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Further evidence as to the relative effects of monetary versus fiscal policy

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CHAPTER I. INTRODUCTION AND HISTORICAL BACKGROUND

Introduction and Purpose

The purpose of this study is to provide further evidence and clarification of some of the issues implicit in the measurement of the relative impact of discretionary fiscal and discretionary monetary policy. This chapter presents a summary of the body of literature of past evidence and places this study into the historical perspective of past debate on the topic. Specified in Chapter II is a model which was constructed on the basis of three alternative assumptions regarding the selection of an exogenous monetary variable to be used for estimation purposes. Specification of the model in such a manner will provide a clearer insight as to a number of the issues involved in the debate conducted in the past. In addition in the second chapter it will be argued and shown that a misspecification of the fiscal variable in the Andersen and Jordan (1968) model exists which leads to a bias in their results. Chapter III contains the empirical results obtained from the estimation of the reduced forms derived from the model constructed in the previous chapter and contrasts these results with those obtained by previous researchers. Finally, Chapter IV presents the summary and conclusions of the study.

Historical Background

Following the apparent success of the 1964 tax cut, most economists seemed prepared to cast themselves into the Keynesian camp where the effectiveness of fiscal policy was readily accepted. Despite its apparent success, fiscal policy was not fully accepted as the most effective governmental stabilization instrument by all economists. Indeed, under the leadership of Milton Friedman, the "neo-quantity" or "monetarist" school of thought took the position that monetary rather than fiscal policy represented the more effective policy tool.

The Friedman and Meiselman Controversy

In an article prepared for the Commission on Money and Credit in 1963, Milton Friedman and David Meiselman (Friedman and Meiselman, 1963) provided the impetus for a controversy out of which one of the earlier statements of the "monetarists" position can be derived. In this article they attempted to derive a test of the relative usefulness of the Keynesian model and the quantity theorists models.

Viewing the consumption function as the key to the Keynesian system they proceed to construct a Keynesian test on the basis of the consumption function. With consumption as the final demand variable the reduced forms used in their Keynesian test may be derived as follows:

$$NNP = C + \bar{I}_n + \bar{G} + \bar{X} - \bar{Q} \qquad 1.1$$

$$NNP = (Y_d + S_b) + \bar{T}n \qquad 1.2$$

$$C = \emptyset_o + \emptyset_1 (NNP - \bar{T}n) + \epsilon \qquad 1.3$$

and by substitution,

$$C = \frac{\emptyset_o}{1-\emptyset_1} + \frac{\emptyset_1}{1-\emptyset_1} (\bar{I}_n + \bar{G} + \bar{X} - \bar{Q} - \bar{T}n) + \frac{\epsilon}{1-\emptyset_1} \qquad 1.4$$

where,

Y_d = Disposable income

NNP = Net National Product

C = Personal consumption expenditure

I_n = Net private domestic investment

G = Total government purchases of goods and services

X = Exports of goods and services

Q = Imports of goods and services

S_b = Business savings

Tn = Net tax receipts

and the bars indicate the exogenously determined variables. Stated somewhat more precisely, Friedman and Meiselman defined their autonomous expenditures variables as the government fiscal surplus, net exports, and net private domestic investment.

In the Keynesian test the stability of the autonomous expenditures multiplier was viewed as the key to the verification of the Keynesian hypothesis. On the other hand, velocity and its stability was viewed as the key to the verification of the quantity theorists hypothesis. To test the stability of velocity under the quantity theory, the model was specified as:

$$Y = \psi_o + \psi_1 \bar{M} + \mu \qquad 1.5$$

where, $\bar{M}$, the money supply, was broadly defined to include time deposits. To contrast the two theories, 1.5, was reformulated as,

$$C = \psi_o' + \psi_1' \bar{M} + \mu'. \qquad 1.6$$

Friedman and Meiselman's discussion was primarily in terms of the correlation between the autonomous expenditures and the final demand variable and between the money supply and the final demand variable. The conclusions reached were that consumer's expenditures were more highly correlated with the money stock, $\overline{M}$, than with autonomous expenditures for the period 1897 to 1958 with the exception of the depression years. Additionally, the appendix to the paper revealed that in regressing GNP upon the autonomous expenditures variable and the monetary variable the results yielded a superior fit for the monetary variable.

Responding to Friedman and Meiselman were Deprano and Mayer (1965), Ando and Modigliani (1965), and Hester (1964). These investigators each questioned the endogenous nature of Friedman and Meiselman's expenditures variable. Each suggested that tax receipts, imports, and inventory investment should be discarded from the autonomous expenditures variable on the basis that each would likely be negative correlated with the error term of the consumption function.

Ando and Modigliani provided an excellent exposition of the difficulty with the Friedman and Meiselman model. In the first place, they claim a grievous misspecification of the consumption function used by Friedman and Meiselman in their test of the Keynesian model. Specifically, they contend that the independent variable used in the Friedman and Meiselman consumption function differs from that normally implied by the income-expenditures approach by the inclusion of corporate retained earnings adjusted for inventory valuation, the statistical discrepancy, excess of wage accruals over disbursements, and government foreign transfer payments. As they state, "seldom would it be suggested that consumption is a linear function of current disposable income, plus corporate savings, plus the statistical discrepancy, plus excess wage accruals over wage disbursements, plus net foreign transfer payments." (Ando and Modigliani, 1965, p. 696).

Inclusion of the war years by Friedman and Meiselman in their test period was also questioned by the respondents. For the estimated consumption function to be viewed as a valid estimate, the parameters would have been expected to have remained constant over the estimation period. Yet it seemed unlikely that this would be the case. Consumption patterns certainly could be anticipated to have changed with the advent of rationing and the general unavailability of specific goods. Indeed this phenomenon could readily have been observed in Friedman and Meiselman's own scatter disgrams (1963, p. 198).

Finally, Ando and Modgliani present what is the most damaging and revealing argument when they offer an alternative model to demonstrate that the estimates of the parameters cannot be expected to be valid except in the limiting case where the consumption function holds without error. The significance of this in terms of the Friedman and Meiselman case is that in their autonomous expenditures equation those items previously suggested as being endogenous will be correlated with the error term, leading to a bias in the estimate of the coefficients as well as in the variance of the error term. If the correlation of the independent variable and the error term is positive, the coefficients would be biased upward and conversely if the correlation is negative. In the Friedman and Meiselman case the correlation would likely be negative between the autonomous expenditures variable and the error term, resulting in a downward bias in the estimated coefficient obtained for the independent variable. The likelihood of the negative correlation would be due to a stochastic positive (negative) change in consumption causing income to rise (fall). A rise (fall) in income is likely to cause tax receipts to rise (fall), imports to rise (fall), and corporate savings to rise (fall). Each of these are elements of the independent variable with a negative sign. Therefore, a stochastic rise (fall) in consumption is likely to cause at least a portion of the independent variable to fall (rise). In the case of inventory investment, a stochastic rise (fall) in consumption may cause unintended decumulation (accumulation) of stocks.

The model constructed by Ando and Modigliani separates the autonomous elements of the independent variable from the induced elements. Reformulating Ando and Modigliani's model so as to capture the essence of the model in a much simpler framework, suppose:

$$Y = C + \overline{I}_{nf} + I_{Inv} + \overline{G} + \overline{X} - Q \qquad 1.7$$

$$Y = Y_d + S_d + \overline{T}_p + T_{np} - F_u - \overline{F}_{nu} \qquad 1.8$$

$$C = C_o + C_1\ Y_d + \epsilon_1 \qquad 1.9$$

$$I_{Inv} = i_o + i_1\ Y + \epsilon_2 \qquad 1.10$$

$$Q = q_o + q_1\ Y + \epsilon_3 \qquad 1.11$$

$$S_b = s_o + s_1\ Y + \epsilon_4 \qquad 1.12$$

$$T_{np} = t_o + t_1\ Y + \epsilon_5 \qquad 1.13$$

$$F_u = f_o + f_1\ Y + \epsilon_6 \qquad 1.14$$

where,

Y = Gross National Product

I_{Inv} = Inventory investment

$\overline{I}_{nf}$ = Autonomous investment

$\overline{G}$ = Autonomous government expenditures

$\overline{X}$ = Autonomous exports

Q = Imports

Y_d = Disposable income

S_b = Corporate savings

$\overline{T}_p$ = Autonomous tax receipts

T_{np} = Induced tax receipts

F_u = Induced transfer payments

$\overline{F}_{nu}$ = Autonomous transfer payments

C = Personal consumption expenditures

and the autonomous variables are defined as those variables which are not correlated with the error terms.[1]

Solving for the reduced forms,

$$C = c_o + \lambda_1 [- \overline{T}_p + \overline{F}_{nu}] + \lambda_2[\overline{I}_{nf} + \overline{G} + \overline{X}] + \epsilon_7 \qquad 1.15$$

or

$$Y = \xi_o + \xi_1[-\overline{T}_p + \overline{F}_{nu}] + \xi_2[\overline{I}_{nf} + \overline{G} + \overline{X}] + \epsilon_8 \qquad 1.16$$

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[1]For exposition purposes the Ando and Modigliani model has been simplified considerably. A number of additional variables were used in their model, but, the model as presented provides the essence of their argument.

where

$$\lambda_1 = \frac{C_1(1-i_1+q_1)}{1-C_1(1-s_1-t_1+f_1)-i_1+q_1} \qquad \lambda_2 = \frac{C_1(1-s_1-t_1+f_1)}{1-C_1(1-s_1-t_1+f_1)-i_1+q_1}$$

$$\xi_1 = \frac{C_1}{1-C_1(1-s_1-t_1+f_1)-i_1+q_1} \qquad \xi_2 = \frac{1}{1-C_1(1-s_1-t_1+f_1)-i_1+q_1}$$

$$\epsilon_7 = \frac{C_1(1-s_1-t_1+f_1)(\epsilon_2-\epsilon_3) + (1-i_1+q_1)[C_1(-\epsilon_4-\epsilon_5+\epsilon_6)+\epsilon_1]}{1-C_1(1-s_1-t_1+f_1)-i_1+q_1}$$

$$\epsilon_8 = \frac{C_1[-\epsilon_4-\epsilon_5+\epsilon_6]+\epsilon_1+\epsilon_2-\epsilon_3}{1-C_1(1-s_1-t_1+f_1)-i_1+q_1} .$$

Testing these equations with the alternative autonomous variable, the results were much more favorable for the autonomous variable than had been the case with the results received by Friedman and Meiselman. The size of ϵ_7 and ϵ_8 depend upon the specification of all the equations of the model since the error terms from the specification of each equation separately would be carried along into the reduced form.

Friedman and Meiselman's test of the quantity theory was also questioned by Ando and Modigliani. As their monetary indicator Friedman and Meiselman used M_2 money, demand deposits plus currency plus time deposits. This formulation was attacked on the basis of the contention that M_2 was positively correlated with the error term in the consumption function, leading to an upward bias in the estimate of the coefficient for M_2.

Ando and Modigliani counter by using an alternative variable, M^*, computed as the maximum amount of currency and demand deposits which could be created, given unborrowed reserves, the reserve requirements, and the public's demand for currency. Justification for the use of M^* was based on the contention that it represented an indicator which was more exogenous than M_2. Results from the use of M^* led them to discard the extreme cases of either the Keynesian or quantity theorist positions on the relative importance of money. This conclusion was based on the error variances from estimation, which became relatively large, suggesting short-run variability in the relation between output and M^*. They further suggested that management of the money supply through M^* would therefore represent a rather weak stabilization policy.

The Friedman and Meiselman debate of 1963 failed to sustain itself, primarily due to the failure to reach accord as to the proper autonomous expenditures variable to use. However, it could be concluded that both Friedman and Meiselman's M_2 money and Ando and Modigliani's autonomous expenditures variable did rather well, suggesting that no conclusion as to the relative usefulness of the Keynesian model or the quantity theorist model could be reached.

The Andersen and Jordan Controversy

The question of the relative importance of monetary versus fiscal policy was renewed in 1968 with the publication of a study prepared at the Federal Reserve Bank of St. Louis under the leadership of Leonall C. Andersen and Jerry L. Jordan (1968). The monetarist position was furthered by the publication of this article when the conclusions were reached that changes in the money supply had an impact on GNP which was (1) greater, (2) more predictable, and (3) faster than the impact of changes in the fiscal variable upon GNP.

As contrasted to the autonomous variable used by Friedman and Meiselman, which seemed to be plagued by problems of endogenity, Andersen and Jordan used the federal full-employment surplus or federal full-employment expenditures and tax receipts taken separately. Acceptance of such a measure of fiscal activity has become somewhat widely recognized since its conception in 1964 by the Council of Economic Advisors (Carlson, 1967).

Suggested in this study will be the view that such a measure is inappropriate and will lead to a biased estimate of the relative impact of fiscal action. Warren L. Smith (1970) also argues in opposition to its use. Smith points out that if it is assumed that expenditures are exogenous and taxes are a function of the level of income, an expansionary fiscal action will initially lead to a growth in income. Suppose, however, that in the same period full-employment tax receipts have grown due to growth in the full-employment income, but by an amount which exceeds the increase in expenditures. During this period, the full-employment surplus will record that fiscal policy has been contractionary, yet it must be noted that the increase in tax receipts has not been due to the discretionary actions of the fiscal authorities. Indeed, the fact that full-employment tax receipts have responded to the growth in full-employment income is a factor which should not be recorded as a part of the effects of the initial fiscal action. Smith further argues that the adjustment for inflation made by de Leeuw and Kalchbrenner (1969) helps to relieve this problem. This adjustment made by de Leeuw and Kalchbrenner was to assume prices constant throughout the estimation period, but it does not assume that the level of full-employment income has remained constant, which would have been necessary to fully correct for the problem.

Keran (1969) tried as his fiscal indicators two other alternatives, the level of the national debt and changes in federal government expenditures. As he felt that the national debt was influenced by changes in tax receipts, the implied endogeneity led to its discard as a fiscal indicator. Results from the use of the changes in federal government expenditures were reported and found not to be significantly different from the results obtained by Andersen and Jordan using high employment government expenditures.

As previously suggested, this researcher will show in Chapter II that use of high employment expenditures as a fiscal indicator is illogical. Indeed, the participants in the controversy have unduly ignored the misspecification of the fiscal variable while concentrating primarily upon the monetary variable used as an indicator of monetary action.

Directing attention to the monetary indicator, Andersen and Jordan used two alternative variables as their indicator: changes in the level of the money stock or the monetary base, where the monetary base is defined as bank reserves plus currency held by the public. As might have been anticipated, the coefficient obtained using the monetary base was much larger than the coefficient obtained using the money stock.[1] Indeed, using the monetary base, a money multiplier of 16.01 was obtained as contrasted to a money multiplier of 5.85 when changes in the money stock were used.

de Leeuw and Kalchbrenner (1969) object to the monetary base on the grounds that it is characterized by an endogenous element. They

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[1]Such a result could conceptually be envisioned by the fact that in order to obtain a given change in the money stock, a multiple change in the monetary base would be required. This multiple relation depends upon the reserve requirements and the banking system's response to a change in bank reserves.

assert that if the endogenous element, which is caused by the borrowed reserves, is not offset by movements in other components, then borrowed reserves should be deleted from the indicator. Similarly, they claim an endogenous movement in the monetary base due to endogenous changes in the currency component. On the basis of these arguments, they conclude that both of these factors should be eliminated from the monetary base before it can be used as an indicator of exogenous monetary action. Resulting from these adjustments they propose the use of unborrowed reserves as the most desirable indicator. As might have been anticipated, use of unborrowed reserves resulted in a much smaller money multiplier.

In contrast to the view of de Leeuw and Kalchbrenner is that of Michael Hamburger (1970), who found unborrowed reserves to be the least exogenous of all the monetary variables. Indeed, in his study, he finds income more closely related to the asset side of the balance sheet than to the liability side, suggesting a bank credit theory of the monetary mechanism which is in considerable contrast to that envisioned by the monetarist.

In a more recent contribution to the Andersen and Jordan Controversy, E. G. Corrigan (1970) of the Federal Reserve Bank of New York incorporates some of the modifications proposed by the prior respondents. These adjustments by Corrigan provided results which strengthened the government receipts aspect of fiscal policy to a renewed Keynesian role. However, the expenditures aspect remained relatively weak and insignificant.

Moving more in the direction of the elimination of the implied upward bias in changes in receipts than did de Leeuw and Kalchbrenner, Corrigan measures the changes in tax receipts on the basis of an unchanged level of income before a tax rate change. This adjustment contrasts to that of de Leeuw and Kalchbrenner in that they assumed only that the price level and the unemployment rate remained unchanged.

Corrigan's expenditures variable was computed as the discrete changes from period to period. However, when he separated transfers from expenditures on goods and services, a negative weight on changes in transfers appeared on the earlier quarters of his distributed lag. This result was conceded to be due potentially to reverse causation since as the level of income rises, a decrease in transfers may have been anticipated.

The results obtained by Corrigan, though more successful in a Keynesian sense than previous results, with the adjustments implied by previous researchers, were conceded to be in general unsatisfactory. Such a conclusion was due to excessively large coefficients on the receipts variable and erratic oscillations as the lag patterns were varied. In addition, the expenditures variable yielded a multiplier of only approximately unity, which probably was due at least partially to the shortcomings of the reduced form technique used for estimation.

Methodological Problems of Measurement

In reviewing the past body of literature the difficulties encountered in the measurement of the effects of monetary and fiscal action become apparent. In this section a brief summary of these problems is presented.

Two distinct approaches exist for use in the measurement of monetary and fiscal policy. The first of these is the single equation reduced form technique similar to that used by Andersen and Jordan, Friedman and Meiselman, E. C. Corrigan, and the one used in this study. Alternatively, a fully specified structural model of the nature of the Federal Reserve-MIT model (de Leeuw and Gramlich, 1969) can be used.

The major advantage of the single equation approach lies in its simplicity. If properly specified, i.e., derived from a set of consistent structural equations, and if the independent variables solved from the structural system are independent of the level of economic activity, it will capture the impact of discrete fiscal and monetary action regardless of the mechanisms by which the effects are transmitted. However, the importance of proper specification of the structural system from which the reduced form is solved was clearly expressed by Ando and Modigliani (1965). If the structural system is not properly specified, the bias in the error from the structural system will carry over into the reduced form, leading to bias in the estimation of the reduced form as well. Frequently in the literature emphasis has been placed upon the selection of what were presumed to be the proper indicators of monetary and fiscal action. This over emphasis has resulted in the failure to seek those variables which could successfully be solved from a consistent structural system. By so doing, researchers have ignored the bias which may have been injected due to the lack of proper specification.

Although the single equation technique captures the effects of monetary and fiscal policy regardless of the transmission mechanism, the flow of causation cannot be established empirically when using the approach, which suggests that use of such a technique may not provide the distinction necessary to determine the relative impact of monetary and fiscal policy. Indeed, frequently in the literature, what has been interpreted as monetarist results could equally have been Keynesian. In the case of the Andersen and Jordan model, mere strengthening of the fiscal variable would have rendered a distinction between a monetarist conclusion and a Keynesian conclusion difficult at best.

Another difficulty disclosed by Keran (1969) was that discrete monetary actions versus other monetary influences will not always be measured by the same variable. Only with additional information, other than movements in the monetary indicator, regarding discrete policy changes on the part of the Federal Reserve, can it be inferred that changes in the level of economic activity have, in fact, been caused by changes in monetary policy; monetary influences may exist without the conscious knowledge of the monetary authorities and if the indicator or variable is to be useful, the authorities must override these external influences if the variable is to be considered exogenous.

Finally, the second approach to estimation of the effects of monetary and fiscal policy is the use of large econometric models. This approach requires the specification of all the various behaviorial relationships as well as the estimation of the parameters associated with each behavioral relationship. Once the various relationships are specified, an attempt is made to solve simultaneously for the reduced form of the model. The scope of such a task is beyond the scope of this study; indeed, few such models exist at all. However, the results from these attempts are contrasted to the results of this study in Chapter III.

CHAPTER II. THE MODEL

A simple Keynesian model was used in this study. The structural system of the model was solved for its reduced form under three alternative sets of assumptions regarding the monetary variable to be used in estimation of the reduced form equations. The reduced form equations were then estimated for the purpose of (a) testing the Andersen and Jordan conclusions regarding the importance of money, and (b) providing insight as to the alternative interpretations of the multipliers obtained when using different monetary variables.

The coefficients obtained from the estimation of the reduced form equations represent the multipliers or, i.e., the amount by which the dependent variable changes as a result of a unit change in the independent variable. In the context of this study, the coefficients represent the change in the level of economic activity resulting from a change in the fiscal or monetary variable. The estimated long-run multipliers are the sum of the distributed-lag incremental multipliers obtained through the use of the Almon distributed lag technique.

The Real Sector

The real sector of the simple Keynesian model used for estimation in this study was constructed as follows:

$$Y = C + I_g + \overline{G}_g + \overline{X} - Q \qquad 2.1$$

$$Y^d = Y + \overline{P}_b - Tx_g + \overline{F}_d - S_b - \overline{K}_c \qquad 2.2$$

$$I_g = \xi_o + \xi_1 R + \xi_2 Y \qquad 2.3$$

$$C = \lambda_o + \lambda_1 Y^d \qquad 2.4$$

$$Q = \rho_o + \rho_1 Y \qquad 2.5$$

$$S_b = \pi_o + \pi_1 Y \qquad 2.6$$

$$Tx_g = Tx_f + Tx_{nf} \qquad 2.7$$

$$Tx_f = \psi_o + \psi_1 Y \qquad 2.8$$

$$Tx_{nf} = \omega_o + \omega_1 Y \qquad 2.9$$

$$G_g = \overline{G}_f + \overline{G}_{nf} \qquad 2.10$$

where,

Y = GNP, current dollars

C = personal consumption expenditures

I_g = gross induced investment expenditures

$\overline{G}_g$ = total autonomous government expenditures on goods and services.

$\overline{G}_f$ = federal autonomous government expenditures on goods and services

$\overline{G}_{nf}$ = non-federal autonomous government expenditures on goods and services

$\overline{X}$ = autonomous exports of goods and services

Q = induced imports of goods and services

Y^d = disposable income

$\overline{P}_b$ = interest payments by consumers

Tx_g = gross induced tax receipts to governments

Tx_f = induced tax receipts to federal government

Tx_{nf} = induced net tax receipts to non-federal governments

$\overline{F}_d$ = consolidated autonomous federal government transfer payments to the private economy

S_b = induced corporate retained earnings

$\overline{K}_c$ = capital consumption allowances

R = rate of interest

and the bars represent exogenously determined variables.

The Monetary Sector

To the real sector a monetary sector has then been added assuming three alternative assumptions regarding the monetary variable to be considered exogenous to the model. Methodologically, each are presented as one of three cases where the specification of the model will reflect the three assumptions.[1] The models specified under each assumption have then been solved for their reduced forms for estimation purposes.

Case I In the first case the money stock, M^s, has been assumed to be the appropriate monetary variable to be used as an indicator of Federal Reserve action.

The monetary sector of the model under this assumption may be constructed as:

$$M^d = \gamma_o + \gamma_1 Y + \gamma_2 R \qquad 2.11$$

$$M^s = \overline{M}^s \qquad 2.12$$

$$M^d = \overline{M}^s \qquad 2.13$$

where M^d represents the demand for money, R the rate of interest, and M^s the supply of money. Equation 2.11 is a conventional demand for money function, 2.12 states that the supply of money is exogenously

[1]Clearly, other alternative cases could have been specified. One such alternative would have been to hypothesize that money does not matter at all and test the hypothesis by excluding money from the estimation equation entirely. Such a test was performed and little additional information was provided. Indeed, the multipliers estimated for the fiscal variables, with the exception of the transfer variable, remained virtually the same while the error term increased sizable suggesting the need for the inclusion of the monetary variable in the estimation equation.

determined, and 2.13 states the required equilibrium condition in the monetary sector.

The required reduced form necessary for the purposes of measuring the relative impact of fiscal versus monetary policy may be obtained as follows. We know:

$$M^S = \gamma_o + \gamma_1 Y + \gamma_2 R \qquad 2.14$$

therefore:

$$R = \frac{\overline{M}^S - \gamma_o - \gamma_1 Y}{\gamma_2} \qquad 2.15$$

and:

$$Y = \lambda_o + \lambda_1 (Y + \overline{P}_b - \psi_o - \psi_1 Y - \omega_o - \omega_1 Y + \overline{F}_d - \pi_o - \pi_1 Y - \overline{K}_c) + \xi_o + \xi_1 \left(\frac{\overline{M}^S - \gamma_o - \gamma_1 Y}{\gamma_2}\right) + \xi_2 Y + \overline{G}_f + \overline{G}_{nf} + \overline{X} - \rho_o - \rho_1 Y \qquad 2.16$$

or:

$$Y - \lambda_1 + \lambda_1 \psi_1 Y + \lambda_1 \omega_1 Y + \lambda_1 \pi_1 Y + \xi_1 \frac{\gamma_1}{\gamma_2} Y - \xi_2 Y + \rho_1 Y = \lambda_o + \lambda_1 (\overline{P}_b - \psi_o - \omega_o + \overline{F}_d - \pi_o - \overline{K}_c) + \xi_o + \xi_1 \left(\frac{\overline{M}^S - \gamma_o}{\gamma_2}\right) + \overline{G}_f + \overline{G}_{nf} + \overline{X} - \rho_o \qquad 2.17$$

therefore:

$$Y = \frac{1}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 + \xi_{1}\frac{\gamma_1}{\gamma_2} - \xi_2 + \rho_1}[\lambda_o$$

$$+ \lambda_1(\overline{P}_b - \psi_o - \omega_o + \overline{F}_d - \pi_o - \overline{K}_c) + \xi_o + \xi_1\frac{\overline{M}^s}{\gamma_2} \quad 2.18$$

$$- \xi_1\frac{\gamma_o}{\gamma_1} + \overline{G}_f + \overline{G}_{nf} + \overline{X} - \rho_o].$$

Differentiating 2.18 with respect to each of the fiscal variables, the impact of each is equivalent to,

$$\frac{\partial Y}{\partial \overline{G}_f} = \frac{1}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 + \xi_1\frac{\gamma_1}{\gamma_2} - \xi_2 + \rho_1} \quad 2.19$$

$$\frac{\partial Y}{\partial \psi_o} = \frac{-\lambda_1}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 + \xi_1\frac{\gamma_1}{\gamma_2} - \xi_2 + \rho_1} \quad 2.20$$

$$\frac{\partial Y}{\partial \overline{F}_d} = \frac{\lambda_1}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 + \xi_1\frac{\gamma_1}{\gamma_2} - \xi_2 + \rho_1} \quad 2.21$$

Equation 2.19 represents the government expenditures multiplier, 2.20 the tax multiplier, and 2.21 the government transfer multiplier. Partially differentiating 2.18 with respect to $\overline{M}^s$ gives the money multiplier as being equivalent to,

$$\frac{\partial Y}{\partial \overline{M}^s} = \frac{\xi_1/\gamma_2}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 + \xi_1\frac{\gamma_1}{\gamma_2} - \xi_2 + \rho_1} \quad 2.22$$

Using ordinary least squares as the technique for the measurement of the values of each of these multipliers, the equation to be estimated may be formulated as:

$$\Delta Y = \alpha_o + \alpha_1 \Delta \overline{G}_f + \alpha_2 \Delta \overline{T}x + \alpha_3 \Delta \overline{F}_d + \alpha_4 \Delta \overline{M}^s + \mu' \qquad 2.23$$

where, assuming strict linearity, the coefficient estimated for α_1 corresponds to the value of 2.19, α_2 to 2.20, α_3 to 2.21, and α_4 to 2.22. The deltas indicate the use of first differences in the equation to measure the discrete changes in Y resulting from changes in the fiscal and monetary variables, i.e., the partial of Y with respect to each of these variables.

Case II An alternative variable, M^*, is viewed as the desired indicator of Federal Reserve action in this case.[1] Construction of the monetary section with the assumption that M^* is the desired exogenous variable for estimation purposes suggests that M^s should be a function of M^*; M^* thus becomes the independent variable which we use in the estimation equation.

Another variable which might also be used and which will result in a similar reduced form is the monetary base. Indeed, this latter variable is the one which Andersen and Jordan did use in part of their estimation equations and which was used as one of the alternative monetary indicators in this study.

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[1] M^* money may be defined as the maximum stock of money which can be created and which depends expgenously upon the reserves provided by the Federal Reserve System. The M^* series used is comparable to the $M1^*$ series derived by Starleaf and Stephenson (1969).

The monetary sector under these assumptions may be constructed as:

$$M^d = \gamma_o + \gamma_1 Y + \gamma_2 R \qquad 2.24$$

$$M^s = \eta_o + \eta_1 M^* + \eta_2 R \qquad 2.25$$

$$M^* = \overline{M}^* \qquad 2.26$$

$$M^d = M^s. \qquad 2.27$$

Equation 2.24 is again the demand for money function. Equation 2.25 is the supply of money function where the money supply now becomes a function of M^* and R and M^* by equation 2.26 is assumed exogenous. Equation 2.27 again represents equilibrium in the monetary sector. Solving for the reduced form, we know:

$$M^d = M^s$$

therefore:

$$\eta_o + \eta_1 \overline{M}^* + \eta_2 R = \gamma_o + \gamma_1 Y + \gamma_2 R \qquad 2.28$$

and:

$$R = \frac{\eta_o + \eta_1 \overline{M}^* - \gamma_o - \gamma_1 Y}{\gamma_2 - \eta_2} . \qquad 2.29$$

Substituting 2.29 into the real sector, we obtain:

$$\begin{aligned} Y = \lambda_o &+ \lambda_1 (Y + \overline{P}_b - \psi_o - \psi_1 Y - \omega_o - \omega_1 Y + \overline{F}_d - \pi_o \\ &- \pi_1 Y - \overline{K}_c) + \xi_o - \xi_1 \frac{\gamma_1 Y}{\gamma_2 - \eta_2} + \xi_1 \frac{\eta_o - \gamma_o}{\gamma_2 - \eta_2} \\ &+ \xi_1 \frac{\eta_1 \overline{M}^*}{\gamma_2 - \eta_2} + \xi_2 Y + \overline{G}_f + \overline{G}_{nf} + \overline{X} - \rho_o - \rho_1 Y \end{aligned} \qquad 2.30$$

and:

$$Y - \lambda_1 Y + \lambda_1 \psi_1 Y + \lambda_1 \omega_1 Y + \lambda_1 \pi_1 Y + \xi_1 \frac{\gamma_1 Y}{\gamma_2 - \eta_2} - \xi_2 Y + \rho_1 Y =$$

$$\lambda_o + \lambda_1 (\bar{P}_b - \psi_o - \omega_o + \bar{F}_d - \pi_o - \bar{K}_c) + \xi_o + \xi_1 \frac{\eta_o - \gamma_o}{\gamma_2 - \eta_2} \qquad 2.31$$

$$+ \xi_1 \frac{\eta_1 \bar{M}^*}{\gamma_2 - \eta_2} + \bar{G}_f + \bar{G}_{nf} + \bar{X} - \rho_o$$

or:

$$Y = \frac{1}{1 - \lambda_1 + \lambda_1 \psi_1 + \lambda_1 \omega_1 + \lambda_1 \pi_1 + \xi_1 \frac{\gamma_1}{\gamma_2 - \eta_2} - \xi_2 + \rho_1} [\lambda_o$$

$$+ \lambda_1 (\bar{P}_b - \psi_o - \omega_o + \bar{F}_d - \pi_o - \bar{K}_c) + \xi_o + \xi_1 \frac{\eta_o - \gamma_o}{\gamma_2 - \eta_2} \qquad 2.32$$

$$+ \xi_1 \frac{\eta_1 \bar{M}^*}{\gamma_2 - \eta_2} + \bar{G}_f + \bar{G}_{nf} + \bar{X} - \rho_o].$$

Taking the partials of Y with respect to the fiscal and monetary variables in 2.32, the multipliers become:

$$\frac{\partial Y}{\partial \bar{G}_f} = \frac{1}{1 - \lambda_1 + \lambda_1 \psi_1 + \lambda_1 \omega_1 + \lambda_1 \pi_1 + \xi_1 \frac{\gamma_1}{\gamma_2 - \eta_2} - \xi_2 + \rho_1} \qquad 2.33$$

$$\frac{\partial Y}{\partial \psi_o} = \frac{-\lambda_1}{1 - \lambda_1 + \lambda_1 \psi_1 + \lambda_1 \omega_1 + \lambda_1 \pi_1 + \xi_1 \frac{\gamma_1}{\gamma_2 - \eta_2} - \xi_2 + \rho_1} \qquad 2.34$$

$$\frac{\partial Y}{\partial \bar{F}_d} = \frac{\lambda_1}{1 - \lambda_1 + \lambda_1 \psi_1 + \lambda_1 \omega_1 + \lambda_1 \pi_1 + \xi_1 \frac{\gamma_1}{\gamma_2 - \eta_2} - \xi_2 + \rho_1} \qquad 2.35$$

$$\frac{\partial Y}{\partial \bar{M}^*} = \frac{\xi_1 \eta_1 / \gamma_2 - \eta_2}{1 - \lambda_1 + \lambda_1 \psi_1 + \lambda_1 \omega_1 + \lambda_1 \pi_1 + \xi_1 \frac{\gamma_1}{\gamma_2 - \eta_2} - \xi_2 + \rho_1} . \qquad 2.36$$

In estimation form,

$$\Delta Y = \alpha_5 + \alpha_6 \Delta \bar{G}_f + \alpha_7 \Delta \bar{T}x + \alpha_8 \Delta \bar{F}_d + \alpha_9 \Delta \bar{M}^* + \mu'' \qquad 2.37$$

where α_6 is equivalent to 2.33, α_7 to 2.34, α_8 to 2.35, and α_9 to 2.36.

The parameter composition of the multipliers have changed in case II with the imposition of a money supply function in the model. The effects of the inclusion of these parameters upon the multipliers will be dependent upon the estimated values of these parameters. Indeed in Chapter III it will be observed that the multipliers in each case where M^* money or the monetary base have been used will be considerably different than those received in case I. A similar phenomena is encountered in the estimation of the multipliers for the fiscal variables, though the differences in the estimated values are of a smaller magnitude. These results suggest that in terms of exogeneity of the monetary indicator used, M^* money or the monetary base must be viewed quite differently from the money stock.

Case III In case III, an assumption will be incorporated which in the recent past was commonly accepted in the literature. This assumption is that the variable which the Federal Reserve considers to be exogenous is the rate of interest, suggesting that the rate of interest should be viewed as exogenous to the model. Such an assumption implies that the real sector becomes a subset of the entire system which is identifiable without the inclusion of a monetary sector. The required reduced forms for the measurement of fiscal versus monetary policy then become:

$$Y = \lambda_o + \lambda_1(Y + \bar{P}_b - \psi_o - \psi_1 Y - \omega_o - \omega_1 Y + \bar{F}_d - \pi_o - \pi_1 Y - \bar{K}_c) + \xi_o + \xi_1\bar{R} + \xi_2 Y + \bar{G}_f + \bar{G}_{nf} + \bar{X} - \rho_o - \rho_1 Y \qquad 2.38$$

or:

$$Y - \lambda_1 Y + \lambda_1\psi_1 Y + \lambda_1\omega_1 Y + \lambda_1\pi_1 Y - \xi_2 Y + \rho_1 Y = \lambda_o + \lambda_1(\bar{P}_b - \psi_o - \omega_1 + \bar{F}_d - \pi_o - \bar{K}_c) + \xi_o + \xi_1\bar{R} + \bar{G}_f + \bar{G}_{nf} + \bar{X} - \rho_o \qquad 2.39$$

and:

$$Y = \frac{1}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 - \xi_2 + \rho_1}[\lambda_o + \lambda_1(\bar{P}_b - \psi_o - \omega_1 + \bar{F}_d - \pi_o - \bar{K}_c) + \xi_o + \xi_1\bar{R} + \bar{G}_f + \bar{G}_{nf} + \bar{X} - \rho_o]. \qquad 2.40$$

Partially diffentiating with respect to the fiscal and monetary variables respectively, the required multipliers are:

$$\frac{\partial Y}{\partial \bar{G}_f} = \frac{1}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 - \xi_2 + \rho_1} \qquad 2.41$$

$$\frac{\partial Y}{\partial \psi_o} = \frac{-\lambda_1}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 - \xi_2 + \rho_1} \qquad 2.42$$

$$\frac{\partial Y}{\partial \bar{F}_d} = \frac{\lambda_1}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 - \xi_2 + \rho_1} \qquad 2.43$$

$$\frac{\partial Y}{\partial \bar{R}} = \frac{\xi_1}{1 - \lambda_1 + \lambda_1\Psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 - \xi_2 + \rho_1} . \quad 2.44$$

In estimation form:

$$\Delta Y = \alpha_{10} + \alpha_{11}\Delta\bar{G}_f + \alpha_{12}\Delta\bar{T}x + \alpha_{13}\Delta\bar{F}_d + \alpha_{14}\Delta\bar{R} + \mu''' \quad 2.45$$

where α_{11} is equivalent to 2.41, α_{12} to 2.42, α_{13} to 2.43, and α_{14} to 2.44.

Fiscal Aspects of Model

Ando and Modigliani (1965) clearly set forth the importance of proper specification of the structural system of a model when using the reduced form approach. In this study it is contended that a misspecification of the fiscal variable, high employment budget expenditures, used by Andersen and Jordan (1968) did exist, leading to bias in their estimated multipliers. Before discussing the fiscal indicators used in this study, it will be shown that such a misspecification does indeed exist in the Andersen and Jordan study.

Recall that high employment budget expenditures and receipts are defined as that level which would be forthcoming with a full-employment level of output. Thus, full-employment tax receipts may be defined as a function of the full-employment level of income, i.e.:

$$Tn^f(t) = \beta_o + \beta_1 Y^f(t) \quad 2.46$$

where $Tn^f(t)$ is the full-employment tax receipts in the t^{th} period and $Y^f(t)$ is full-employment income in the t^{th} period.

Taking the total differential of $Tn^f(t)$:

$$dTn^f(t) = d\beta_o + d\beta_1 Y^f(t) + \beta_1 dY^f(t) \qquad 2.47$$

it is clear that, in the absence of frequent and sizable changes in tax rates, most of the change in $Tn^f(t)$ will be caused by changes in $Y^f(t)$, i.e., $dY^f(t)$. Thus, changes in $Tn^f(t)$ are likely to be due mainly to changes in $Y^f(t)$ rather than to autonomous changes in the tax structure.

Now solve for $Tn(t)$ from the equation for $Tn^f(t)$:

$$Tn^f(t) = \beta_o + \beta_1 Y^f(t) \qquad 2.48$$

$$= \beta_o + \beta_1[Y^f(t) - Y(t)] + \beta_1 Y(t) \qquad 2.49$$

$$= Tn(t) + \beta_1[Y^f(t) - Y(t)] \qquad 2.50$$

$$Tn(t) = Tn^f(t) - \beta_1[Y^f(t) - Y(t)] \qquad 2.51$$

where $Tn(t)$ represents the actual level of tax receipts. The difficulty with the use of $Tn^f(t)$ as the independent variable in the estimation equation now becomes more apparent, as does the deviation between $Y^f(t)$ and $Y(t)$. Indeed, as the deviation increases, the greater the overstatement of the restraint of taxation will become.

Finally, place $Tn(t)$ and $Tn^f(t)$ into a simple Keynesian model:

$$Y(t) = C(t) + I(t) + G(t) \qquad 2.52$$

$$Y(t) = Tn(t) + Y^d(t) \qquad 2.53$$

$$Tn(t) = Tn^f(t) - \beta_1 Y^f(t) + \beta_1 Y(t) \qquad 2.54$$

$$Tn^f(t) = \beta_o + \beta_1 Y^f(t) \qquad 2.55$$

$$C(t) = \alpha_o + \alpha_1 Y^d(t) \qquad 2.56$$

$$I(t) = \overline{I} \tag{2.57}$$

$$G(t) = \overline{G} \tag{2.58}$$

where C(t) is consumption, I is investment, G is government expenditures, Y^d is disposable income, and the bars represent exogenous variables. Solving for Y(t), we obtain:

$$\begin{aligned} Y(t) &= \alpha_o + \alpha_1(Y(t) - Tn(t)) + \overline{G} + \overline{I} \\ &= \alpha_o + \alpha_1 Y(t) - \alpha_1 Tn^f(t) + \alpha_1\beta_1 Y^f(t) - \alpha_1\beta_1 Y(t) \\ &\quad + \overline{I} + \overline{G} \end{aligned} \tag{2.59}$$

and:

$$Y(t) = \frac{1}{1 - \alpha_1(1 - \beta_1)} (\alpha_o - \alpha_1 Tn^f(t) + \alpha_1\beta_1 Y^f(t) + \overline{I} + \overline{G}). \tag{2.60}$$

Taking the partial of Y(t) with respect to $Tn^f(t)$, we obtain:

$$\frac{\partial Y(t)}{\partial Tn^f(t)} = \frac{-\alpha_1}{1 - \alpha_1(1 - \beta_1)} \tag{2.61}$$

which gives the change in Y(t) as a result of a change in $Tn^f(t)$. Yet it is known that $dTn^f(t) = d\beta_o + d\beta_1 Y^f(t) + \beta_1 dY^f(t)$ and that most of the change in $dTn^f(t)$ is due to $dY^f(t)$. However, $dY^f(t)$ has no influence on Y(t), as is shown by substitution:

$$\begin{aligned} Y(t) = \frac{1}{1 - \alpha_1(1 - \beta_1)} \; (&\alpha_o - \alpha_1\beta_o - \alpha_1\beta_1 Y^f(t) + \alpha_1\beta_1 Y^f(t) \\ &+ \overline{I} + \overline{G}). \end{aligned} \tag{2.62}$$

The $\alpha_1\beta_1 Y^f(t)$'s cancel out leaving Y(t) solely a function of I and G and the remaining parameters. The partial of Y(t) with respect to $Y^f(t)$ is now zero, thus $Y^f(t)$ has no influence on Y(t). Clearly, use of high employment data as the indicator of fiscal policy leads to a misspecification resulting in biased estimates.

In cognizance of the misspecification in the Andersen and Jordan model, as an alternative, the fiscal variables for the model used in this study were exogenous changes in federal government expenditures on goods and services, exogenous changes in consolidated federal government tax receipts, and exogenous changes in consolidated federal transfer payments to persons.

Federal government expenditures on goods and services were assumed to be exogenously determined. Discrete changes in fiscal action were measured as being equivalent to the first differences in the data. The data were in current dollars and were led by two quarters. The lead in the data was made to correct for an adjustment made by the Department of Commerce in converting the data from a cash timing basis, which is probably approximately equal to the actual timing of production, to a delivery timing basis. The correction was necessary to record more accurately the actual impact of the expenditures at their point of injection into the system.

To measure the impact of fiscal action due to changes in the tax structure, the non-linear tax equations of the Federal Reserve-MIT econometric model of the United States (de Leeuw and Gramlich, 1969) were used. Inasmuch as the tax functions specified in the real sector of the model are linear functions, these non-linear functions were used to obtain an approximation of the changes in tax receipts due to discrete linear changes in the tax structure. The non-linear tax functions were formulated in the following manner to obtain the desired changes in tax receipts due to discrete tax structure changes:

$$\Delta T_{fp} = \Delta t_n Y_T \qquad 2.63$$

$$\Delta T_{fc} = e^{-.4161}(Y_c - T_{sc})^{1.0177}(t_{c_t}^{.7262} - t_{c_{t-1}}^{.7262}) - \alpha_1 z_k E_{pd} \qquad 2.64$$

$$\Delta T_{fI} = (t_{I_t}^{1.1027} - t_{I_{t-1}}^{1.1027})C^{.6315}e^{1.0883} \qquad 2.65$$

$$\Delta T_{fs} = e^{-.4840}\,\Delta t_s Y_h^{.9473} \qquad 2.66$$

$$\Delta T_{fu} = \Delta t_u Y_h^{.4480}\left[t_{uic_t}^{1.2887} - t_{uic_{t-1}}^{1.2887}\right]e^{-2.9812} \qquad 2.67$$

where

T_{fp} = federal personal income tax liabilities

t_h = personal income tax rate, average

Y_t = taxable income

T_{fc} = federal corporate profits tax accruals

z_k = rate of tax credit for investment in producers durable equipment

E_{pd} = expenditures on producers durable equipment

Y_c = corporate income

T_{sc} = state and local corporate taxes

t_c = corporate tax rate

T_{fI} = federal indirect tax receipts

t_I = federal excise tax rate

T_{fs} = federal social insurance contributions

t_s = federal OASDI tax rate

Y_h = personal income

T_{fu} = federal social insurance contributions, unemployment insurance benefits

t_u = federal unemployment insurance tax rate

t_{uic} = labor force covered by unemployment insurance, insurance over total labor force

and ΔX_t is defined as being equivalent to $X_t - X_{t-1}$. Changes in receipts due to changes in the federal estate and gift taxes and federal social insurance contributions, other than those in T_{fs} were computed as first differences in the receipts data. It was assumed that a positive change in receipts represented a restrictive discrete policy change. Likewise, a negative change in receipts represents an expansionary policy. Consolidated changes in tax receipts, which were used in the regression equations, were obtained by summing the changes in tax receipts due to each of the various taxes. Indirect taxes were deleted from the final consolidated tax receipts variable due to the lack of data.

Federal government transfer payments were assumed exogenous to the model presented earlier in the chapter. However, an approximation of the changes in transfers was obtained by using the unemployment insurance benefits equation of the Federal Reserve-MIT model. Changes in benefits due to changes in maximum weekly benefits in the equation were obtained by formulating the equation as:

$$\Delta F_u = \left[t_{UIB_t}^{.5862} - t_{UIB_{t-1}}^{.5862}\right] [L_{FC} - L_E]^{1.2156} e^{-2.9162} \qquad 2.68$$

where F_u is the change in unemployment benefits, T_{UIB} the maximum weekly benefits, L_{FC} the labor force in billions, and L_E the employed labor force in billions. Changes in federal interest payments and federal non-unemployment transfer payments to persons were added to changes in unemployment benefits to obtain a consolidated transfers variable to be used in the estimation equations.

It must be emphasized that the use of the non-linear Federal Reserve-MIT tax and transfer equations to obtain the changes in tax receipts and transfer payments for the estimation equation represents an approximation of the linear forms of the equations of the model used in this study. It is evident that use of the non-linear functions in the model would not yield a linear model for which the reduced forms could be solved. Recalling the federal tax receipts function of the model as being $Tx = \psi_o + \psi_1 Y$, it is apparent that the technique used records the discrete changes in ψ_o and only that portion of the induced tax receipts which were generated by the discrete change in the tax structure.

Before leaving the fiscal aspects of the model, two implicit assumptions should be noted. The first assumption is that in the consolidation of the discrete changes in tax receipts and transfer payments, the effects of all taxes as well as transfers are implicitly assumed to be the same. Also assumed has been the constancy of the parameters of the equations in the Federal Reserve-MIT model. The significance of these assumptions are apparent and, indeed, the erratic nature of the estimated results could be partially explained by the lack of validity of these assumptions.

Monetary Aspects of Model

Four alternative monetary indicators were used in the estimation of the model. In the reduced forms derived in case I, the money stock was selected as the monetary indicator, in case II the monetary base and M^* money, and in case III the rate of interest on 4-6 month prime commercial paper. First differences were used in the estimation of each of the variables. As in the case of the fiscal variables not estimated from the Federal Reserve-MIT equations, the sign of the first differences was assumed to reflect expansionary or contractionary policy.

Identification of Structural Parameters

Solution for the reduced forms of the model in this study reveal clearly that the choice of a monetary indicator bears heavily upon the parameter composition of the multipliers. Comparison of money multipliers estimated using differing monetary indicators could result in a grievous misinterpretation of the results. Indeed, identification of the parameters implicit to the reduced form becomes imperative for proper interpretation of the results.

An example of the difficulty of parameter identification exists in the Andersen and Jordan (1968) article. Reported in their study are the results obtained using two different monetary indicators, the money stock and the monetary base. Consistent with the specification of the model of this study, the two multipliers were of a considerably different magnitude as the implicit parameters of the two multipliers are quite different.

Distributed Lags and Lagged Responses in Behavior

In cognizance of the lagged response in behavior pending fiscal or monetary action, a polynomial distributed lag technique was used in estimation. The technique used was that of Shirley Almon (1965) who suggested that the method of Lagrange for polynomial interpolation, in conjunction with ordinary least squares, be used for estimation of a weighted lag structure. The derivation and technical aspects of the technique are discussed in the Appendix.

The Almon technique poses the problem of establishing an acceptable criterion for determining the desired lag length to be used on each lagged independent variable. Andersen (1969) proposed that the proper criterion should be the standard error of the overall estimate of the reduced form. Such a criterion was used in this study; however, an attempt was also made to allow the lag structure to approach zero in the latter quarters of the structure. Extension of the structure should provide no additional explanation of variance, i.e., no additional evidence of response to the independent variable. Indeed, the lag length of the monetary variable in this study was extended to twenty-seven quarters in the past to test whether additional evidence could be detected. This test revealed that the structure merely oscillated about the horizontal axis and remained statistically insignificant beyond the fourth or fifth quarter.

Due to the apparent immediate effects of government expenditures on goods and services, no additional explanation of variance could be detected beyond a single discrete lag period. Use of a distributed lag would have provided no additional explanation and for this reason it was not used in the case of the expenditures variable.

Formulation of the estimation equations derived in this chapter to include a distributed lag structure may be accomplished by placing each in the following general form:

$$\Delta Y(t) = \alpha_o + \sum_{i=0}^{M_1} \alpha_1 \omega(i) \Delta \bar{G}_f + \sum_{i=0}^{M_2} \alpha_2 \omega(i) \Delta \bar{T}x + \sum_{i=0}^{M_3} \alpha_3 \omega(i) \Delta \bar{F}_d + \sum_{i=0}^{M_4} \alpha_4 \omega(i) \Delta \bar{M}^s + \mu'. \qquad 2.69$$

The summation of the weights is over the lag length of the independent variable. The product of the α's and the $\omega(i)$ in each period represent the distributed lag incremental multipliers. The sum of the distributed lag incremental multipliers provides the total multipliers or total response of the dependent variable, Y, in the current period to incremental changes in the independent variables in the current and past periods.

To reflect the fact that the federal government expenditures variable was not estimated using a distributed lag, the general formulation, 2.69, may be rewritten as:

$$\Delta Y_t = \alpha_o + \alpha_1 \Delta \bar{G}_{f_t} + \alpha_2 \Delta \bar{G}_{f_{t-1}} + \sum_{i=0}^{M_1} \alpha_3 \omega(i) \Delta \bar{T}x + \sum_{i=0}^{M_2} \alpha_4 \omega(i) \Delta \bar{F}_d + \sum_{i=0}^{M_3} \alpha_5 \omega(i) \Delta \bar{M}^s + \mu' \qquad 2.70$$

which was the general form of the estimation equation used in this study.

CHAPTER III. EMPIRICAL RESULTS

The results obtained from the estimation of the reduced forms derived from the alternative specifications of Chapter II are presented below. These results are then contrasted to those of previous researchers.

Estimates Under Alternative Specifications

Case I

Recall that under the assumptions of case I, the money stock was assumed to be exogenously determined. The respective fiscal and monetary multipliers obtained were:

$$\frac{\partial Y}{\partial \bar{G}_f} = \frac{1}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 + \xi_1\frac{\gamma_1}{\gamma_2} - \xi_2 + \rho_1} \tag{3.1}$$

$$\frac{\partial Y}{\partial \psi_o} = \frac{-\lambda_1}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 + \xi_1\frac{\gamma_1}{\gamma_2} - \xi_2 + \rho_1} \tag{3.2}$$

$$\frac{\partial Y}{\partial \bar{F}_d} = \frac{\lambda_1}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 + \xi_1\frac{\gamma_1}{\gamma_2} - \xi_2 + \rho_1} \tag{3.3}$$

$$\frac{\partial Y}{\partial \bar{M}^s} = \frac{\xi_1/\gamma_2}{1 - \lambda_1 + \lambda_1\psi_1 + \lambda_1\omega_1 + \lambda_1\pi_1 + \xi_1\frac{\gamma_1}{\gamma_2} - \xi_2 + \rho_1}\,. \tag{3.4}$$

The sums of the incremental multipliers estimated for each of the past periods equal the value of these multipliers.

The required regression equation necessary for the estimation of the multipliers is:

$$\Delta Y_t = \alpha_o + \alpha_1 \Delta \overline{G}_{f_t} + \alpha_2 \Delta \overline{G}_{f_{t-1}} + \sum_{i=0}^{M_1} \alpha_3 \omega(i) \Delta \overline{T}x + \sum_{i=0}^{M_2} \alpha_4 \omega(i) \Delta \overline{F}_d + \sum_{i=0}^{M_3} \alpha_5 \omega(i) \Delta \overline{M}^s + \mu'. \qquad 3.5$$

Table 3.1 contains the results of the estimation of Equation 3.5.

A fourth degree polynomial was used in estimation of the distributed lag function. Selection of the proper degree to use was constrainted to either the third or fourth degree due to the program capabilities. The fourth degree was selected (a) to be consistent with past similar studies, and (b) to provide the flexibility necessary to observe the nature of the lag structure as the structure approached the horizontal axis and oscillated about it. With a lower degree the oscillations which might be observed would be limited by the ability of the estimated polynomial to change directions. To obtain some idea as to what might result from increasing the degree of the polynomial and extending the lag length tests were run on a time sharing hookup which allowed such an extention.[1] In this test the lag length of the money stock was extended to twenty-seven quarters in the past and a seventh degree polynomial was used. Regressing changes in gross national product on changes in the money stock with these extensions yielded the lag structure presented in Figure 3.1. Note that these results are not significantly different from those received using the fourth degree in

[1]The Data Resources Incorporated time sharing system was used in performing this test.

Table 3.1. Changes in gross national product, current dollar, regressed on changes in consolidated tax receipts, consolidated transfer payments, changes in government expenditures on goods and services, and changes in the money supply, 1952-1 to 1969-2

Lag polynomial degree: 4
R squared: .69
R-bar squared: .60
St. error of estimate: 4.1471
Durbin-Watson statistic: 1.5969

Total multipliers: $\bar{G}_f$ = 0.83, t = 6.25; $\bar{TX}$ = -2.11, t = 1.94; $\bar{F}_d$ = 3.27, t = 1.82; $\bar{M}^s$ = 3.54, t = 3.46

Lagged independent variable		Quarters in past 0	1	2	3	4	5	6	7	8	9
$\bar{G}_f$											
	w(i)	0.615	0.216								
	STE(i)	0.361	0.344								
	t	1.705	0.629								
$\bar{TX}$											
	w(i)	-0.172	-0.103	-0.225	-0.382	-0.470	-0.439	-0.293	-0.088	0.064	0.0
	STE(i)	0.356	0.513	0.435	0.253	0.285	0.319	0.241	0.262	0.329	0.0
	t	0.483	0.200	0.517	1.509	1.646	1.375	1.215	0.337	0.194	0.0
$\bar{F}_d$											
	w(i)	0.872	1.502	0.929	0.167	-0.197	0.0				
	STE(i)	0.706	0.757	0.666	0.849	0.717	0.0				
	t	1.235	1.983	1.395	0.197	0.275	0.0				
$\bar{M}^s$											
	w(i)	1.512	1.358	1.131	0.694	0.078	-0.516	-0.721	0.0		
	STE(i)	0.812	0.606	0.483	0.398	0.534	0.609	0.585	0.0		
	t	1.863	2.242	2.344	1.742	0.146	.848	1.232	0.0		

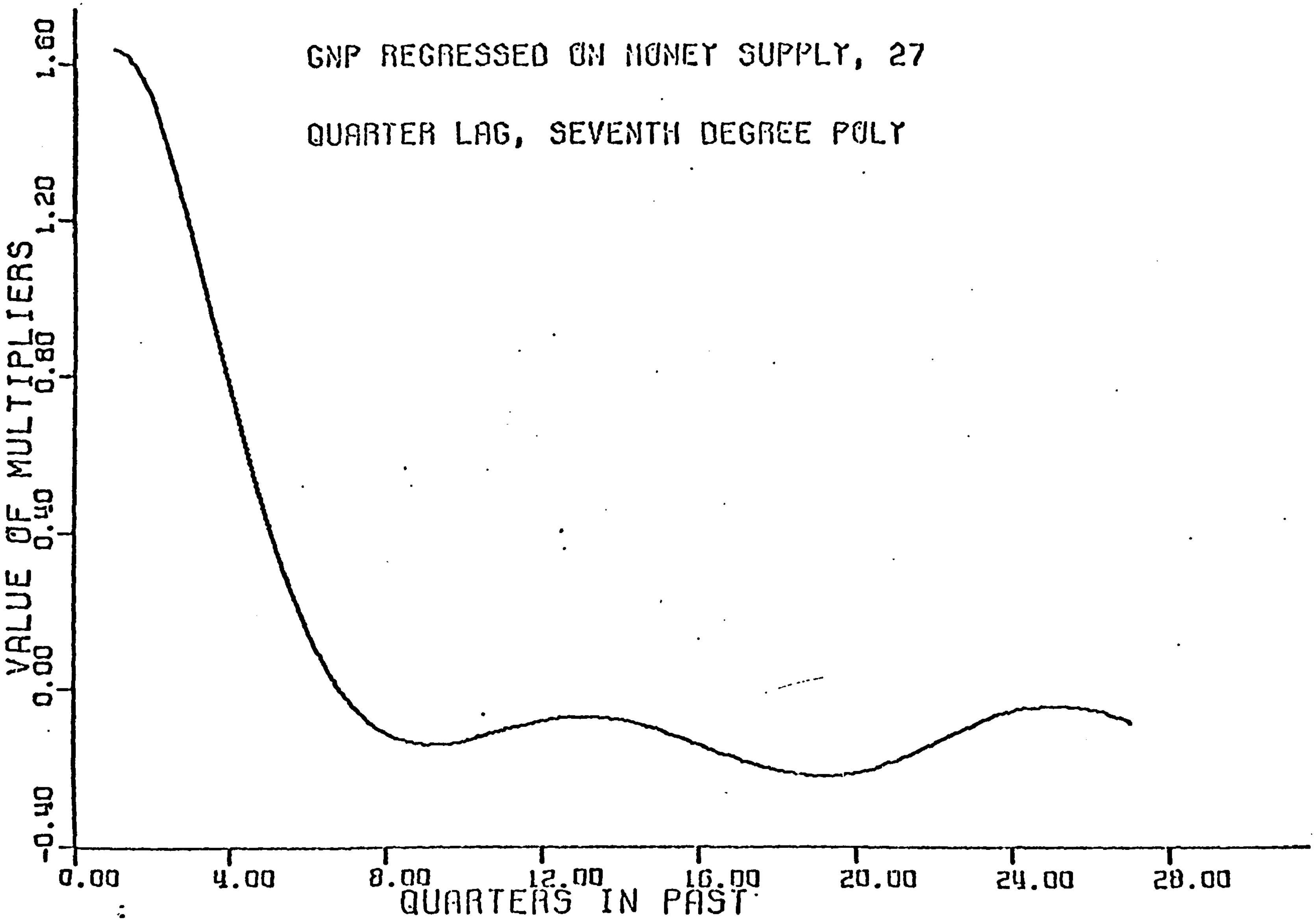

Figure 3.1. GNP regressed on money supply, 27 quarter lag, seventh degree polynomial

the earlier quarters when the incremental multipliers are statistically significant. Oscillation of the curve very near the axis is also apparent, as well as the fact that beyond the fourth quarter the incremental multipliers are not significantly different from zero at the .05 level of significance.[1] These results suggest that the fourth degree polynomial was sufficient for the estimation of the lags. Further, a priori economic reasoning does not suggest fluctuations in the lag structure which would require a higher degree polynomial.

The arbitrary periods selected for the interpolation of the polynomial lag structure extending nine quarters in the past were 0.0, 3.0, 6.0, 8.0, and 9.0. For the five quarter lag, they were 0.0, 1.0, 2.0, 4.0, and 5.0 and for the seven quarter lag, 0.0, 1.0, 3.0, 6.0, and 7.0. These periods were selected arbitrarily, though in each case the last quarter in the lag was one of the selected periods. This was for program efficiency in the final computations.

Estimation of the impact of discrete changes in federal government expenditures on goods and services resulted in no additional information being provided by using a distributed lag technique. For this reason, Table 3.1 contains only the results of using a single lagged period in the case of the expenditures variable. The coefficient of the single lagged period is statistically insignificant, as frequently was the case. Testing to determine whether the single lagged period should be included, a trial run was estimated by using the single lagged period

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[1] A .05 level of significance has been used throughout the remainder of the study.

as the only expenditures variable. Generally the results were that it was significant, though not strongly so. For this reason, it was included in the final regression equation. Had it been dropped from the equation, the multiplier obtained in the current period would rise to be approximately equivalent to the sum of the two periods upon inclusion of the lagged period.

The value of the multiplier estimated for the federal expenditures on goods and services was 0.83. A priori, this is of a magnitude which is much smaller than would have been expected. Explanation of this phenomena by those using the reduced form technique and experiencing similar results has varied considerably.

The "monetarist" attribute it to the "crowding out" effect where increases in expenditures not accompanied by money creation induce temporary increases in nominal GNP but have little long-term effects.[1] They go on to argue that increased expenditures financed by increased taxation of an equal amount will encounter an upper limit in its multiplier effects equal to the balanced budget multiplier of unity. Debt financed increases in government expenditures likewise could result in the crowding out of private investment expenditures, a smaller wealth effect, or a diversion of funds from consumption to bond purchases. The net effects of each of the latter effects depend additionally upon the movement of the interest rate pending fiscal debt management activities.

This phenomenon may also be partially atrributable to a substitution

[1] See Roger W. Spencer and William P. Yohe (1970) for a discussion of these effects.

effect as the production of goods to fulfill government orders is substituted for production of private goods. This may be particularly true in the case of defense oriented industries. Inasmuch as approximately one half of the government budget goes to defense spending, such effects could be of considerable importance.

Given this interpretation, imports also take on a new role. Indeed, rather than actually substituting the production of defense items for civilian goods, imported goods may be substituted for domestic production.

Regardless, the effects of such substitution would suggest a smaller multiplier effect due to government expenditures.

To test for the existence of these effects in the context of the estimation technique being used in this study, it was hypothesized that during periods of high unemployment the substitution effects would be expected to be of a smaller degree, suggesting that in such periods, the expenditures multiplier might be of a larger magnitude. Observation of Table 3.2 shows that during the period 1954 to 1965 a high level of unemployment did exist. Under the proposed hypothesis, the expenditures multiplier would be expected to be of a larger magnitude during this period.

Table 3.3 contains a comparison of the expenditures multiplier by observation period, including the period 1954 to 1964. The expenditures multiplier during this period does show signs of increasing magnitude when the money stock, the monetary base, or M^* money is used as the monetary variable. Extension of the observation period to 1969 shows a distinct decline in the expenditures multiplier, as might have been expected, since employment rose considerably during the period 1964 to 1969.

Finally, the multiplier on the expenditure variable falls drastically during the period 1960 to 1962, a finding which is consistent with the hypothesis in that during this period employment was at a very high level.

However, the latter observation period may not represent a valid test in that during this period the intention of the government was to actively use fiscal policy as a stabilization tool. If indeed success was experienced in its use the negative signs observed may be consistent with what might have been expected and in estimating the multiplier effects of fiscal policy the period may not provide much useful information.

Finally, it is apparent that, in observing the government expenditures data, the absolute magnitude of the positive changes in the latter

Table 3.2. Unemployment as a percent of civilian labor force[a]

1948	3.8
1949	5.9
1950	5.3
1951	3.3
1952	3.0
1953	2.9
1954	5.5
1955	4.4
1956	4.1
1957	4.3
1958	6.8
1959	5.5
1960	5.5
1961	6.7
1962	5.5
1963	5.7
1964	5.2
1965	4.5
1966	3.8
1967	3.8
1968	3.6
1969	3.5

[a]Source: Department of Labor, Bureau of Labor Statistics (1969).

Table 3.3. Comparison of expenditures multiplier by observation periods

Observation period	Monetary indicator used	Value of expenditures multiplier
1952-1 to 1969-2	M^s	0.83*
	MB	0.29
	M*	1.13*
	RCP	1.06*
1954-1 to 1964-4	M^s	1.03*
	MB	1.21*
	M*	1.51*
	RCP	0.60
1954-1 to 1969-2	M^s	0.70
	MB	-0.11
	M*	0.89*
	RCP	0.63*
1960-1 to 1969-2	M^s	-0.19
	MB	-0.29
	M*	-0.05
	RCP	0.01

*Significance at 0.05 level.

years of the observation period dominate the series. If, in fact, a high degree of substitution did exist during this period, the implied low expenditures multiplier could have been imposed upon the entire series due to the dominance of the latter years.

In summary, a relatively small and short-lived impact of the expenditures variable on the changes in the level of economic activity is observed. The results of the hypothesis tested to explain the relatively low expenditures multiplier are not conclusive. Though some insight may have been gained, these results were not particularly strong and it is suggested that the technique used simply is not sufficiently robust to depict these substitution effects adequately.

A nine quarter lag length was used in the estimation of the consolidated tax receipts variable. The signs for each of the incremental multipliers in the past periods are negative, as expected. Extension of the lag length provided no further explanation of variance and in trial runs it continued to intersect the axis and become equal to zero at the end of approximately the eighth period. The total multiplier is -2.11 which is of the expected magnitude. In trial runs at varying the lag length the multiplier remained constant within a range of approximately -2.00 to -2.40. Impact of a tax change was found to have its greatest effects after a lag of about three or four quarters.

The estimated value of the transfer multiplier is 3.27 which has the proper sign but is of magnitude which is greater than that which might have been expected. The variable was lagged five quarters with most of the impact of the discretionary changes being felt in the first three quarters following the change. Inasmuch as the recipients would receive the benefits directly, along with the fact that these individuals would likely possess relatively high propensities to spend, the shortness of the lag structure is consistent with what would have been expected a priori.

In conventional economic theory it would have been predicted that the transfer multiplier would have been of the same relative size as the tax multiplier. Observation of the standard error of each reveals that they are within one standard deviation of each other, suggesting that the apparent differential between the two may not be as great as it first appears. Examination of the data also provides some insight as to the larger transfer multiplier in that a relatively large injection of transfer payments resulting from increased national life insurance benefits to veterans after the Korean War was made. This single injection could have caused an upward bias in the results for the entire series. Another factor observed was that, as the lag length of the money series being used was varied, the lag structure and multiplier for the transfer variable appeared to be rather sensitive to these changes. This finding suggested the existence of multi-collinearity despite the use of first differences in the data. Examination of the correlation matrix revealed that some collinearity did exist, though not of an excessive amount. A more plausible explanation may lie in the assumption that the effects of taxes and the transfers are the same and that the various parameters in each case would be equivalent. It is tenuous to assume that say the λ_1 or the parameters of the money demand function for both the taxed and the recipients of transfer payments would be the same. This could have explained much of the difference between the two multipliers as the parameters of the two multipliers may not be equivalent to each other.

Finally, the money supply variable used in case I was estimated with a seven quarter lag. The results obtained on the money variable are consistent with those received by Andersen and Jordan in that the effects of money were found to be relatively large, with a total multiplier of 3.54, and relatively quick in that most of the effects are registered within the first three quarters.

Case II

Table 3.4 contains the results obtained on the estimation of the reduced forms derived under the assumptions of case II. The estimation equation used was:

$$\Delta Y_t = \alpha_o + \alpha_1 \Delta\overline{G}_{f_t} + \alpha_2 \Delta\overline{G}_{f_{t-1}} + \sum_{i=0}^{M_1} \alpha_3 \omega(i) \Delta\overline{T}x + \sum_{i=0}^{M_2} \alpha_4 \omega(i) \Delta\overline{F}_d + \sum_{i=0}^{M_3} \alpha_5 \omega(i) \Delta\overline{M}^* + \mu'', \qquad 3.6$$

or, under an alternative specification where the monetary base was used in the place of M^*:

$$\Delta Y_t = \alpha_o + \alpha_1 \Delta\overline{G}_{f_t} + \alpha_2 \Delta\overline{G}_{f_{t-1}} + \sum_{i=0}^{M_1} \alpha_3 \omega(i) \Delta\overline{T}x + \sum_{i=0}^{M_2} \alpha_4 \omega(i) \Delta\overline{F}_d + \sum_{i=0}^{M_3} \alpha_5 \omega(i) \Delta\overline{M}B + \mu''. \qquad 3.7$$

As in case I, a single discrete lag was used for estimation of the multiplier for federal government expenditures on goods and services. The multiplier increases to 1.13, but remains at a level somewhat lower than expected. The discussion in case I as to the reason for its relative size is again applicable in case II.

The parameter composition of the multiplier has now changed to include η_2, which in the model specification is the coefficient associated with the interest rate in the money supply function. The expected effects of η_2 depends upon the relative size of η_2 to γ_2. If $\eta_2 > \gamma_2$ the effect will be to increase the size of the multiplier. The validity of such a conclusion, however, rests upon a question of whether the money supply responds more to an interest rate change than does money demand.

The tax multiplier estimated under this specification decreased, though not significantly. The lag structure shifted, with the structure

Table 3.4. Changes in gross national product, current dollars, regressed on changes in government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments, and M*, 1952-1 to 1969-2

Lag polynomial degree: 4
R squared: .63
R-bar squared: .53

St. error of estimate: 4.5118
Durbin-Watson statistic: 1.3512

Total Multipliers:	$\bar{G}_f$	$\bar{TX}$	$\bar{F}_d$	$\bar{M}^*$
	= 1.13	= -2.02	= 3.86	= 3.80
t	= 7.29	= 1.70	= 1.82	= 2.91

Lagged independent variable		Quarters in past 0	1	2	3	4	5	6	7	8	9
$\bar{G}_f$											
	w(i)	0.661	0.473								
	STE(i)	0.394	0.374								
	t	1.679	1.263								
$\bar{TX}$											
	w(i)	-0.082	-0.097	-0.311	-0.518	-0.594	-0.490	-0.233	0.069	0.234	0.0
	STE(i)	0.380	0.560	0.477	0.279	0.312	0.348	0.262	0.287	0.360	0.0
	t	0.216	0.174	0.651	1.858	1.902	1.406	0.889	0.241	0.649	0.0
$\bar{F}_d$											
	w(i)	0.232	1.400	1.663	0.846	-0.280	0.0				
	STE(i)	0.808	0.885	0.785	0.994	0.824	0.0				
	t	0.287	1.582	2.119	0.852	0.340	0.0				
$\bar{M}^*$											
	w(i)	0.216	0.754	1.344	1.429	0.866	-0.079	-0.730	0.0		
	STE(i)	0.778	0.529	0.436	0.390	0.508	0.571	0.550	0.0		
	t	0.278	1.426	3.079	3.660	1.706	0.138	1.328	0.0		

approaching zero approximately two quarters earlier than under the previous specification. The quarter during which the primary impact is felt does not change and the greatest impact remains in the third and fourth quarters which is consistent with the discussion of case I.

The transfer multiplier again is of a magnitude which is greater than would have been anticipated with the lag structure shifting further into the past. It remains within a single standard deviation of the tax multiplier as it did in case I.

The monetary variable, M^*, also demonstrates a shift in the lag structure, though the impact remains concentrated in approximately the same quarters. The primary difference observed was that, after the fourth quarter, the lag fell very rapidly. The relative magnitude of the money multiplier remained about the same as when the money stock was used.

It is evident in each variable that the primary change was in the lag structure. This, at least in part, must be explained by the parameter η_2 obtained from the money supply function. This parameter suggests that if the Federal Reserve responds to changes in a variable such as M^* a greater lag might be anticipated on the money variable as well as the transfer variable since the measurement of the exogenous change is now being recorded at a different point in time. Indeed, if the money supply is used as the monetary variable, the response of the commercial banking system to discretionary monetary changes has already taken place, this is not necessarily the case with M^*. The η_2 measures this response of the money supply as a result of a change in M^* and thus, in measuring the impact of monetary or fiscal policy, the parameter should appear and the multiplier under such a specification should differ from that of case I.

The results of the alternative specification, where the monetary base replaced M^*, are presented in Table 3.5. The composition of the parameters of the multipliers remain the same yet the values of the total multipliers have changed sizably. The expenditures multiplier has dropped dramatically, the tax receipts multiplier has risen, and the transfer and money multipliers have risen rather sharply.

Vividly illustrated by this specification are the difficulties encountered in identifying the parameters. Despite similar reduced forms when using both M^* or the monetary base, the results differ considerably. The parameter η_2 provides the only explainable reconciliation of these results and, unless care is taken in identifying η_2, misinterpretation of the results is likely.

Case III

Table 3.6 presents the results of the estimation of,

$$\Delta Y_t = \alpha_o + \alpha_1 \Delta\overline{G}_{f_t} + \alpha_2 \Delta\overline{G}_{f_{t-1}} + \sum_{i=0}^{M_1} \alpha_3 \omega(i) \Delta\overline{T}x + \sum_{i=0}^{M_2} \alpha_4 \omega(i) \Delta\overline{F}_d + \sum_{i=0}^{M_3} \alpha_5 \omega(i) \Delta RCP + \mu''' \qquad 3.8$$

which is the reduced form obtained under the assumptions made in case III.

Of concern in this case is the fact that the multiplier obtained from use of the rate of interest on 4-6 month commercial paper as the monetary variable yielded coefficients which were found to be statistically

Table 3.5. Changes in gross national product, current dollars, regressed on changes in government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments, and the monetary base, 1952-1 to 1969-2

Lag polynomial degree: 4
R squared: .69
R-bar squared: .63
St. error of estimate: 4.0126
Durbin-Watson statistic: 1.6517

Total multipliers: $\bar{G}_f$ = 0.291, t = 0.900; $\overline{TX}$ = -2.57, t = 2.41; $\bar{F}_d$ = 4.06, t = 2.23; $\overline{MB}$ = 7.93, t = 3.13

Lagged independent variable	Quarters in past: 0	1	2	3	4	5	6	7	8	9
$\bar{G}_f$										
w(i)	0.291									
STE(i)	0.323									
t	0.900									
$\overline{TX}$										
w(i)	-0.064	-0.058	-0.237	-0.443	-0.569	-0.562	-0.423	-0.204	-0.010	0.0
STE(i)	0.344	0.503	0.424	0.243	0.280	0.313	0.235	0.261	0.329	0.0
t	0.186	0.116	0.560	1.820	2.035	1.797	1.804	0.782	0.031	0.0
$\bar{F}_d$										
w(i)	0.959	1.703	1.212	0.368	-0.177	0.0				
STE(i)	0.639	0.692	0.586	0.757	0.651	0.0				
t	1.500	2.460	2.068	0.486	0.272	0.0				
$\overline{MB}$										
w(i)	2.949	8.511	6.727	1.894	-2.774	-5.156	-4.213	0.0		
STE(i)	2.169	1.625	1.386	1.388	1.704	1.799	1.695	0.0		
t	1.360	5.239	4.852	1.365	1.628	2.867	2.485	0.0		

Table 3.6. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and the rate on commercial paper, 1952-1 to 1969-2

Lag polynomial degree: 4
R squared: .64
R-bar squared: .56
St. error of estimate: 4.3716
Durbin-Watson statistic: 1.4610

Total multipliers: $\bar{G}_f$ = 1.06, t = 2.42; $\bar{TX}$ = -1.91, t = 1.88; $\bar{F}_d$ = 7.53, t = 5.32; $\bar{RCP}$ = -1.06, t = 0.32

Lagged independent variable	Quarters in past: 0	1	2	3	4	5	6	7	8	9
$\bar{G}_f$										
w(i)	0.738	0.327								
STE(i)	0.384	0.367								
t	1.920	0.891								
$\bar{TX}$										
w(i)	-0.367	-0.045	-0.294	-0.556	-0.541	-0.233	0.121	0.0		
STE(i)	0.382	0.314	0.270	0.277	0.341	0.376	0.364	0.0		
t	0.960	0.145	1.091	2.008	1.587	0.618	0.333	0.0		
$\bar{F}_d$										
w(i)	1.554	2.587	1.836	0.984	0.573	0.0				
STE(i)	0.702	0.652	0.539	0.723	0.697	0.0				
t	2.215	3.970	3.405	1.361	0.822	0.0				
$\bar{RCP}$										
w(i)	6.252	0.261	-1.908	-2.269	-1.992	-1.406	0.0			
STE(i)	1.466	1.857	0.842	0.987	1.134	1.239	0.0			
t	4.266	0.141	2.267	2.298	1.756	1.135	0.0			

nonsignificant in three of the four observation periods used in estimation. In the period in which significance was observed, the sign of the coefficient was positive which is not as predicted.

These results suggest that if R is exogenous, monetary policy is not very effective. Indeed, as long as the estimate remains insignificant it cannot be implied that the coefficient is significantly different from zero.

The government expenditures multiplier and tax multiplier remain about the same as in case I and II and the transfer multiplier has increased to a relatively large magnitude. The lag structures have likewise remained unchanged from the previous cases.

Stability of Estimates

To test the stability of the estimates of the multipliers the observation period was altered to observe whether the multipliers would remain relatively constant over these alternative observation periods. Table 3.7 presents a summary and comparison of the multipliers obtained in estimation during the periods 1952 to 1969, 1954 to 1964, 1964 to 1969, and 1960 to 1969. The discussion of the expenditures multiplier in case I demonstrated that the government expenditures multiplier did vary depending upon the period selected. Indeed, in the latter periods the multiplier became negative, though during these periods it tended to be insignificant. The only time that the expenditures multiplier became significant was when it was positive and normally, significance did not appear until the multiplier began to approach or exceed unity.

The tax multiplier also showed considerable variation as the observation period was changed. With the exception of the multiplier

Table 3.7. Comparison of multipliers by observation periods

Observation period	Monetary indicator used	Multipliers			
		Expenditures multiplier	Tax receipts multiplier	Transfer payments multiplier	Monetary multiplier
1952-1 to 1969-2	M^S	.83*	-2.11*	3.27*	3.54*
	MB	.29	-2.57*	4.06*	7.93*
	M*	1.13*	-2.02*	3.86*	3.80*
	RCP	1.06*	-1.91*	7.53*	-1.06
1954-1 to 1964-4	M^S	1.03*	-.20	-2.43	4.97*
	MB	1.21*	-2.01	-.91	12.35*
	M*	1.51*	-.18	1.45	7.06*
	RCP	.60	1.23	.29	1.79
1954-1 to 1969-2	M^S	.70*	-1.14	.15	4.96*
	MB	-.11	-1.11	2.18	11.15*
	M*	.89*	-1.51	1.35	5.01*
	RCP	.63*	-2.82*	8.80*	.41
1960-1 to 1969-2	M^S	-.19	-2.48*	5.21*	2.51*
	MB	-.29	-2.60*	6.68*	4.94
	M*	-.05	-2.23*	3.06	4.40*
	RCP	.01	-3.09*	8.05*	6.57*

*Significance at 0.05 level.

obtained using the rate on 4-6 month commercial paper, during the period 1954 to 1964, the sign consistently remained negative. During the periods 1954 to 1964 and 1954 to 1969 the relative size of the multiplier remained smaller than expected, though in the period 1954 to 1969 it increased in magnitude. Explanation of the relatively small magnitude may rest in the fact that the only significant change in the taxes during this period was the 1964 tax cut. Addition of the period 1964 to 1969 adds to the series such changes in the tax structure as the 1968 surtax and increases in social security contributions necessary to finance increased social security benefits. The effects of these latter changes are clearly illustrated in the results obtained for the period 1960 to 1969. Further observation of the data shows that in the periods prior to 1954 the change in the data also exceed those in the period 1954 to 1964. It is thus likely that these earlier and later years in the data dominate to provide the results for the period 1952 to 1969.

Considerable variation in the multiplier also exists in the case of the transfers multiplier. A puzzling aspect of the transfers multiplier was the fact that in the period 1954 to 1964 two of the multipliers were negative.[1] As with taxes changes in the data on transfers were not significant during this period. Also, similarly in the over-all series most of the changes took place either in the years prior to 1954 or after 1964, particularly in the latter case as social security benefits were

[1]A similar result was encountered by Corrigan (1970). He ascribed the outcome to reverse causation in the earlier quarters of the lag structure since as income rises, initially transfers may tend to fall, causing the negative coefficient in the earlier quarters.

increased. Again it is likely that the earlier and later years have dominated the entire series in testing over the period 1952 to 1969.

Finally, unlike the fiscal variables, the monetary variables other than the rate of interest on 4-6 month commercial paper show considerable resilience to changes in the observation period. In all cases where the money stock, the monetary base, or M^* money is used the signs remain positive and the multiplier is of a relatively large magnitude. In only one case is significance lost and in this case extension of the lag led to a higher multiplier and significance. The equation with the extended lag was not selected for reporting, however, as the standard error of estimate for the over-all equation would not have been minimized, though the standard error on the monetary variable alone could have been lowered.

Stability of the money multipliers is further confirmed by computation of 95 percent confidence intervals for each of the multipliers estimated in each of the alternative observation periods. Table 3.8 presents the confidence intervals for the multipliers obtained using the money stock, the monetary base, and M^* money as the monetary indicator. Clearly demonstrated by the confidence intervals for each of the multipliers estimated, using the alternative monetary indicators in each observation period, is the fact that the confidence intervals overlap each other from period to period. Indeed, if the lower of the upper limits and the higher of the lower limits for each of the confidence intervals computed for the alternative monetary indicators are observed it can be noted that the estimated value of the multiplier for each of the observation periods fall easily within this range. This is true for all

Table 3.8. Confidence intervals for estimates of money multipliers using the money stock, the monetary base, and M* money

Observation period	Monetary indicator	95 percent confidence interval
1952-1 to 1969-2	M^S	$1.52 \leq k^a \leq 5.56$
	MB	$2.90 \leq k \leq 12.96$
	M*	$1.19 \leq k \leq 6.41$
1954-1 to 1964-4	M^S	$1.05 \leq k \leq 8.89$
	MB	$2.56 \leq k \leq 22.14$
	M*	$2.38 \leq k \leq 11.74$
1954-1 to 1969-2	M^S	$2.53 \leq k \leq 7.39$
	MB	$5.02 \leq k \leq 17.28$
	M*	$2.10 \leq k \leq 7.92$
1960-1 to 1969-2	M^S	$-0.12 \leq k \leq 5.15$
	MB	$-3.72 \leq k \leq 13.60$
	M*	$1.12 \leq k \leq 7.68$

[a]The k is the money multiplier estimated using the respective monetary indicators.

of the monetary indicators with the exception of the rate of interest on 4-6 month commercial paper clearly suggesting that it can be stated with 95 percent confidence that the multiplier falls within this range for all the observation periods.

The lag structures for each of the equations estimated for the periods 1954 to 1964, 1954 to 1969, and 1960 to 1969 are presented in Appendix C. Observation of the nature of the lag structures reveals that during the periods 1954 to 1964 and 1954 to 1969 the lag structures for the tax and transfer variables changed considerably. The lack of significant change in the data during these periods, particularly 1954 to 1964, made it very difficult to minimize the standard error of the over-all equation and at the same time obtain minimum standard error for each variable and obtain a superior lag structure. Indeed, it was possible in most cases to obtain lag structures for specific variables very similar to those which were obtained for the period 1952 to 1969; however, this led to a higher standard error for the over-all equation and higher standard errors on the remaining variables in the equation. Of importance is the fact that whenever significance was obtained, such as during the period from 1960 to 1969, the lag structures returned to be approximately similar to those obtained for the period 1952 to 1969.

In conclusion, it is apparent that the monetary variables, with the exception of the rate of interest on 4-6 month commercial paper, provide multipliers characterized with much greater stability than do the fiscal variables. This finding suggests that monetary policy may represent the more reliable policy instrument of the two. This is not, however, to suggest that fiscal policy is not effective; such a conclusion is not justified on the basis of the results obtained. Indeed, the size of the tax and transfer multipliers suggest that fiscal policy can be very effective.

Contrast of Results of This Study to Previous Research

Table 3.9 provides a summary of the results received by previous research studies seeking to determine the relative impact of monetary versus fiscal policy.

It is apparent that the results of this study compare very closely to those of E. G. Corrigan (1970). The techniques used by Corrigan are similar to those used in this study and a favorable comparison could have been expected.

Table 3.9. Estimates of monetary and fiscal policy multipliers

Study	Sample period	Multiplier for monetary variable	Multiplier for[a] expenditures var.	Multiplier for tax variable
Friedman-Meiselman	Annual, 1948-57	2.58	1.71	-1.71
	Quarterly, 1945-58	2.94 (for M_2)	1.06	-1.06
Ando-Modigliani	Annual, 1929-58 excluding war	.26 (for M*)	1.62	-1.98
Deprano-Mayer	Annual, 1929-63	1.05 (for M_2)	1.51	n.c.
Andersen-Jordan	Quarterly, 1952-68	16.01 (for adjusted monetary base)	-.54	.51
de Leeuw-Kalchbrenner	Quarterly, 1952-68	11.6 (for adjusted unborrowed reserves)	2.5	
	1st differences		2.5	-2.8
FRB-MIT model	Quarterly post-war	20.6 (for unborrowed reserves)	2.7	-2.5
Corrigan	Quarterly, 1952-68	4.4 (for M_1)	.7 (G_{g+s})[a]	-2.5
	1st differences		1.9 (G_{tr})[a]	-2.5

[a]In all the studies, with the exception of the one performed by Corrigan, transfer payments were included in the expenditures variable. Corrigan separated the transfers out and this explains G_{g+s} which are expenditures on goods and services and G_{tr} which are the transfers.

Beyond this similarity, it is evident that considerable variation exists between these studies. This is particularly true of the multipliers obtained for the monetary and expenditures variables. Despite the dissimilarities, the evidence points more strongly towards money having a greater impact than the fiscal variables, though the magnitude of its impact is anything but clear, as evidenced by the contrasting results.

Finally, it must be kept in mind that differing results should be expected as the specification of the various models used for estimation vary greatly. The effects of using different specifications has been demonstrated rather clearly in this chapter and likely confirmed by these contrasting results.

CHAPTER IV. SUMMARY AND CONCLUSIONS

Since 1963 the debate over the relative impact of monetary versus fiscal policy has from time to time reappeared in the literature as further empirical evidence has been offered. The debate initially was inaugurated by Friedman and Meiselman in 1963 only to abate with failure to reach agreement as to an acceptable autonomous expenditures variable to be used in the test. Andersen and Jordan refueled the debate in 1968 with a presumably acceptable expenditures variable, full-employment expenditures, but with the monetary variable under attack by their respondents.

The research in this study constitutes an additional contribution to the evidence in the debate as well as a clarification of some of the issues involved. Of the benefits to be derived from this study, perhaps those of greatest significance are (a) a clarification of the difficulties with using the full-employment concept in deriving a fiscal indicator, (b) a clarification of the reasons for the contrasting multipliers due to differences in model specification, (c) a clarification of the econometric difficulties encountered with reduced forms when a misspecification of the underlying structural equations exists, and (d) that empirically, money exerts a stable, quick, and relatively large influence upon the level of economic activity.

Specified in this study was a simple Keynesian model solved for its reduced forms under three alternative sets of assumptions. Observation of the results obtained from the estimation of the alternative reduced forms demonstrate clearly that very similar reduced forms may lead to different results depending upon the values of the parameters implicit in the structural system from which the reduced forms are derived.

Empirically, the results suggest that money is important as a determinant of the level of economic activity. The stability of the estimates of the money multipliers shown in Chapter III confirm that money over time has consistently contributed to movements in GNP. Due to the erratic nature of the multipliers for the fiscal variables, the role of these variables is less clearly defined. Suggested, however, is that taxes and transfer payments do play a significant role. Finally, the evidence fails to support the extreme views of either the "monetarist" or the "Keynesian" positions. Indeed, the extreme monetarist position that "money only matters" is not confirmed due to the empirical results obtained in estimating the multipliers for the tax and transfer variables. On the other hand, the passive role of money envisioned by the extreme Keynesians is not supported on the basis of the relatively strong empirical results obtained from the monetary variables. On balance, it must be concluded that the role of money is more firmly supported by the empirical results of this study than is the role of the fiscal variables. This conclusion is not to be interpreted, however, as excluding the role of fiscal policy entirely, as clearly the tax and transfer variables of the model do exhibit a considerable role in the determination of the level of economic activity.

Apparent in the results is also the imperative need to heed the dangers of the statistical technique used to estimate the various multipliers as well as the nature of the data being used. The latter difficulties with the nature of the data became very clear in the discussion of the stability of the estimates in Chapter III. As a statistical technique, regression analysis expresses only the association between movements in the independent and dependent variables. In no sense does the technique reveal a direct flow of causation between the variables. Thus, in a study such as this, the technique implies only that an association in movements between the assumed exogenous policy variable and the dependent variable are being recorded. Without additional information, a precise causual link cannot be interpreted from the results. Finally, in using the reduced form technique, the very complex set of interlocking behavioral relationships which characterize the economy have been consolidated into a few key variables. Only if the consolidation of these relationships, as reflected by the specification of the model, is accepted as being valid can the evidence provide meaningful interpretation.

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APPENDIX A. ALMON DISTRIBUTED LAG FUNCTIONS

Most distributed lag functions state that a dependent variable, Y, is determined by a weighted sum of the past values of the independent variable, X, i.e.,

$$Y_t = \sum_{i=0}^{N} \omega(i) X_{t-i} \qquad \text{A.1.1}$$

where t represents the current period, t-i a given period in the past, and n+1 the number of periods in the past.

A similar formulation as this was used in this study where the first differences of current GNP (ΔY_t) was regressed on current and lagged values of first differences of federal expenditures on goods and services in current dollars (ΔG_f), tax receipts (ΔTx), transfer payments (ΔF_d), and a monetary indicator. This may be expressed as,

$$\Delta Y_t = \alpha_o + \sum_{i=0}^{M_1} \alpha_1 \omega(i) \Delta\overline{G}_f + \sum_{i=0}^{M_2} \alpha_2 \omega(i) \Delta\overline{T}x + \sum_{i=0}^{M_3} \alpha_3 {}^{\omega}(i) \Delta\overline{F}_d + \sum_{i=0}^{M_4} \alpha_4 \omega(i) \Delta\overline{M}^s + \mu'. \qquad \text{A.1.2}$$

The purpose of the study was to obtain estimates of the $\alpha_g{}^{\omega}(i)$ which represent the impact of a change in the independent variable in a past period, t-i, upon the dependent variable in the current period, t. These estimated coefficients may also be interpreted as multipliers where a single unit change in the independent variable will lead to a change in the dependent variable equal to the value of the coefficient or weight.

By assuming that we know the value of selected $\alpha_g \omega_g(i)$ and that at these selected values a polynomial of a specified degree pass we could solve for the desired coefficients through the simultaneous solution of the set of polynomials passing through the selected points. To illustrate assume these polynomials are of the fourth degree. To assure a polynomial of the fourth degree five values of the structure must be known. These $\omega(i)$ may be written as,

$$
\begin{aligned}
\omega(i_1) &= \alpha_o + \alpha_1 i_1 + \alpha_2 i_1^2 + \alpha_3 i_1^3 + \alpha_4 i_1^4 \\
\omega(i_2) &= \alpha_o + \alpha_1 i_2 + \alpha_2 i_2^2 + \alpha_3 i_2^3 + \alpha_4 i_2^4 \\
\omega(i_3) &= \alpha_o + \alpha_1 i_3 + \alpha_2 i_3^2 + \alpha_3 i_3^3 + \alpha_4 i_3^4 \\
\omega(i_4) &= \alpha_o + \alpha_1 i_4 + \alpha_2 i_4^2 + \alpha_3 i_4^3 + \alpha_4 i_4^4 \\
\omega(i_5) &= \alpha_0 + \alpha_1 i_5 + \alpha_2 i_5^2 + \alpha_3 i_5^3 + \alpha_4 i_5^4 .
\end{aligned}
\qquad \text{A.1.3}
$$

In matrix notation A.1.3 becomes,

$$
Z = \begin{bmatrix} \omega(i_1) \\ \omega(i_2) \\ \omega(i_3) \\ \omega(i_4) \\ \omega(i_5) \end{bmatrix}
\qquad
X = \begin{bmatrix}
1 & i_1 & i_1^2 & i_1^3 & i_1^4 \\
1 & i_2 & i_2^2 & i_2^3 & i_2^4 \\
1 & i_3 & i_3^2 & i_3^3 & i_3^4 \\
1 & i_4 & i_4^2 & i_4^3 & i_4^4 \\
1 & i_5 & i_5^2 & i_5^3 & i_5^4
\end{bmatrix}
$$

$$
A = \begin{bmatrix} \alpha_o \\ \alpha_1 \\ \alpha_2 \\ \alpha_3 \\ \alpha_4 \end{bmatrix}
$$

The solution to A, the α's, is

$$A = X^{-1}Z. \qquad \text{A.1.4}$$

The values of the fourth degree polynomials passing through the selected periods can be obtained by substituting the α's into A.1.3. Likewise values of the polynomials at the points not selected may be determined with the values of the α's derived at the known values of the weight structure.

The difficulty with this technique is that it is explicitly assumed that knowledge of the weights at selected periods is known. In this study, as in most economic studies, possession of such knowledge does not exist.

Shirley Almon in 1965 suggested an alternative technique where instead of assuming knowledge of the values of the weights at specific points all that is required is to specify the lag length, the degree of the polynomial, and selected arbitrary periods in the lag structure. The method of Lagrange for polynomial interpolation in conjunction with the method of ordinary least squares is then used to estimate the weight structure. With this technique rather than assuming that we know specific values of the $\omega(i)$ the $\omega(i)$ will be estimated from the data by the use of ordinary least squares.

Similar to the previous case begin by assuming that each period in the weight structure may be represented by the value of a polynomial of the degree q. The value of the polynomial at each point may be written as,

$$\omega_g(i) = \sum_{h=0}^{q} {}_g a_h i^h \qquad i = 0,1,\ldots,m_g \qquad \text{A.1.5}$$
$$g = 1,2,\ldots,N;\ N = 4$$

which is of the degree q in i where i is a period in the lag structure, n the number of periods back that the lag extends, and g the variable for which the lag structure is being constructed.

Multiplying by α_g on both sides of A.1.5,

$$\alpha_g \omega(i) = \alpha_g \sum_{h=0}^{q} {}_g a_h i^h . \qquad \text{A.1.6}$$

Recalling equation A.1.2 the coefficients of this equation are polynomials of the degree q in i. Suppose it is assumed that $\alpha_g \omega(i) = {}_g b_k$ for q+1 known values of i. Using equation A.1.6 $\alpha_g \omega(i)$ may be written as,

$$\alpha_g \omega(i) = \phi_o(i) b_o + \phi_1(i) b_1 + \ldots + \phi_k(i) b_k \qquad \text{A.1.7}$$

where the $\phi_k(i)$'s are Lagrangian interpolation coefficients.

Equation A.1.2 may now be rewritten as,

$$\Delta Y_t = \alpha_o + \sum_{i=0}^{M_1}\left[\sum_{k=1}^{q} {}_1\phi_k(i)\, {}_1b_k\right]\Delta G_{f_{t-i}} + \sum_{i=0}^{M_2}\left[\sum_{k=1}^{q} {}_2\phi_k(i)\, {}_2b_k\right]\Delta Tx_{t-i}$$
$$+ \sum_{i=0}^{M_3}\left[\sum_{k=1}^{q} {}_3\phi_k(i)\, {}_3b_k\right]\Delta F_{d_{t-i}} + \sum_{i=0}^{M_4}\left[\sum_{k=1}^{q} {}_4\phi_k(i)\, {}_4b_k\right]\Delta M^s{}_{t-i} \qquad \text{A.1.8}$$

or,

$$\Delta Y_t = \alpha_o + \sum_{k=1}^{q} {}_1b_k\left[\sum_{i=0}^{M_1} {}_1\phi_k(i)\Delta G_{f_{t-i}}\right] + \sum_{k=1}^{q} {}_2b_k\left[\sum_{i=0}^{M_2} {}_2\phi_k(i)\Delta Tx_{t-i}\right]$$
$$+ \sum_{k=1}^{q} {}_3b_k\left[\sum_{i=0}^{M_3} {}_3\phi_k(i)\Delta F_{d_{t-i}}\right] + \sum_{k=1}^{q} {}_4b_k\left[\sum_{i=0}^{M_4} {}_4\phi_k(i)\Delta M^s{}_{t-i}\right] \qquad \text{A.1.9}$$

where ${}_g b_{q+1} = \alpha_g \omega(m_g) = 0$ which has the effect of forcing the last period in the lag structure to have a value of 0.

Let,

$$ {}_g^kA_t = \sum_{i=0}^{M_g} {}_g\phi_k(i)X_g \qquad \text{A.1.10} $$

be the Almon variables upon which changes in the dependent variable will be regressed. The X_g in A.1.10 represents $\Delta G_{f_{t-i}}$, ΔTx_{t-i}, ΔF_{t-i}, and ΔM^s_{t-i}.

Equation A.1.9 now becomes,

$$ \Delta Y_t = \alpha_o + \sum_{k=1}^{q} {}_1b_{k1}{}^kA_t + \sum_{k=1}^{q} {}_2b_{k2}{}^kA_t + \sum_{k=1}^{q} {}_3b_{k3}{}^kA_t + \sum_{k=1}^{q} {}_4b_{k4}{}^kA_t. \qquad \text{A.1.11} $$

Before the ${}_g\hat{b}_k$'s can be estimated the polynomials at each point in the lag structure must possess specific properties to ensure that ${}_gb_k = \alpha_g\omega(i_k)$. Suppose equation A.1.7 is rewritten as,

$$ f(i_k) = \alpha_g\omega(i_k) = \phi_o(i)b_o + \phi_1(i)b_1 + \ldots + \phi_k(i)b_k \qquad \text{A.1.12} $$

where i_k represents an arbitrarily selected period. Assume a fourth degree polynomial so that $f(i_k)$ takes the form,

$$ f(i_k) = \alpha_g\omega(i_k) = \phi_o(i)b_o + \phi_1(i)b_1 + \phi_2(i)b_2 + \phi_3(i)b_3 + \phi_4(i)b_4. \qquad \text{A.1.13} $$

For $\alpha_g\omega(i_o)$ at $i = i_o$ in A.1.13 t equal b_o, $\phi_o(i)$ must equal 1 while all the other remaining $\phi_k(i)$ must equal 0. Polynomials which possess this property may be constructed in the following manner.

Let,

$$\phi_k(i) = c \prod_{\substack{j=1 \\ j\neq k}}^{q+1} (i - i_j) \text{ for } i \neq i_k \qquad \text{A.1.14}$$

where the i_j th period represents selected known periods other than the i_k th period. Substitute i_k for i and equate A.1.14 to 1, i.e.,

$$\phi_k(i_k) = c \prod_{\substack{j=1 \\ j\neq k}}^{q+1} (i_k - i_j) = 1. \qquad \text{A.1.15}$$

Solve for c and substitute this value of c into A.1.14 to obtain

$$\phi_k(i) = \frac{\prod_{j=1}^{q+1}{}' (i - i_j)}{\prod_{j=1}^{q+1}{}' (i_k - i_j)} \qquad \text{A.1.16}$$

where the prime after the product means the $j\neq k$. The resultant $\phi_k(i)$ are the Lagrangian interpolation coefficients used in equations A.1.8 and A.1.9. Ordinary least squares may now be used to estimate ${}_g\hat{b}_k$ which will also be equal to the weight in the arbitrarily selected periods. Since the polynomials constructed at each point in the structure are linear combinations of each other the weights in the unknown periods may be calculated by recalling that,

$$\alpha_g \omega(i) = \sum_{k=1}^{q+1} {}_g\phi_k(i)\, {}_gb_k. \qquad \text{A.1.17}$$

Since,

$$\sum_{i=0}^{M_g} \omega_g(i) = 1 \qquad \text{A.1.18}$$

and,

$$\sum_{i=0}^{M_g} \alpha_g \omega_g(i) = \alpha_g \qquad \text{A.1.19}$$

the estimates of the α_g may be computed with relative ease.

The,

$$\text{Var}\,[\alpha_g \omega(i)] = \sum_{k=1}^{q} \left[{}_g\phi_k(i)\right]^2 \text{var}\,({}_g b_k) \qquad \text{A.1.20}$$

where var $({}_g b_k)$ is obtained from regression.

The t statistic may be calculated for each weight as,

$$t_{\alpha,df} = \frac{\alpha_g \omega(i)}{\sqrt{\text{var}\ \alpha_g \omega(i)}} \,. \qquad \text{A.1.21}$$

APPENDIX B. SOURCES AND DESCRIPTION OF DATA

Gross National Product: The "Gross National Product" or expenditures is the market value of the output of goods and services produced by the nation's economy, before deduction of depreciation charges and other allowances for business and institutional consumption of durable goods. The quarterly series of data in current dollars is available from The U. S. Department of Commerce, Office of Business Economics and is published in Business Statistics (1969b, pp. 1 and 199).

Federal expenditures on goods and services: Quarterly estimates are obtained essentially from the monthly Statement of Receipts and Expenditures of the U. S. Government issued by the U. S. Treasury Department. The data has been adjusted to reflect the fact that the total budgetary expenditures reported in The Monthly Statement includes some non-purchases of goods and services and excludes others. The adjustments made and the series of data can be found in Business Statistics (1969b, pp. 1 and 199).

M^S: Is a quarterly series of daily averages of the seasonally adjusted money supply. Equals demand deposits at all commercial banks minus cash items in process of collection, minus federal reserve float, plus coins and currency outside of the treasury, federal reserve banks, and the vaults of the commercial banks. Data was obtained through private communications with the Federal Reserve Bank of St. Louis.

MB: The monetary base is a quarterly series computed as being equivalent to bank reserves plus currency held by the public. Data obtained through private communications with the Federal Reserve Bark of St. Louis.

M^*: Defined as the maximum stock of money which can be created given the reserve requirement and the public demand for currency. Is equal to currency in the hands of the public plus member bank reserves plus member bank excess reserves. Data for its computation is available from the Board of Governors of the Federal Reserve System.

RCP: Averages of daily offering rates of the money market rates on prime 4-6 month commercial papers. Series is available in Business Statistics (1969b, p. 90).

Listed below are the data series obtained from the Federal Reserve-MIT econometric model data bank along with data descriptions and the sources of the data cited by the Federal Reserve-MIT econometric model data directory (1970).

t_h: Average effective rate of personal income tax available from Statistics on Income, U. S. Treasury Department (1968).

Y_T: Taxable income calculated as being equivalent to YTF$ = $\{$1.0 - exponent (Log e(1-QYTF$/YP$))$\}$x YP$, where QYTF$ is the natural logarithm of (1-YTF$/YP$), YP$ is personal income, and YTF$ is taxable income, all in current dollars.

Z_r: Series of effective rate of tax credit on investment on producers durables available in the National Income and Product Accounts, published by the U. S. Department of Commerce, Office of Business Economics (1969a).

E_{PD}: Expenditures on producers durables available in the National Income and Product Accounts published by the U. S. Department of Commerce, Office of Business Economics (1969a).

Y_C: Corporate income available in the National Income and Product Accounts published by the U. S. Department of Commerce, Office of Business Economics (1969a).

T_{SC}: Corporate tax liability to state and local governments available from National Income and Product Accounts published by U. S. Department of Commerce, Office of Business Economics (1969a).

t_C: The marginal rate of corporate income tax available in The Federal Tax System: Facts and Problems, Joint Economic Committee, 88th Congress, 2nd Session, p. 285 (1964).

t_I: The OASDHI contribution rate available in the Annual Statistical Supplement to the Social Security Bulletin (1969).

Y_H: Personal income available in the National Income and Product Accounts, U. S. Department of Commerce, Office of Business Economics (1969a).

t_U: Unemployment insurance contribution rate available in Unemployment Insurance Tax Rates by Industry published by the U. S. Department of Labor (1969b).

t_{uic}: Ratio of covered to total labor force computed as,

$$t_{uic} = \frac{\text{Average Covered Employment all U. S. Industries}}{\text{Civilian Labor Force}} .$$

Data for its computation is available in Unemployment Insurance Tax Rates by Industry published by the U. S. Department of Labor (1969b).

t_{UIB}: The series is a weighted average of maximum weekly benefits for 20 states, the weights being average employment in those states. Data is available in Comparison of State Unemployment Insurance Laws published by the U. S. Department of Labor (1969b).

L_{FC} and L_E: Total labor force and total civilian employment both available in the Survey of Current Business published by the U. S. Department of Commerce, Office of Business Economics (1969c).

TEGF, GFP, and GFI: Federal gift and estate taxes, federal government transfer payments to persons other than unemployment insurance benefits, and federal government interest payments to persons all available in the National Income Product Accounts published by the U. S. Department of Commerce, Office of Business Economics (1969a).

TOSI: Contributions to social insurance other than OASI and unemployment insurance computed as,

$$TOSI = A - TO - TU$$

where A is the contributions for social insurance to federal government, TO is the OSIA contributions, and TU is contributions for unemployment insurance. Data available for computation in National Income Product Accounts published by U. S. Department of Commerce, Office of Business Economics (1969a).

APPENDIX C. TABLES OF RESULTS

Table 1. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and the stock of money, 1954-1 to 1964-4

Lag polynomial degree: 4 | St. error of estimate: 4.2192
R squared: .53 | Durbin-Watson statistic: 1.6540
R-bar squared: .33

Total multipliers:	$\bar{G}_f$ = 1.03	$\bar{TX}$ = -0.20	$\bar{F}_d$ = -2.42	$\bar{M}^s$ = 4.97
	t = 2.12	t = 0.06	t = 0.38	t = 2.52

Lagged independent variable	Quarters in past 0	1	2	3	4	5	6	7	8	9
$\bar{G}_f$										
w(i)	1.034									
STE(i)	0.488									
t	2.121									
$\bar{TX}$										
w(i)	0.512	0.157	-0.012	-0.166	-0.325	-0.361	0.0			
STE(i)	0.719	1.166	0.511	0.588	0.873	1.272	0.0			
t	0.711	0.135	0.024	0.283	0.372	0.284	0.0			
$\bar{F}_d$										
w(i)	-0.781	1.274	-0.939	-1.763	-0.218	0.0				
STE(i)	1.637	1.866	1.827	2.279	1.959	0.0				
t	0.477	0.683	0.514	0.773	0.111	0.0				
$\bar{M}^s$										
w(i)	1.640	0.797	1.477	1.550	0.430	-0.922	0.0			
STE(i)	1.240	1.370	0.572	0.795	0.906	0.999	0.0			
t	1.322	0.582	2.581	1.948	0.474	0.923	0.0			

Table 2. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and the monetary base, 1954-1 to 1964-4

Lag polynomial degree: 4
R squared: .50
R-bar squared: .27
St. error of estimate: 4.3769
Durbin-Watson statistic: 1.6458

Total multipliers: $\bar{G}_f$ = 1.21, t = 2.01; $\overline{TX}$ = -2.01, t = 0.70; $\bar{F}_d$ = -.91, t = 0.14; $\overline{MB}$ = 12.35, t = 2.51

Lagged independent variable	Quarters in past: 0	1	2	3	4	5	6	7	8	9
$\bar{G}_f$										
w(i)	1.213									
STE(i)	0.603									
t	2.012									
$\overline{TX}$										
w(i)	0.614	0.202	-0.025	-0.474	-1.069	-1.256	0.0			
STE(i)	0.741	1.190	0.527	0.580	0.902	1.348	0.0			
t	0.829	0.170	0.048	0.817	1.185	0.932	0.0			
$\bar{F}_d$										
w(i)	0.794	2.654	-0.763	-2.540	-1.058	0.0				
STE(i)	1.734	1.888	1.961	2.401	1.999	0.0				
t	0.458	1.406	0.389	1.058	0.529	0.0				
$\overline{MB}$										
w(i)	3.083	4.593	6.048	4.139	-0.785	-4.719	0.0			
STE(i)	3.869	4.667	2.110	2.472	2.868	3.189	0.0			
t	0.797	0.984	2.867	1.674	0.274	1.480	0.0			

Table 3. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and M_1^* money, 1954-1 to 1964-4

Lag polynomial degree: 4
R squared: .58
R-bar squared: .38
St. error of estimate: 4.0482
Durbin-Watson statistic: 1.6156

Total multipliers: $\overline{G}_f$ = 1.52, t = 4.09; $\overline{TX}$ = -.18, t = 0.06; $\overline{F}_d$ = 1.45, t = 0.22; $\overline{M}^*$ = 7.06, t = 3.00

Lagged independent variable	Quarters in past 0	1	2	3	4	5	6	7	8	9
$\overline{G}_f$										
w(i)	1.716	-0.192								
STE(i)	0.519	0.524								
t	3.306	0.368								
$\overline{TX}$										
w(i)	0.417	0.188	0.144	-0.032	-0.356	-0.541	0.0			
STE(i)	0.681	1.176	0.516	0.592	0.886	1.296	0.0			
t	0.612	0.160	0.279	0.054	0.402	0.417	0.0			
$\overline{F}_d$										
w(i)	-1.480	1.431	-0.003	-0.077	1.580	0.0				
STE(i)	1.766	2.133	1.909	2.387	1.882	0.0				
t	0.838	0.671	0.002	0.032	0.840	0.0				
$\overline{M}^*$										
w(i)	0.273	0.539	2.425	3.003	1.505	-0.680	0.0			
STE(i)	1.137	1.337	0.582	0.728	0.886	1.073	0.0			
t	0.240	0.403	4.166	4.125	1.699	0.634	0.0			

Table 4. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and the rate on commercial paper, 1954-1 to 1964-4

Lag polynomial degree: 4			St. error of estimate: 3.7347	
R squared: .62			Durbin-Watson statistic: 1.4352	
R-bar squared: .47				
Total multipliers:	$\overline{G}_f$ = 0.60	$\overline{TX}$ = 1.23	$\overline{F}_d$ = .29	$\overline{RCP}$ = 1.79
	t = 1.38	t = 0.46	t = 0.06	t = 0.60

Lagged independent variable	Quarters in past 0	1	2	3	4	5	6	7	8	9
$\overline{G}_f$										
w(i)	0.600									
STE(i)	0.434									
t	1.382									
$\overline{TX}$										
w(i)	-0.018	-0.366	-0.779	-0.639	0.164	1.229	1.647	0.0		
STE(i)	0.615	0.527	0.453	0.449	0.617	0.850	0.888	0.0		
t	0.029	0.695	1.721	1.422	0.265	1.445	1.853	0.0		
$\overline{F}_d$										
w(i)	-0.958	0.850	-1.018	-0.554	1.968	0.0				
STE(i)	1.425	1.550	1.554	1.920	1.613	0.0				
t	0.672	0.548	0.655	0.289	1.220	0.0				
$\overline{RCP}$										
w(i)	8.030	-1.412	0.685	-0.374	-5.136	0.0				
STE(i)	1.818	1.690	1.020	1.545	1.550	0.0				
t	4.418	0.835	0.671	0.242	3.314	0.0				

Table 5. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and the stock of money, 1954-1 to 1969-2

Lag polynomial degree: 4
R squared: .69
R-bar squared: .61
Total multipliers: $\bar{G}_f$ = 0.70, t = 2.04; $\overline{TX}$ = -1.14, t = 1.06; $\bar{F}_d$ = 0.15, t = 0.06; $\bar{M}^s$ = 4.96, t = 4.08

St. error of estimate: 3.9780
Durbin-Watson statistic: 1.8967

Lagged independent variable	Quarters in past 0	1	2	3	4	5	6	7	8	9
$\bar{G}_f$										
w(i)	0.704									
STE(i)	0.345									
t	2.042									
$\overline{TX}$										
w(i)	-0.147	0.023	-0.205	-0.386	-0.330	-0.097	0.0			
STE(i)	0.378	0.594	0.276	0.310	0.352	0.373	0.0			
t	0.389	0.038	0.742	1.248	0.938	0.261	0.0			
$\bar{F}_d$										
w(i)	0.267	0.330	0.210	-0.170	-0.483	0.0				
STE(i)	0.728	0.880	0.782	0.974	0.742	0.0				
t	0.366	0.375	0.268	0.175	0.651	0.0				
$\bar{M}^s$										
w(i)	1.642	1.099	1.480	1.310	0.264	-0.831	0.0			
STE(i)	0.846	0.940	0.375	0.567	0.651	0.735	0.0			
t	1.940	1.169	3.946	2.310	0.406	1.132	0.0			

Table 6. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and the monetary base, 1954-1 to 1969-2

Lag polynomial degree: 4
R squared: .67
R-bar squared: .58
Total multipliers: $\bar{G}_f$ = -.11, t = 0.54; $\overline{TX}$ = -1.11, t = 0.98; $\bar{F}_d$ = 2.18, t = 0.84; $\overline{MB}$ = 11.15, t = 3.63

St. Error of estimate: 4.1562
Durbin-Watson statistic: 1.8063

Lagged independent variable	Quarters in past 0	1	2	3	4	5	6	7	8	9
$\bar{G}_f$										
w(i)	0.352	-0.466								
STE(i)	0.426	0.445								
t	0.825	1.046								
$\overline{TX}$										
w(i)	0.220	0.164	-0.231	-0.521	-0.507	-0.236	0.0			
STE(i)	0.379	0.601	0.282	0.307	0.352	0.378	0.0			
t	0.579	0.273	0.818	1.696	1.440	0.625	0.0			
$\bar{F}_d$										
w(i)	0.901	1.099	0.662	-0.024	-0.454	0.0				
STE(i)	0.798	0.908	0.705	0.928	0.778	0.0				
t	1.129	1.210	0.939	0.026	0.584	0.0				
$\overline{MB}$										
w(i)	1.297	8.371	7.299	2.196	-3.079	-4.925	0.0			
STE(i)	2.579	3.346	1.503	1.784	2.083	2.349	0.0			
t	0.470	2.502	4.856	1.231	1.478	2.096	0.0			

Table 7. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and M^*, 1954-1 to 1969-2

Lag polynomial degree: 4
R squared: .67
R-bar squared: .59
St. error of estimate: 4.1586
Durbin-Watson statistic: 1.7179

Total multipliers:	$\bar{G}_f$ = 0.85	$\overline{TX}$ = -1.51	$\bar{F}_d$ = 1.35	$\bar{M}^*$ = 5.01
	t = 3.93	t = 1.32	t = 0.47	t = 3.44

Lagged independent variable	0	1	2	3	4	5	6	7	8	9
	Quarters in past									
$\bar{G}_f$										
w(i)	0.948	-0.052								
STE(i)	0.430	0.458								
t	2.204	0.112								
$\overline{TX}$										
w(i)	-0.140	0.118	-0.312	-0.623	-0.489	-0.068	0.0			
STE(i)	0.388	0.618	0.285	0.326	0.371	0.397	0.0			
t	0.360	0.192	1.093	1.913	1.318	0.171	0.0			
$\bar{F}_d$										
w(i)	-0.073	0.473	1.118	0.527	-0.695	0.0				
STE(i)	0.877	1.072	0.910	1.136	0.819	0.0				
t	0.083	0.441	1.229	0.464	0.849	0.0				
$\bar{M}^*$										
w(i)	0.026	0.886	1.977	1.983	0.768	-0.632	0.0			
STE(i)	0.802	0.881	0.371	0.491	0.610	0.764	0.0			
t	0.032	1.005	5.324	4.040	1.259	0.828	0.0			

Table 8. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and the rate on commercial paper, 1954-1 to 1969-2

Lag polynomial degree: 4
R squared: .71
R-bar squared: .62
St. error of estimate: 3.9495
Durbin-Watson statistic: 1.4022

Total multipliers: $\overline{G}_f$ = 0.63, t = 1.89; $\overline{TX}$ = -2.82, t = 2.67; $\overline{F}_d$ = 8.80, t = 5.67; $\overline{RCP}$ = 0.41, t = 0.15

Lagged independent variable	Quarters in past 0	1	2	3	4	5	6	7	8	9
$\overline{G}_f$										
w(i)	0.627									
STE(i)	0.333									
t	1.887									
$\overline{TX}$										
w(i)	-0.559	-0.193	-0.493	-0.778	-0.706	-0.274	0.185	0.0		
STE(i)	0.356	0.292	0.252	0.261	0.324	0.366	0.358	0.0		
t	1.572	0.662	1.952	2.978	2.180	0.749	0.518	0.0		
$\overline{F}_d$										
w(i)	1.469	2.285	2.008	1.690	1.354	0.0				
STE(i)	0.642	0.658	0.542	0.713	0.638	0.0				
t	2.286	3.470	3.707	2.371	2.122	0.0				
$\overline{RCP}$										
w(i)	8.712	-2.600	0.356	-0.334	-5.722	0.0				
STE(i)	1.505	1.448	0.964	1.395	1.373	0.0				
t	5.790	1.796	0.369	0.239	4.167	0.0				

Table 9. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and the money stock, 1960-1 to 1969-2

Lag polynomial degree: 4
R squared: .79
R-bar squared: .68
St. error of estimate: 3.3196
Durbin-Watson statistic: 2.2260

Total multipliers: $\overline{G}_f$ = -0.19, t = 0.39; $\overline{TX}$ = -2.48, t = 2.49; $\overline{F}_d$ = 5.21, t = 1.87; $\overline{M}^s$ = 2.51, t = 1.90

Lagged independent variable		Quarters in past 0	1	2	3	4	5	6	7	8	9
$\overline{G}_f$											
	w(i)	-0.190									
	STE(i)	0.488									
	t	0.389									
$\overline{TX}$											
	w(i)	-2.270	-0.068	-0.442	-0.743	-0.675	-0.291	0.0			
	STE(i)	0.333	0.534	0.247	0.283	0.319	0.334	0.0			
	t	0.811	0.127	1.791	2.629	2.116	0.873	0.0			
$\overline{F}_d$											
	w(i)	0.596	1.388	1.959	1.305	-0.039	0.0				
	STE(i)	0.714	0.969	0.870	1.054	0.679	0.0				
	t	0.836	1.432	2.253	1.238	0.058	0.0				
$\overline{M}^s$											
	w(i)	0.185	0.208	1.789	1.981	0.187	-1.841	0.0			
	STE(i)	0.971	0.973	0.400	0.563	0.659	0.762	0.0			
	t	0.191	0.213	4.473	3.521	0.284	2.415	0.0			

Table 10. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and the monetary base, 1960-1 to 1969-2

Lag polynomial degree: 4
R squared: .74
R-bar squared: .58
St. error of estimate: 3.8026
Durbin-Watson statistic: 1.7626

Total multipliers:	$\overline{G}_f$ = -0.29	$\overline{TX}$ = -2.60	$\overline{F}_d$ = 6.68	$\overline{MB}$ = 4.94
	t = 0.63	t = 2.16	t = 2.08	t = 1.14

Lagged independent variable	Quarters in past 0	1	2	3	4	5	6	7	8	9
$\overline{G}_f$										
w(i)	-0.087	-0.208								
STE(i)	0.588	0.628								
t	0.148	0.331								
$\overline{TX}$										
w(i)	-0.117	-0.178	-0.456	-0.685	-0.705	-0.460	0.0			
STE(i)	0.368	0.581	0.271	0.298	0.348	0.385	0.0			
t	0.317	0.306	1.679	2.296	2.028	1.195	0.0			
$\overline{F}_d$										
w(i)	0.694	1.741	2.130	1.591	0.525	0.0				
STE(i)	0.854	1.093	0.931	1.152	0.783	0.0				
t	0.812	1.593	2.288	1.382	0.670	0.0				
$\overline{MB}$										
w(i)	-3.037	6.162	8.549	5.726	0.027	-5.482	-7.002	0.0		
STE(i)	3.324	2.452	2.125	2.181	2.685	2.927	2.813	0.0		
t	0.914	2.513	4.023	2.626	0.010	1.873	2.489	0.0		

Table 11. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and M^*, 1960-1 to 1969-2

Lag polynomial degree: 4			St. error of estimate: 3.7329	
R squared: .74			Durbin-Watson statistic: 1.8151	
R-bar squared: .59				
Total multipliers:	$\overline{G}_f$ = -.05	$\overline{TX}$ = -2.23	$\overline{F}_d$ = 3.06	$\overline{M}^*$ = 4.40
	t = 0.10	t = 2.03	t = 1.02	t = 2.68

Lagged independent variable		Quarters in past 0	1	2	3	4	5	6	7	8	9
$\overline{G}_f$											
	w(i)	-0.053									
	STE(i)	0.526									
	t	0.101									
$\overline{TX}$											
	w(i)	-0.185	-0.049	-0.385	-0.664	-0.633	-0.314	0.0			
	STE(i)	0.362	0.586	0.267	0.314	0.357	0.383	0.0			
	t	0.510	0.084	1.439	2.110	1.771	0.820	0.0			
$\overline{F}_d$											
	w(i)	0.149	0.622	1.469	1.056	0.235	0.0				
	STE(i)	0.863	1.153	0.951	1.183	0.784	0.0				
	t	0.172	0.539	1.544	0.893	0.299	0.0				
$\overline{M}^*$											
	w(i)	-0.024	0.217	1.564	2.019	1.049	-0.421	0.0			
	STE(i)	1.039	0.972	0.410	0.527	0.672	0.865	0.0			
	t	0.023	0.224	3.817	3.831	1.561	0.486	0.0			

Table 12. Changes in gross national product, current dollars, regressed on changes in federal government expenditures on goods and services, consolidated tax receipts, consolidated transfer payments and the rate on commercial paper, 1960-1 to 1969-2

Lag polynomial degree: 4			St. error of estimate: 2.6059	
R squared: .86			Durbin-Watson statistic: 2.2811	
R-bar squared: .80				
Total multipliers:	$\overline{G}_f$ = 0.01	$\overline{TX}$ = -3.09	$\overline{F}_d$ = 8.05	$\overline{RCP}$ = 6.58
	t = 0.03	t = 4.07	t = 6.14	t = 2.05

Lagged independent variable		Quarters in past 0	1	2	3	4	5	6	7	8	9
$\overline{G}_f$											
	w(i)	0.011									
	STE(i)	0.379									
	t	0.029									
$\overline{TX}$											
	w(i)	-0.661	-0.280	-0.469	-0.691	-0.662	-0.350	0.027	0.0		
	STE(i)	0.246	0.200	0.172	0.177	0.223	0.263	0.262	0.0		
	t	2.690	1.402	2.717	3.909	2.967	1.330	0.105	0.0		
$\overline{F}_d$											
	w(i)	0.833	1.961	2.493	1.985	0.778	0.0				
	STE(i)	0.468	0.525	0.439	0.577	0.524	0.0				
	t	1.779	3.736	5.675	3.441	1.484	0.0				
$\overline{RCP}$											
	w(i)	10.005	0.833	2.761	-0.111	-6.911	0.0				
	STE(i)	1.865	1.773	1.164	1.688	1.643	0.0				
	t	5.363	0.470	2.372	0.066	4.207	0.0				

APPENDIX D. DATA USED IN ESTIMATION

DATE	CH IN GNP	CH IN G	CH IN TX	CH IN FD	CH IN MS	CH IN M*
19482	7.6000	2.2000	-0.1001	-0.2952	-1.0000	-0.0344
19483	6.9000	1.6000	-0.0002	-0.0927	0.1000	-0.3410
19484	1.3999	2.2000	-0.8741	-0.0926	-0.3999	-0.7563
19491	-5.3999	-0.1000	0.1999	0.5248	-0.6000	0.2402
19492	-3.3000	1.2000	0.0000	0.1326	0.2000	0.0561
19493	1.8999	-0.3000	-0.0999	0.0429	-0.4000	-0.1880
19494	-2.0999	-0.2000	0.0001	-0.2552	0.0000	1.0529
19501	11.0000	-1.7000	2.5794	8.6132	1.0000	1.4351
19502	9.3999	-1.3000	-0.1997	-6.6850	1.7000	0.8882
19503	17.7000	0.6000	0.0011	-1.9910	1.2001	1.6697
19504	11.4001	2.8000	3.7410	0.7105	0.9999	0.3679
19511	13.5000	7.3000	1.6614	0.2063	1.2000	1.1068
19512	7.7998	6.5000	0.0999	0.6054	1.1000	1.2206
19513	7.0000	7.5000	-0.0002	0.1074	1.5000	2.5676
19514	4.1001	4.9000	0.9091	-0.1921	2.2001	1.7714
19521	2.6001	1.1000	1.3352	-0.3982	1.6000	-0.2384
19522	-0.4001	3.3000	-0.0131	-0.1000	1.0330	-0.1245
19523	6.5000	3.0000	-0.0870	0.8019	1.2670	0.2873
19524	12.1001	0.1000	-0.0001	0.4016	1.2670	0.5937
19531	6.5000	2.7000	-0.5713	0.0015	0.5000	2.0648
19532	3.3000	0.9000	0.0004	0.0014	0.8660	1.2364
19533	-1.7002	-1.3000	-0.1994	0.2015	0.2000	0.7395
19534	-5.0000	0.4000	-0.0995	0.2044	0.1000	1.0323
19541	-0.0999	-4.6000	-1.4533	0.5170	0.3671	0.4801
19542	-0.3000	-4.9000	-0.0863	0.1153	0.3000	1.3995
19543	4.3000	-1.7000	0.0861	0.3198	1.2330	1.2868
19544	8.7000	-1.6000	-0.1706	0.7309	1.3341	0.2253
19551	12.8000	-0.1000	0.1999	0.3261	1.5330	0.6369
19552	8.2000	-0.7000	0.0001	0.4240	0.8000	-0.4362
19553	8.1001	1.1000	0.3007	0.3223	0.5670	-0.2373

DATE	CH IN GNP	CH IN G	CH IN TX	CH IN FD	CH IN MS	CH IN M*
19554	6.2998	0.3000	0.1158	0.2230	0.2330	0.3035
19561	1.8000	-0.2000	0.1006	0.4097	0.4669	0.2730
19562	5.6001	1.3000	0.3161	0.3101	0.3660	0.4548
19563	4.3999	-0.5000	-0.0162	0.4100	0.0340	1.1651
19564	8.9001	1.3000	0.3601	0.1098	0.6331	0.0433
19571	7.3999	2.7000	0.9408	0.9093	0.2670	-0.8837
19572	3.0000	0.3000	0.0836	1.3120	0.0660	0.1496
19573	6.3999	0.1000	0.1000	0.1125	0.0339	-0.1109
19574	-4.7998	-0.1000	-0.3000	0.5000	-0.7340	1.3146
19581	-6.8000	1.7000	0.1000	0.3041	-0.1660	2.3987
19582	3.5999	1.6000	-0.2169	0.5347	1.5659	0.8538
19583	13.1001	1.4000	0.3173	0.3343	1.3670	0.7134
19584	13.0000	1.6000	0.0003	0.4328	1.7000	0.9345
19591	9.6001	-1.3000	0.9521	1.1291	1.3330	0.3120
19592	12.8999	-0.5000	-0.1817	0.7249	1.0670	0.0109
19593	-2.8999	-1.0000	0.1827	0.7260	0.5669	-0.9721
19594	6.5000	-0.2000	0.2203	0.6276	-1.1669	-0.7946
19601	12.5000	-0.2000	2.0105	0.7249	-1.2001	-0.0252
19602	1.7000	0.3000	0.1811	0.1127	-0.9000	1.2916
19603	-0.5000	0.9000	-0.1000	0.0103	0.4000	1.1572
19604	-0.9001	0.7000	0.5993	0.2159	0.2000	0.5733
19611	0.3000	0.8000	0.1000	1.3132	0.6330	1.0062
19612	11.3000	1.9000	-0.5000	-0.5864	1.0340	0.7308
19613	9.3000	0.5000	0.3000	1.3130	0.7331	1.1952
19614	13.5000	1.4000	-0.0185	0.1156	1.5000	0.8605
19621	10.0999	2.7000	1.3081	0.9138	0.8670	0.3962
19622	9.4001	2.1000	0.0000	0.4132	0.4331	-0.2421
19623	7.2000	-0.7000	0.6834	0.6102	-0.2330	0.9282
19624	7.6001	1.1000	0.1999	0.8135	0.9330	1.1893
19631	5.3999	0.6000	1.9280	1.2927	1.5670	1.2154

DATE	CH IN GNP	CH IN G	CH IN TX	CH IN FD	CH IN MS	CH IN M*
19632	6.8000	-1.6000	0.0000	-0.8070	1.3660	1.0546
19633	10.5000	0.8000	0.1000	0.5000	1.3999	1.4270
19634	11.0999	0.2000	-0.0003	0.6070	1.6340	1.0775
19641	11.9001	0.6000	-6.0684	1.4069	0.9330	1.3039
19642	10.3000	1.0000	0.0000	-0.7000	1.2670	2.2040
19643	10.8999	-0.8000	0.4000	0.4000	2.2330	1.5310
19644	6.2000	-0.7000	0.1992	0.3000	1.6670	0.7829
19651	17.7000	-0.1000	-3.6039	1.6215	1.0330	0.8176
19652	12.9001	1.1000	-0.1246	-0.3776	1.1330	1.9784
19653	15.3999	2.1000	0.3000	4.1400	2.0340	2.9426
19654	18.9001	2.5000	0.2000	-1.3608	2.7331	2.3665
19661	19.5000	2.7000	3.9370	1.5000	2.6999	1.5758
19662	13.7998	2.8000	0.1000	0.1000	1.8671	-0.6399
19663	12.6001	4.9000	0.9000	1.8000	-0.4340	0.4563
19664	14.8000	1.6000	-0.9000	3.6000	0.2000	2.3757
19671	3.5000	5.7000	3.1347	2.7000	1.5000	3.3098
19672	9.3000	2.5000	-0.2000	0.2000	2.6339	4.3451
19673	16.8999	1.0000	0.3000	0.6000	4.2660	2.0841
19674	15.7000	2.2000	0.0000	1.2000	2.4670	1.5050
19681	19.2000	2.8000	2.4230	2.7000	2.2671	2.7023
19682	23.4001	2.7000	7.4870	2.9000	3.3329	4.4032
19683	17.7000	1.9000	0.1000	1.1000	3.9670	2.4775
19684	16.1001	1.0000	0.4000	1.7000	2.7330	1.8652
19691	16.2000	-1.0000	2.5421	1.6000	2.9001	1.2453
19692	16.0999	-1.1000	0.6000	1.6000	2.2000	0.7699

DATE	CH IN MB	RCP	CH IN TFP	CH IN TFU	CH IN TFS	CH IN TFC
19482	-0.1970	1.3800	0.0000	-0.0001	0.0000	0.0000
19483	0.2100	1.4600	0.0000	-0.0002	0.0000	0.0000
19484	-0.3170	1.5600	-0.7740	-0.0001	0.0000	0.0000
19491	-0.3870	1.5600	0.0000	-0.0001	0.0000	0.0000
19492	-0.0980	1.5600	0.0000	0.0000	0.0000	0.0000
19493	0.2380	1.4600	0.0000	0.0001	0.0000	0.0000
19494	-0.2930	1.3600	0.0000	0.0001	0.0000	0.0000
19501	-0.0020	1.3100	0.7950	0.0001	1.0703	0.8140
19502	0.2360	1.3100	0.0000	0.0003	0.0000	0.0000
19503	0.2560	1.4700	0.0000	0.0011	0.0000	0.0000
19504	0.3070	1.7100	3.5790	0.0006	-0.1386	0.0000
19511	0.2180	1.9600	-0.6570	-0.0005	0.0119	2.3070
19512	0.6800	2.2000	0.0000	-0.0001	0.0000	0.0000
19513	0.6210	2.2500	0.0000	-0.0002	0.0000	0.0000
19514	0.7380	2.2600	0.9220	-0.0003	-0.0126	0.0000
19521	0.3880	2.3800	0.8260	-0.0002	0.0127	0.2967
19522	0.2790	2.3200	0.0000	-0.0002	-0.0129	0.0000
19523	0.9480	2.3100	0.0000	-0.0002	0.0132	0.0000
19524	0.5350	2.3100	0.0000	-0.0001	0.0000	0.0000
19531	0.1090	2.3300	-0.5710	-0.0003	0.0000	0.0000
19532	-0.0330	2.6200	0.0000	0.0004	0.0000	0.0000
19533	0.7420	2.7500	0.0000	0.0006	0.0000	0.0000
19534	-0.0990	2.3700	0.0000	0.0005	0.0000	0.0000
19541	-0.0230	2.0400	-2.8770	0.0004	1.3233	0.0000
19542	-0.0330	1.6300	0.0000	0.0000	0.0137	0.0000
19543	0.3260	1.3600	0.0000	0.0000	-0.0139	0.0000
19544	0.4310	1.3100	0.0000	0.0000	-0.0706	0.0000
19551	-0.0770	1.6100	0.0000	-0.0001	0.0000	0.0000
19552	0.1990	1.9700	0.0000	0.0001	0.0000	0.0000
19553	0.2230	2.3300	0.0000	0.0007	0.0000	0.0000

DATE	CH IN MB	RCP	CH IN TFP	CH IN TFU	CH IN TFS	CH IN TFC
19554	0.0990	2.8300	0.0000	0.0006	0.0152	0.0000
19561	0.1440	3.0000	0.0000	0.0006	0.0000	0.0000
19562	0.1580	3.2600	0.0000	0.0004	0.0157	0.0000
19563	0.1140	3.3500	0.0000	-0.0003	-0.0159	0.0000
19564	0.2430	3.6300	0.1440	-0.0001	0.0162	0.0000
19571	0.0180	3.6300	-0.1460	0.0000	0.7868	0.0000
19572	0.1550	3.6800	0.0000	0.0002	-0.0166	0.0000
19573	0.0010	3.9500	0.0000	0.0000	0.0000	0.0000
19574	-0.0420	3.9900	0.0000	0.0000	0.0000	0.0000
19581	0.1900	2.8200	0.0000	0.0000	0.0000	0.0000
19582	0.6860	1.7200	0.0000	0.0000	-0.0169	0.0000
19583	0.2460	2.1300	0.0000	0.0001	0.0172	0.0000
19584	0.1960	3.2100	0.0000	0.0003	0.0000	0.0000
19591	0.3430	3.3000	0.0000	0.0003	0.8518	0.0000
19592	0.2850	3.6000	0.0000	0.0002	0.0181	0.0000
19593	0.0500	4.1900	0.0000	0.0002	-0.2175	0.0000
19594	-0.0370	4.7600	0.0000	0.0000	0.2203	0.0000
19601	0.0080	4.6900	0.0000	0.0000	1.8105	0.0000
19602	-0.0520	4.0700	0.0000	0.0000	-0.0189	0.0000
19603	0.0920	3.3700	0.0000	0.0000	0.0000	0.0000
19604	0.4630	3.2700	0.0000	-0.0007	0.0000	0.0000
19611	0.3710	3.0100	0.0000	0.0000	0.0000	0.0000
19612	0.0330	2.8600	0.0000	0.0000	0.0000	0.0000
19613	0.2990	2.9000	0.0000	0.0000	0.0000	0.0000
19614	0.8260	3.0600	0.0000	0.0016	-0.0201	0.0000
19621	0.4010	3.2400	0.0000	0.0000	0.5081	0.0000
19622	0.4790	3.2000	0.0000	0.0000	0.0000	0.0000
19623	0.2440	3.3300	0.0000	0.0000	0.0208	0.0000
19624	0.6220	3.2600	0.0000	-0.0001	0.0000	0.0000
19631	0.5860	3.3100	0.0000	0.0000	2.0280	0.0000

DATE	CH IN MB	RCP	CH IN TFP	CH IN TFU	CH IN TFS	CH IN TFC
19632	0.5500	3.3200	0.0000	0.0000	0.0000	0.0000
19633	0.6310	3.7000	0.0000	0.0000	0.0000	0.0000
19634	0.7590	3.9100	0.0000	-0.0003	0.0000	0.0000
19641	0.6730	3.9500	-5.4100	0.0000	0.0226	-0.7810
19642	0.6780	3.9300	0.0000	0.0000	0.0000	0.0000
19643	0.7740	3.9100	0.0000	0.0000	0.0000	0.0000
19644	0.8280	4.0600	0.0000	-0.0008	0.0000	0.0000
19651	0.6480	4.3000	-2.6350	0.0000	0.0241	-0.8930
19652	0.7080	4.3800	0.0000	0.0000	-0.0246	0.0000
19653	0.7060	4.3800	0.0000	0.0000	0.0000	0.0000
19654	1.0270	4.4700	0.0000	0.0000	0.0000	0.0000
19661	0.8450	4.9700	0.4720	0.0000	3.2650	0.0000
19662	0.9180	5.4300	0.0000	0.0000	0.0000	0.0000
19663	0.5370	5.7900	0.0000	0.0000	0.0000	0.0000
19664	0.2390	6.0000	0.0000	0.0000	0.0000	0.0000
19671	0.9230	5.4500	1.1090	0.0000	1.7257	0.0000
19672	1.0180	4.7200	0.0000	0.0000	0.0000	0.0000
19673	0.9660	4.9700	0.0000	0.0000	0.0000	0.0000
19674	1.1220	5.3000	0.0000	0.0000	0.0000	0.0000
19681	1.0110	5.5800	0.3370	0.0000	0.0000	2.3860
19682	1.0880	6.0800	6.9870	0.0000	0.0000	0.0000
19683	1.1830	5.9600	0.0000	0.0000	0.0000	0.0000
19684	1.2140	5.9600	0.0000	0.0000	0.0000	0.0000
19691	1.0390	6.6600	0.0000	0.0000	2.6421	0.0000
19692	0.7750	7.5400	0.0000	0.0000	0.0000	0.0000

DATE	CH IN INCR	CH IN TFE	CH IN FU	CH IN TEGF	CH IN TDSI	CH IN GFP
19482	0.0000	0.0000	0.0048	0.0000	-0.1000	-0.3000
19483	0.0000	0.0000	0.0073	0.0000	0.0000	-0.2000
19484	0.0000	0.0000	0.0074	-0.1000	0.0000	-0.1000
19491	0.0000	0.0000	0.0248	0.0000	0.2000	0.4000
19492	0.0000	0.0000	0.0326	0.0000	0.0000	0.1000
19493	0.0000	0.0000	0.0429	-0.1000	0.0000	0.0000
19494	0.0000	0.0000	0.0448	0.0000	0.0000	-0.3000
19501	0.0000	0.0000	0.0132	0.0000	-0.1000	8.5000
19502	0.0000	0.0000	0.0150	-0.1000	-0.1000	-6.7000
19503	0.0000	0.0000	0.0090	0.0000	0.0000	-2.0000
19504	0.0000	0.0000	0.0105	0.1000	0.2000	0.6000
19511	0.0000	0.0000	0.0063	0.0000	0.0000	0.2000
19512	0.0000	0.0000	0.0054	0.0000	0.1000	0.5000
19513	0.0000	0.0000	0.0074	0.1000	-0.1000	0.0000
19514	0.0000	0.0000	0.0079	0.0000	0.0000	-0.2000
19521	0.0000	0.0000	0.0018	0.0000	0.2000	-0.4000
19522	0.0000	-0.0813	0.0000	0.0000	0.0000	0.0000
19523	0.0000	0.0000	0.0019	0.1000	-0.2000	0.8000
19524	0.0000	0.0000	0.0016	0.0000	0.0000	0.3000
19531	0.0000	-0.0845	0.0015	0.0000	0.0000	0.0000
19532	0.0000	0.0000	0.0014	0.0000	0.0000	0.0000
19533	0.0000	-0.1699	0.0015	0.0000	-0.2000	0.1000
19534	0.0000	-0.2538	0.0044	0.0000	-0.1000	0.2000
19541	0.0000	0.0852	0.0170	0.0000	0.1000	0.4000
19542	0.0000	-0.6808	0.0153	0.0000	-0.1000	0.1000
19543	0.0000	0.0860	0.0198	0.0000	0.1000	0.3000
19544	0.0000	-0.0869	0.0309	0.0000	-0.1000	0.7000
19551	0.0000	0.0000	0.0261	0.1000	0.1000	0.4000
19552	0.0000	-0.0893	0.0240	-0.1000	0.1000	0.4000
19553	0.0000	0.0000	0.0223	0.1000	0.2000	0.3000

DATE	CH IN INCR	CH IN TFE	CH IN FU	CH IN TEGF	CH IN TOSI	CH IN GFP
19554	0.0000	-0.0910	0.0230	0.1000	0.0000	0.1000
19561	0.0000	0.0000	0.0097	0.1000	0.0000	0.3000
19562	0.0000	0.0000	0.0101	0.2000	0.1000	0.1000
19563	0.0000	1.0286	0.0100	-0.1000	0.1000	0.3000
19564	0.0000	-0.0943	0.0098	0.0000	0.2000	0.1000
19571	0.0000	-0.2850	0.0093	0.0000	0.3000	0.7000
19572	0.0000	-0.0955	0.0120	0.3000	-0.2000	1.2000
19573	0.0000	-0.0964	0.0125	-0.1000	0.2000	0.0000
19574	0.0000	0.0000	0.0000	-0.1000	-0.2000	0.6000
19581	0.0000	0.0966	0.0041	0.0000	0.1000	0.4000
19582	0.0000	0.0973	0.0347	-0.1000	-0.1000	0.6000
19583	0.0000	-0.0982	0.0343	0.0000	0.3000	0.2000
19584	0.0000	0.0000	0.0328	0.0000	0.0000	0.2000
19591	0.0000	-0.1006	0.0291	0.1000	0.0000	0.9000
19592	0.0000	0.0000	0.0249	-0.1000	-0.1000	0.5000
19593	0.0000	0.1030	0.0260	0.2000	0.2000	0.3000
19594	0.0000	1.2526	0.0276	0.0000	0.0000	0.3000
19601	0.0000	0.0000	0.0249	0.1000	0.1000	0.2000
19602	0.0000	0.0000	0.0127	0.2000	0.0000	0.3000
19603	0.0000	-0.2117	0.0103	-0.2000	0.1000	0.2000
19604	0.0000	0.0000	0.0159	0.5000	0.1000	0.4000
19611	0.0000	0.0000	0.0132	0.0000	0.1000	1.4000
19612	0.0000	0.1073	0.0136	-0.3000	-0.2000	-0.4000
19613	0.0000	0.1083	0.0130	0.2000	0.1000	1.2000
19614	0.0000	0.1096	0.0156	0.0000	0.0000	0.1000
19621	0.0000	0.0000	0.0138	0.0000	0.8000	0.6000
19622	0.0000	0.0000	0.0132	0.2000	-0.2000	0.2000
19623	0.7626	0.0000	0.0102	-0.2000	0.1000	0.4000
19624	0.0000	-0.2267	0.0135	0.2000	0.0000	0.6000
19631	0.0000	-0.1143	-0.0073	0.0000	-0.1000	1.3000

DATE	CH IN INCR	CH IN TFE	CH IN FU	CH IN TEGF	CH IN TOSI	CH IN GFP
19632	0.0000	-0.1150	-0.0070	0.0000	0.0000	-0.9000
19633	0.0000	0.0000	0.0000	0.1000	0.0000	0.3000
19634	0.0000	0.1170	0.0070	0.0000	0.0000	0.4000
19641	0.0000	0.0000	0.0069	0.1000	0.0000	1.2000
19642	0.0000	0.4819	0.0000	0.1000	-0.1000	-0.7000
19643	0.0000	0.1222	0.0000	0.2000	0.2000	0.2000
19644	0.0000	-0.1225	0.0000	0.1000	0.1000	0.2000
19651	0.0000	-0.1244	0.0215	0.1000	-0.2000	1.6000
19652	0.0000	-1.0007	0.0224	-0.2000	0.1000	-0.6000
19653	0.0000	-0.5059	0.0400	0.2000	0.1000	4.0000
19654	0.0000	-0.1285	0.0392	0.1000	0.1000	-1.4000
19661	0.0000	-0.9072	0.0000	0.2000	0.0000	1.3000
19662	0.0000	0.5245	0.0000	0.0000	0.1000	-0.2000
19663	0.0000	-0.1325	0.0000	-0.2000	1.1000	1.6000
19664	0.0000	0.0000	0.0000	0.0000	-0.9000	3.1000
19671	0.0000	0.0000	0.0000	0.1000	0.2000	2.5000
19672	0.0000	-0.1357	0.0000	-0.1000	-0.1000	0.5000
19673	0.0000	-0.2729	0.0000	0.2000	0.1000	0.2000
19674	0.0000	0.0000	0.0000	-0.1000	0.1000	0.8000
19681	0.0000	0.0000	0.0000	-0.4000	0.1000	2.4000
19682	0.0000	0.0000	0.0000	0.5000	0.0000	2.5000
19683	0.0000	0.0000	0.0000	0.0000	0.1000	0.8000
19684	0.0000	0.0000	0.0000	0.3000	0.1000	1.2000
19691	0.0000	0.0000	0.0000	-0.2000	0.1000	1.3000
19692	0.0000	0.0000	0.0000	0.6000	0.0000	1.2000

DATE	CH IN GFI
19482	0.0000
19483	0.1000
19484	0.0000
19491	0.1000
19492	0.0000
19493	0.0000
19494	0.0000
19501	0.1000
19502	0.0000
19503	0.0000
19504	0.1000
19511	0.0000
19512	0.1000
19513	0.1000
19514	0.0000
19521	0.0000
19522	-0.1000
19523	0.0000
19524	0.1000
19531	0.0000
19532	0.0000
19533	0.1000
19534	0.0000
19541	0.1000
19542	0.0000
19543	0.0000
19544	0.0000
19551	-0.1000
19552	0.0000
19553	0.0000

DATE	CH IN GFI
19554	0.1000
19561	0.1000
19562	0.2000
19563	0.1000
19564	0.0000
19571	0.2000
19572	0.1000
19573	0.1000
19574	-0.1000
19581	-0.1000
19582	-0.1000
19583	0.1000
19584	0.2000
19591	0.2000
19592	0.2000
19593	0.4000
19594	0.3000
19601	0.5000
19602	-0.2000
19603	-0.2000
19604	-0.2000
19611	-0.1000
19612	-0.2000
19613	0.1000
19614	0.0000
19621	0.3000
19622	0.2000
19623	0.2000
19624	0.2000
19631	0.0000

DATE	CH IN GFI
19632	0.1000
19633	0.2000
19634	0.2000
19641	0.2000
19642	0.0000
19643	0.2000
19644	0.1000
19651	0.0000
19652	0.2000
19653	0.1000
19654	0.0000
19661	0.2000
19662	0.3000
19663	0.2000
19664	0.5000
19671	0.2000
19672	-0.3000
19673	0.4000
19674	0.4000
19681	0.3000
19682	0.4000
19683	0.3000
19684	0.5000
19691	0.3000
19692	0.4000