. With regard to ΔB, the coefficients are about equal to those for ΔE in the first quarter and are much greater in the two subsequent quarters. The partial coefficients of determination for the total contribution of each policy variable to changes in GNP over four quarters may be developed. Table 2 shows that the partial coefficients of determination for the overall response of ΔGNP to ΔM and ΔB range from .38 to .53, while those for ΔE are virtually zero.

Other implications of the results presented in table 1 may be used to test further the relative strength of the response of GNP to alternative government actions

[17]Arthur S. Goldberger, *Econometric Theory*. John Wiley & Sons, Inc., December 1966, New York, pp. 197–200.

Table 3

Simulated Response of an Increase in Government Expenditures Financed by Monetary Expansion (millions of dollars)

	Increase in Government Expenditures			Required Increase in Money			Total Response in GNP	
Quarter	Change in Expenditures	Impact Effect on GNP	Cumulative Effect on GNP	Change in Money Stock	Impact Effect on GNP	Cumulative Effect on GNP	Impact Effect on GNP	Cumulative Effect on GNP
1	$1000	$400	$400	$250	$ 385	$ 385	$ 785	$ 785
2	0	540	940	250	775	1160	1315	2100
3	0	− 30	910	250	1135	2295	1105	3205
4	0	− 740	170	250	1458	3753	718	3923
5	− 1000	− 400	− 230	0	1072	4825	672	4595
6	0	− 540	− 770	0	682	5507	142	4737
7	0	30	− 740	0	323	5830	353	5090
8	0	740	0	0	0	5830	740	5830

under conditions where "other things" are held constant. Three alternative actions are assumed taken by stabilization authorities: (1) the rate of government spending is increased by $1 billion and is financed by either borrowing from the public or increasing taxes; (2) the money stock is increased by $1 billion with no change in the budget position; and (3) the rate of government spending is increased by $1 billion for a year and is financed by increasing the money stock by an equal amount.

The impact on total spending of the first two actions may be measured by using the sums of the regression coefficients presented for equation 1.3. A $1 billion increase in the rate of government spending would, after four quarters, result in a permanent increase of $170 million in GNP. By comparison, an increase of the same magnitude in money would result in GNP being $5.8 billion permanently higher after four quarters.

The results of the last action are presented in table 3.[18] The annual rate of government spending is assumed to be increased by $1 billion in the first quarter and held at that rate for the following three quarters. This would require an increase in money of $250 million during each of the four quarters to finance the higher level of expenditures. Since we are interested only in the result of financing the original increase in expenditures by monetary expansion, expenditures must be reduced by $1 billion in the fifth quarter. If expenditures were held at the higher rate, money would have to continue to grow at $250 million per quarter. According to table 3, GNP would rise to a permanent level $5.8 billion higher than at the beginning. This increase in GNP results entirely from monetary expansion.

According to these three tests, the regression results implied by Proposition I did not occur. Therefore, the proposition that the response of total demand to fiscal actions is greater than that of monetary actions is not confirmed by the evidence.

Proposition II holds that the response of economic activity to fiscal actions is more predictable than the response to monetary influence. This implies that the regression coefficients relative to their standard errors (this ratio is called the "t-value"), relating changes in E to changes in GNP, should be greater than the corresponding measures for changes in M and in B. The greater the t-value, the more confidence there is in the estimated regression coefficient, and hence, the greater is the reliability of the estimated change in GNP resulting from a change in the variable. These t-values are presented in table 4.

An examination of this table indicates greater t-values for the regression coefficients of the two monetary variables than for the fiscal variable, except for the third quarter after a change. Also, the t-values for the

[18]The authors wish to give special thanks to Milton Friedman for suggesting this illustration and table 3. However, the formulation presented here is the sole responsibility of the authors.

Table 4

Measurement of Reliability of the Response of GNP to Monetary and Fiscal Actions ("t-values" of regression coefficients[1])

Quarter	ΔM	ΔE	ΔR	ΔB	ΔE	ΔR
First Differences						
t	2.03	1.15	0.53	0.49	0.67	1.68
t-1	2.85	2.15	0.03	3.37	1.36	0.07
t-2	2.69	0.19	0.10	4.10	0.84	0.64
t-3	1.82	2.82	0.32	1.54	3.10	0.39
Sum	6.57	0.13	0.32	5.67	0.89	0.67
Central Differences						
t	2.01	1.52	1.05	0.28	0.73	2.55
t-1	2.78	2.44	0.17	3.16	1.87	0.27
t-2	2.45	0.60	0.46	3.92	1.04	1.31
t-3	1.72	3.15	0.48	1.71	3.65	0.87
Sum	7.57	0.04	0.54	6.95	1.37	1.16

[1]t-values associated with equations 1.2, 1.4, 2.2 and 2.4 in table 1.

sum of the regression coefficients for ΔM and ΔB are large, while those for ΔE are not statistically significant from zero. Since the regression results implied by Proposition II did not appear, the proposition is not confirmed.

Proposition III states that the influence of fiscal actions on economic activity occurs faster than that of monetary actions. It is tested by examining the characteristics of the lag structure in the regressions. Proposition III implies that beta coefficients for ΔE should be greater than those for ΔM in the quarter of a change and in those immediately following. It also implies that the main response of GNP to fiscal actions occurs within fewer quarters than its response to monetary actions.

The beta coefficients are plotted in the charts.[19] A change in the money stock induces a large and almost equal response in each of the four quarters. The largest response of GNP to changes in the monetary base occurs in the first and second quarters after a change. The beta coefficients for changes in M are greater than those for changes in E for the quarter of a change and the following quarter, indicating comparatively smaller response of GNP to fiscal actions in these first two quarters. Moreover, the largest coefficient for ΔE occurs for the third quarter after a change.

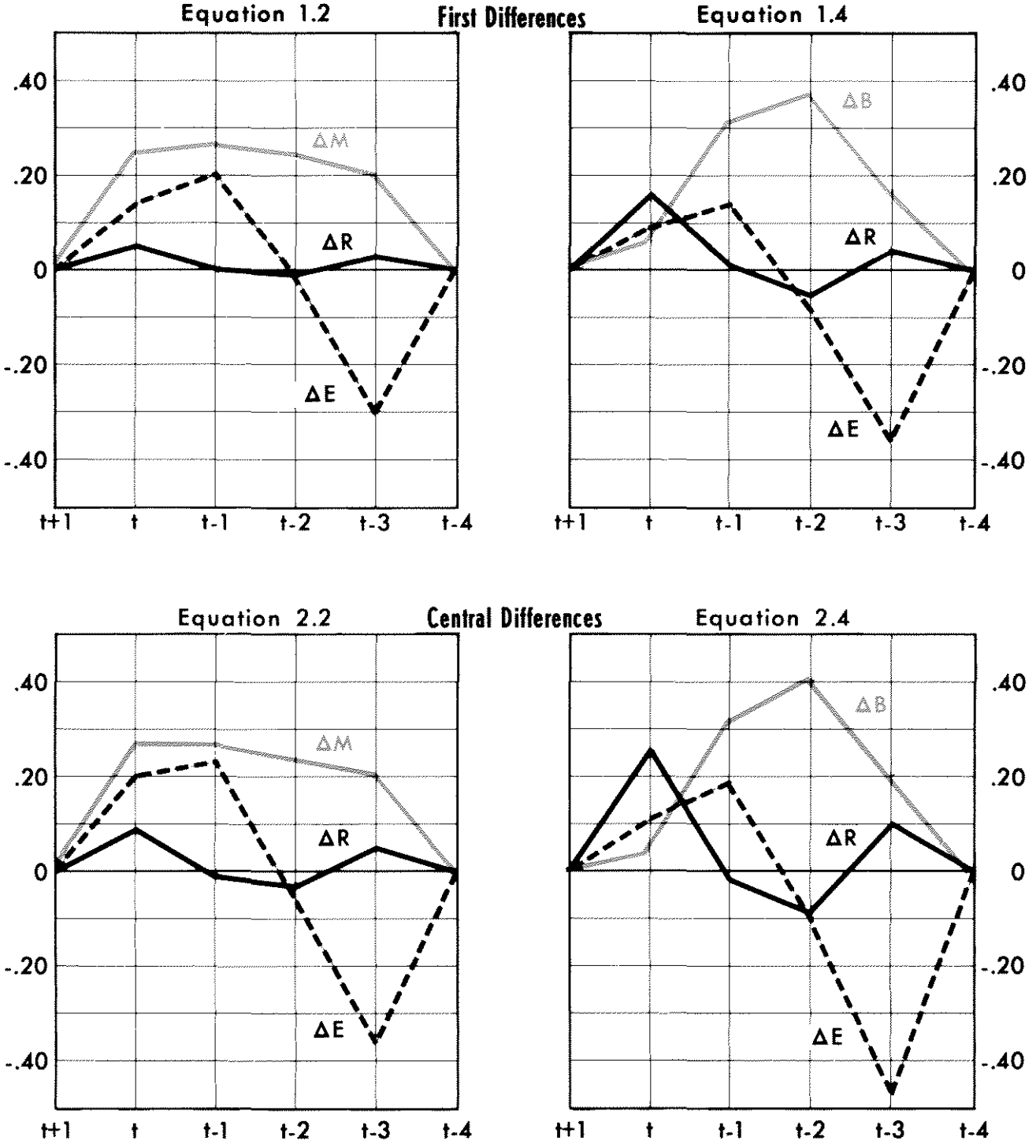
The expected regression results implied by Proposition III were not found. Therefore, the proposition that the major impact of fiscal influence on economic activity occurs within a shorter time interval than monetary influence is not confirmed.

Summary — This section tested the propositions that the response of economic activity to fiscal actions relative to monetary actions is (I) larger, (II) more predictable and (III) faster. The results of the tests were not consistent with any of these propositions. Consequently, either the commonly used measures of fiscal influence do not correctly indicate the degree and direction of such influence, or there was no measurable net fiscal influence on total spending in the test period.

The test results are consistent with an alternative set of propositions. The response of economic activity to monetary actions compared with that of fiscal actions is (I′) larger, (II′) more predictable, and (III′) faster. It should be remembered that these alternative

[19]The Almon lag structure was developed by using a fourth degree polynomial and constraining the coefficients for t-4 to zero. The regressions indicate that four quarters constitute an appropriate response period for both fiscal and monetary actions. Equations using up to seven lagged quarters were also estimated, but there was little response in GNP to fiscal and monetary actions beyond the three quarter lags reported.

Measures of Lag Response



Beta coefficients are for changes in the money stock (ΔM), the monetary base (ΔB), high-employment expenditures (ΔE), and high-employment receipts (ΔR). These beta coefficients are calculated as the products of the regression coefficient for the respective variables times the ratio of the standard deviation of the variable to the standard deviation of GNP.

propositions have not been proven true, but this is always the case in scientific testing of hypothesized relationships. Nevertheless, it is asserted here that these alternative propositions are appropriate for the conduct of stabilization policy until evidence is presented proving one or more of them false.

There is a major qualification to these statements. Since the propositions were tested using the period first quarter 1952 to second quarter 1968, it is implicitly assumed in making these statements that the general environment prevailing in the test period holds for the immediate future.

Implications for Economic Stabilization Policy

Rejection of the three propositions under examination and acceptance of the alternatives offered carry important implications for the conduct of economic stabilization policy. All of these implications point to the advisability of greater reliance being placed on monetary actions than on fiscal actions. Such a reliance would represent a marked departure from most present procedures.

The finding that statements which assert that changes in tax rates have a significant influence on total spending are not supported by this empirical investigation suggests that past efforts in this regard have been overly optimistic. Furthermore, the finding that the response of total spending to changes in government expenditures is small compared with the response of spending to monetary actions strongly suggests that it would be more appropriate to place greater reliance on the latter form of stabilization action.

Finding of a strong empirical relationship between economic activity and either of the measures of monetary actions points to the conclusion that monetary actions can and should play a more prominent role in economic stabilization than they have up to now. Furthermore, failure to recognize these relationships can lead to undesired changes in economic activity because of the relatively short lags and strong effects attributable to monetary actions.

Evidence was found which is consistent with the proposition that the influence of monetary actions on economic activity is more certain than that of fiscal actions. Since monetary influence was also found to be stronger and to operate more quickly than fiscal influence, it would appear to be inappropriate, for stabilization purposes, for monetary authorities to wait very long for a desired fiscal action to be adopted and implemented.

Evidence found in this study suggests that the money stock is an important indicator of the total thrust of stabilization actions, both monetary and fiscal. This point is argued on two grounds. First, changes in the money stock reflect mainly what may be called discretionary actions of the Federal Reserve System as it uses its major instruments of monetary management — open market transactions, discount rate changes, and reserve requirement changes. Second, the money stock reflects the joint actions of the Treasury and the Federal Reserve System in financing newly created government debt. Such actions are based on decisions regarding the monetization of new debt by Federal Reserve actions, and Treasury decisions regarding changes in its balances at Reserve banks and commercial banks. According to this second point, changes in government spending financed by monetary expansion are reflected in changes in the monetary base and in the money stock.

A number of economists maintain that the major influence of fiscal actions results only if expenditures are financed by monetary expansion. In practice, the Federal Reserve does not buy securities from the Government. Instead, its open market operations and other actions provide funds in the markets in which both the government and private sectors borrow.

The relationships expressed in table 1 may be used to project the expected course of GNP, given alternative assumptions about monetary and fiscal actions. Such projections necessarily assume that the environment in the period used for estimation and the average relationships of the recent past hold in the future. The projections are not able to take into consideration the influences of other independent forces; therefore, they are not suitable for exact forecasting purposes. However, they do provide a useful measure of monetary and fiscal influences on economic activity.

An example of such projections using equation 1.3 is presented in table 5. Equation 1.3 related quarter-to-quarter changes in GNP to changes in the money stock and changes in high-employment expenditures, both distributed over four quarters.

Assumptions used in computing the projections of quarterly changes in GNP reported in table 5 include: (a) high-employment expenditures were projected through the second quarter of 1969 under the assumption that federal spending in fiscal 1969 will be about 5 percent (or $10 billion) greater than fiscal 1968;

Table 5

Projected Change in GNP with Alternative Rates of Change in Money Stock[1]

	Assumed Rates of Change in Money Stock[2]			
Quarter	2%	4%	6%	8%
1968/III[3]	17.9	17.9	17.9	17.9
IV	14.6	16.0	17.5	19.0
1969/I	12.0	15.0	18.0	20.7
II	11.0	15.2	19.4	23.7
III	6.8	12.3	18.0	23.4
IV	8.0	13.7	19.4	25.2

[1]First differences of quarterly data. All variables are in billions of dollars. Projections are based on coefficients of equation 1.3 in table 1.

[2]Assumed alternative rates of change in the money stock from III/68 to IV/69.

[3]Preliminary estimate by the Department of Commerce.

(b) federal spending was assumed to continue increasing at a 5 to 6 percent rate in the first two quarters of fiscal 1970; and (c) quarter-to-quarter changes in the money stock were projected from III/68 to IV/69 for four alternative constant annual growth rates for money: 2 percent, 4 percent, 6 percent, and 8 percent.

The highest growth rate of the money stock (8 percent) indicates continued rapid rates of expansion in GNP during the next five quarters. The slowest growth rate of money (2 percent) indicates some slowing of GNP growth in the fourth quarter of this year and further gradual slowing throughout most of next year.

The projections indicate that if the recent decelerated growth in the money stock (less than 4 percent from July to October) is continued, and growth of government spending is at about the rate indicated above, the economy would probably reach a noninflationary growth rate of GNP in about the third quarter of 1969 and would then accelerate slightly. These projections, of course, make no assumptions regarding the Vietnam War, strikes, agricultural situations, civil disorders or any of the many other noncontrollable exogenous forces.

Appendix[1]

The specific hypothesis underlying the analysis in this study is expressed by the following relation:

(1) $Y = f(E, R, M, Z)$,

where: Y = total spending;
E = a variable summarizing government expenditure actions;
R = a variable summarizing government taxing actions;
M = a variable summarizing monetary actions;
Z = a variable summarizing all other forces that influence total spending.[2]

Expressing this relation in terms of the changes of each variable yields:

(2) $\Delta Y = f(\Delta E, \Delta R, \Delta M, \Delta Z)$.

If this relation (2) were empirically estimated, the following would be obtained:[3]

(3) $\Delta Y = \alpha_1 \Delta E + \alpha_2 \Delta R + \alpha_3 \Delta M + \alpha_4 \Delta Z$,

where the values for α_1, α_2, α_3, and α_4 are estimated by regression of the observed values of ΔY on the observed values of ΔE, ΔR, ΔM, and ΔZ. In (3) the value of the coefficients (α's) are the total response of ΔY to changes in each of the four independent variables.

As discussed in the text, time series for E, R, and M have been selected on the basis of frequently used indicators or measures of fiscal and monetary actions. The purpose of this study was to test some frequently encountered rival conjectures regarding the influence of fiscal and monetary forces on economic activity, not to quantify all forces influencing our economy. Therefore, attention here has been directed toward estimating the magnitude and statistical

[1]The authors would like to give special thanks to Karl Brunner for useful discussion regarding the points made in this note.

[2]See exhibit 1 for a listing of "other forces" which influence total spending.

[3]For purposes of this note the lags of the independent variables are ignored.

reliability of the response of ΔY to ΔE, ΔR, and ΔM. However, ΔZ cannot be simply ignored.

The reader will note that there is no constant term in equation (3) since the effect of "all other forces" influencing spending are summarized by $\alpha_4\Delta Z$. However, in the results reported in table 1 of this study, a constant term is reported for each equation. These constant terms are an estimate of α_4 times the average autonomous non-monetary and non-fiscal forces summarized in Z.

In a complex market economy, it is possible for monetary and fiscal actions to exert an indirect as well as a direct influence on ΔY. This indirect influence would operate through ΔZ. One form of the relation between ΔZ and monetary and fiscal forces is shown by:

$$(4)\quad \Delta Z = b_0 + b_1\Delta E + b_2\Delta R + b_3\Delta M.$$

The empirical values of α_1, α_2 and α_3, which were estimated by regression analysis and reported in this study, embody both the direct and the indirect responses of total spending to monetary and fiscal actions. Using ΔE as an example, the expression $(a_1 + b_1a_4)$ is an estimate of α_1, the total response of ΔY to ΔE. The direct response is a_1, and the indirect response is b_1a_4. Consequently, the equation estimated and reported in this study (for example, equation 1.2 in table 1) is:

$$(5)\quad \Delta Y = b_0a_4 + (a_1+b_1a_4)\Delta E + (a_2+b_2a_4)\Delta R + (a_3+b_3a_4)\Delta M;$$

where b_0a_4 is the "constant" reported in table 1. If it were known that b_1, b_2 and b_3 are zero, it could be concluded that there are no indirect effects of monetary and fiscal forces operating through Z on Y, only direct effects which are measured by a_1, a_2 and a_3. Since this cannot be established conclusively, it cannot be ruled out that ΔZ may include some indirect monetary and fiscal forces influencing economic activity.

The constant term is estimated to be quite large and statistically significant. This provides indirect evidence that ΔZ is explained to some extent by factors other than ΔE, ΔR, and ΔM. The value of b_0a_4 is a measure of the average effect of "other forces" on ΔY, which operate through ΔZ.

As another test of the independence of ΔZ from monetary and fiscal forces, the total time period was divided into two sub-samples and the equations were estimated for these sub-samples. The Chow test (see text) was applied to the sets of regression coefficients estimated from the sub-samples compared to the whole sample; the hypothesis that there were no structural shifts in the time period could not be rejected, implying no change in the size of b_0a_4. If there were a significant indirect influence of ΔE, ΔR, and ΔM operating through ΔZ, b_0a_4 would change along with changes in these independent variables. Since this intercept was found to be stable over the test period, this provides further evidence that ΔZ is influenced by factors other than monetary and fiscal forces.

The results from the sub-samples indicate that there were differences in the relative variability of the independent variables between the two sub-samples. This tends to strengthen the conclusions of this article since the response of ΔGNP to ΔM or ΔB was greater even in the first sub-sample (I/53 to I/60) in which the variability of ΔM and ΔB was smaller than the variability of ΔE and ΔR.