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A REPLICATION OF THE ST. LOUIS TEST
FOR NEW ZEALAND

A dissertation
submitted in partial fulfilment
of the requirements for the degree
of
Master of Social Sciences

by

NG AH KAN

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INTRODUCTION

Monetary theory is less abstract than some economic theory in the sense that it cannot avoid a relation to reality. Its development has been to a considerable extent prompted by experiences encountered by the writers in their own time, and monetary disturbances have always acted as a catalyst in its development. It seems that the role of money in an economy has appeared to be more important in some periods than in others, and writers on monetary issues have, therefore, had to adjust their theories accordingly.

The post-war period has witnessed such an "agonising reappraisal", as in the face of successful monetary policies and unsuccessful fiscal policies, Keynesian theory has had to give much ground to Quantity-type theories, which had been so thoroughly discredited in the inter-war period.

No firm conclusions have as yet been reached, however, and in New Zealand in particular there is no agreement as to the importance which should be accorded to the money supply as an instrument of macro-policy. Much work is still required and in this dissertation we shall in Part One examine Classical, Neo-classical, Keynesian, and Modern Quantity Theories as a prelude to an empirical investigation, described in Part Two, along the lines of Andersen and Jordan's work at the Federal Reserve Bank of St. Louis ('Monetary and Fiscal Actions: A Test of Their Relative Importance in Economic Stabilization', Monthly Review, Nov. 1968, Federal Reserve Bank of St. Louis.) Although it is believed that such investigations are at least better

than nothing in seeking to confirm or deny the importance of money supply, it has to be admitted that our results are not as conclusive as, and the level of statistical explanation is not as high as those achieved by Andersen and Jordan, nor are our conclusions the same. But they are not without interest, indicating as they do that:

- (i) Changes in the supply of narrowly defined money (M^1) exerted equally important influence, in terms of magnitude and reliability, on changes in aggregate expenditures compared with the same influence exerted by changes in government expenditures.
- (ii) In regressions where seasonal dummy variables were included or where seasonally adjusted data were applied, changes in M^1 acted one quarter-period slower than changes in government expenditures in influencing changes in aggregate expenditures.
- (iii) On the average, changes in M^1 exerted a slightly more reliable impact on changes in aggregate expenditures than did changes in government revenue or budget surplus.

PART ONE

SURVEY OF MONETARY THEORY

A. Classical and Neo-classical
Monetary Theory

The classical monetary theorists paid particular attention to the quantity or stock of money supply in their discussions of monetary issues. Their theory was dominated by the so-called "Quantity Theory of Money".

The quantity of money supply at that time was mainly determined by the level of production or supply of precious metals like gold and silver. Changes in the supply of gold and silver would bring forth changes in the quantity of money, and this would subsequently lead to fluctuations of general price level of other commodities. About three-quarter of a century after the discovery of the New World, the French were particularly troubled by violent price inflation. Bodin, in his "Response to the Paradoxes of Monsieur de Malestroict" (1568), explained that the most important cause of the current inflation was the continuous increase in the quantity of gold and silver which had been imported in large amounts from the New World for many decades. Bodin was thus regarded as the discover of the Quantity Theory of Money ((1, p. 311)). Briscoe, in 1694, was the first to write an equation of exchange in the unsatisfactory form: stock of money equals prices time real incomes. David Hume later re-expressed the equation in his Essays in 1750 ((2)), this statement now being widely accepted as a nicely balanced account of the so-called "Naive Quantity Theory", or sometimes known as the "Crude Quantity Theory", "Pure Quantity Theory", "Strict Quantity Theory", or the "Classical Quantity Theory".

During the early stage of the development of the classical Quantity Theory, the writers assumed that an increase in money supply, "whether lent or spent, will enter into circulation and will not fail to raise the price of products and merchandise in all the channels of circulation which it enters" ((3)). Money was treated solely as a medium of exchange, and the classical writers probably ignored the possibility that part of the money in the private sector may be hoarded and not drained into the circulation. (Cantillon ((3)), and later, J.S. Mill ((2, p. 705)), did mention that the State may hold part of the money for certain purposes, say for providing services in extremity; but this notion is closer to the definition of "savings" than to the definition of "hoarding of money" in the modern sense.) However, as we shall see in this survey, this assumption was gradually relaxed in the later stage of the development of the classical Quantity Theory.

It is often implied that the classical theorists further assumed a proportionate increase in the prices of all commodities when an increase in expenditure results from an increase in money supply. This implies that relative prices among commodities remain unchanged. However, this view was not accepted by all the classical theorists. Cantillon, for example, did not agree with this view. He wrote that "by doubling the quantity of money in a State, the prices of products and merchandise are not always doubled. A river which runs and winds about in its bed will not flow with double the speed when the amount of its water is doubled. It (the increased quantity of money) will be directed more or less to certain kinds of products or merchandise according to the idea of those who acquire the money. Market prices will rise more for certain things than for others however abundant the money may be." ((Ibid)) Cantillon was also aware that there might be an uneven distribution of the increased money ("..... many who lived without handling money will now have some"). He also stated that

the speed of circulation of money might not be constant, and said that the impact of "an acceleration of greater rapidity in circulation of money in exchange is equivalent to (that of) an increase of actual money up to a point". He concluded that when a large surplus of money was brought into a State, the new money would give a new turn to consumption and even a new speed to circulation, but it was not possible to say to what extent.

Although Cantillon expressed many unique views on the various aspects of the classical Quantity Theory, he, like most classical monetary theorists, paid most of his attention to the relationship between money and the price level and neglected the role of money in the determination of real output. David Hume, in his Essays ((2)) stated that the price level would reach a "just proportion" with the increased quantity of money only after a period of price adjustments. He observed that it was only in this interval or immediate situation, between the acquisition of money and the rise of prices, that the increasing quantity of gold and silver was favourable to industry. In other words, he believed that the level of economic activity would be stimulated during the process of price adjustments. But later writers, as R.W. Clower comments, have not always stated or interpreted the theory so judiciously. As construed by some writers, the propositions advanced by Hume were made to assert that the 'real' work money has to perform is determined simply by the amount of goods and services that have to be traded; hence that money, as money, is merely a 'veil', explicit consideration of which obscures the working of those truly important forces of productivity. ((4, p. 18))

Thornton, an English banker and a witness of England's War Inflation of 1793-1815, regarded the rapidity of circulation of money as a variable quantity that fluctuates with the 'state of confidence', that is, substantially with general business conditions. This redis-

covery of a fundamental truth that stood historically in the name of Cantillon was never again lost, but it was so little attended to that it had to be re-emphasised from time to time by Pigou, Marshall, and Keynes. ((1, p. 706))

The role of money in influencing the level of economic activity was more explicitly explored in Thornton's writings. As banking facilities were playing an increasingly important part in economic life, the effect of credit expansion was also included in his discussion of monetary issues. For example, he once wrote that bank loans which add to the means of payments may not only stimulate output rather than prices if they impinge upon an underemployed economy, but also that, even after full employment has been reached, credit expansion may still have some effect upon output ((1, pp. 723-4)).

The rate of interest was also a much neglected topic in the early stage of the development of classical monetary theory. The most important contributor on the theory of interest rate at that time was Thornton, whose contribution was described by Schumpeter as the 'casting into a scientific mould of ideas on the relation between money, prices, and interest rate ((1, p. 707)). The most commonly known version of the role of interest rate in the classical school is the role it plays to bring about the equality of savings and investment, that is, the equality of demand for investment funds and the supply of funds provided by savings.

J.S. Mill was a believer in the theory that variations in the quantity of money will affect its value 'in a ratio exactly equivalent'. However, seeing the emergence of the popularity of 'credit', he argued that, with a developed system of credit, prices no longer depend in any simple manner on the quantity of money in bullions. Mill emasculated the Quantity Theory still further by restricting its validity to the circulating quantity of money which people are willing to lay out. Thus

the idea of hoarding of money as a reserve for future contingencies was explicitly stated ((1, p. 705)). But Mill still retained the doctrine that variations in the quantity of money and variations in physical volume of output had nothing to do with one another and would never coincide except by chance ((1, p. 711)).

Thomas Tooke also suggested that money need not all become active and that commodities may be purchased without the use of money. The quantity of money, according to him, was not a useful datum in the discussion of monetary issues. ((1, p. 709))

From this brief survey, we see that the classical writers on monetary subjects were not unanimous in their views on the various aspects of the Quantity Theory. All the writers we refer to believed that the most important influence of a change in the quantity of money is its impact on the general price index, though they differed in their opinions as to the extent the price level changes in response to a change in money supply. We see that the view Hume and J.S. Mill held on the exact proportionality between changes in money supply was an extreme version of the classical school. Cantillon and Thornton, for example, had already cast doubt and criticised such a view. So was the opinion on the constancy of the velocity of circulation of money. Not all classical theorists believed it to be constant over time.

The most controversial issue among the classical writers, however, lies on the question whether changes in money supply would have any impact on the level of real output. Though some economists like Hume and Thornton, for examples, had argued that certain expansionary effects on the level of output could be expected from an increase in money supply (and in credit expansion, in the case of Thornton), their views were not properly emphasised and were largely neglected by their readers.

Also, we see that the concept of money hoarding had been developing in the minds of many classical theorists; but, again, the concept had not been properly illustrated, and it was not until the emergence of Keynes's liquidity preference analysis that such a concept was developed into a systematic and vigorous analysis.

The second half of the nineteenth century and the beginning of the twentieth century is referred to as the period of the neo-classical school. Many writers began to emphasise the store-of-value function of money and the cause and effect of hoarding of money was brought into discussion.

I. Fisher, in his "The Purchasing Power of Money" (1911) ((5)), slightly modified Hume's equation by introducing demand deposits into his own Equation of Exchange:

$$MV + M'V' = PT$$

where M consists of coin and bank notes, M' is demand deposits, V and V' are the velocities of circulation of M and M' respectively, P is the general price index and T the total physical quantity of transactions. He believed that M' held a definite relation with M. Any increase in M will be followed by a proportionate increase in M'. He asserted that a change in the quantity of money does not normally change V or V'. The velocities of circulation depend on "technical condition and bear no discoverable relation to the quantity of money in circulation". Their magnitudes depended on factors like the density of population, commercial customs, rapidity of transport, and other technical conditions, but not on the quantity of money and deposits nor on the price level. With regard to T, the volume of trade, Fisher believed that it was independent of the quantity. "An inflation of the currency cannot increase the product of farms and factories, nor the

speed of freight trains or ships. The stream of business depends on natural resources and technical conditions, not on the quantity of money. The whole machinery of production, transportation, and sale is a matter of physical capacities and technique, none of which depend on the quantity of money." Thereby, he stated that "there is no possible escape from the conclusion that a change in the quantity of money must normally cause a proportional change in the price level".

In short, Fisher's equation was an attempt to reassert the classical mechanical relationship between the quantity of money and price index. The velocity of circulation was regarded as an exogeneous factor independent of the quantity of money. The volume of T is a matter of "physical capacities and technique" and not dependent on the quantity of money. The quantity of money was regarded as playing a "neutral" role in the system.

A.C. Pigou ((6)) shifted the attention from the supply of money to the demand for money. The definition of money had now been relaxed to include both currency and demand deposits. He said that there were two motives for people to demand money : (1) for ordinary transactions of life without trouble, and (2) for the precautionary motive to secure one against unexpected demands due to a sudden need or to a rise in the price of something that one cannot easily dispense with. His equation of the demand for money was as follows:

$$M = \frac{k R}{P^*}$$

where M denotes the amount of money demanded, R was total resources or production during a particular period, k was the proportion of production or resources people choose to keep in the form of money, and P^* is the price index of legal tender in terms of real output or resources, which is equivalent to the reciprocal of the price index of commodities

in terms of money (i.e. $P^* = 1/P$). Thus, the equation can be rewritten as:

$$M = k P R$$

Like Fisher, Pigou thought that R , which is equivalent to Fisher's T , is not dependent on M , but determined by "developments that bring the forces of nature more effectively under man's control". He considered k to be dependent on the satisfaction of convenience obtained through the possession of money and on the sacrifice of present consumption and the opportunity cost of not lending or investing the held resources. He stated that k would be smaller, i.e. the demand for money would be smaller, if the "production use" of money was attractive (or, in other words, if the expected returns from investment were attractive or the interest rate is high). Expectation of an increase in future prices, and suspicion on the convertibility of currency would also lower the demand for money and thus k . Also, industrial expansion which resulted in an increase in real income, may easily involve an increase in k .

Pigou's analysis was indeed a great transformation from the classical equation of transaction analysis to the demand for money analysis. It focussed attention on the proportion of production or resources (k) people desire to keep in the form of money instead of focussing it on the velocity of circulation. The forces of interest rate, expected rate of returns of investment, and the factor of expectation (e.g. expectation for future price changes) were regarded as the determinants of the magnitude of k , and thus were implied in his analysis of the demand for money. This was an improvement over the classical analysis.

In the strict classical Quantity Theory, the velocity of circulation (V) was assumed to be constant. In Pigou's analysis, the k , which can be regarded as an inverse function of V , is not treated as a constant.

This implies that, to Pigou, the velocity of circulation was not a constant parameter. This assumption seemed to be more realistic and more acceptable than the classical assumption at the time when Pigou was writing the article.

In Pigou's analysis, the demand for money seems to be dependent on the level of production. It exhibits only a 'one-way' relationship between M and level of production (R). Pigou did not state that only a 'one-way' relationship exists between M and R. We cannot, therefore, intuitively derive the conclusion that Pigou denied the possibility of the 'two-way' relationship between M and R. (A simultaneous-equation model is needed to show the 'two-way' relationship between M and R.) However, if we shift R over to the left-hand side and M to the right-hand side, we will derive an equation showing:

$$R = \frac{1}{k} \cdot M \cdot P^*$$

Substituting P^* with $1/P$, we get:

$$R = \frac{1}{k} \cdot M \cdot \frac{1}{P}$$

or,

$$R \cdot P = \frac{1}{k} \cdot M$$

$1/k$ is equivalent to what was called later the "Income Velocity" of money.

A. Marshall explored further the analysis of the demand for money in his "Money, Credit, and Commerce" (1922) ((7)). He modified the analysis by introducing both annual income (Y) and physical assets (A) into his equation:

$$M = k \cdot Y + k' \cdot A$$

However, the asset part of Marshall's formula was ignored by his

followers, and indeed by Marshall himself ((8, p. 2)). The commonly known Marshallian equation is

$$M = k \cdot Y$$

Re-arranging, we get:

$$Y = \frac{1}{k} \cdot M$$

or

$$Y = V^* \cdot M$$

where V^* is the "Income Velocity" of money.

Arithmetically, the k in the Pigovian-Marshallian equation (or sometimes known as the Cambridge Equation) is simply the reciprocal of the V in the Hume-Fisher equation. A.H. Hansen warned us that it does not follow from the mere fact that $V = 1/k$, as an arithmetic identity, that therefore the Pigovian-Marshallian analysis is in fact the same thing as the Hume-Fisher analysis. To assert this is to miss entirely the significance of the k in the Cambridge equation ((8,p. 49)). According to Hansen, the difference between the two can be stated as follows: In the terms of the Cambridge approach, sudden and rapid shifts in the desire of the public to hold money may profoundly affect prices even though the monetary authority successfully maintains a high stability in the money supply. The desire of the public to hold money enters as a powerful factor. Drastic and sudden shifts in the desire to hold money, reflected in a change in k , may produce large and quickly moving changes in the level of income and prices. Shifts in public psychology, in expectations, must be taken into account of no less than changes in the money supply. In the Pigovian-Marshallian analysis, a shift in k may start an upward or downward movement. It is k , not M , that holds the stage ((8, pp. 49-50)).

A graphical presentation will be useful for the comparison between

the classical Quantity Theory and the neo-classical theory. In Fig. 1, the relation between P and M in the pure Quantity Theory is represented by the ϕ function. This function is regarded as stable in the short run as any cyclical changes in output or transaction are offset by corresponding changes in V . Also the function is regarded as stable from the long-run standpoint, V/T being thought to change over time according to some fixed pattern.

The Cambridge equation $M = k.Y$ is presented in Fig. 2. Here k is regarded as controlling the level of Y , if M is given by the monetary authority. L represents the demand for money schedule and is a function of Y . It represents the amount of money people desire to hold at a given level of income and tell us nothing about the actual quantity of money. The supply schedule of M is independent of the level of income and is thus perfectly income inelastic. A shift in the L function toward greater demand for money, from L to L_0 , will drive income down from Y_1 to Y_2 , M remaining fixed at M_0 . Under this situation, in order to restore income to Y_1 , the monetary authority shall increase the quantity of money to M_1 . ((8, pp 49-52)).

We have seen a new analysis had been developed by Pigou and Marshall, in which the demand ^{for} of money was the theme of discussion. However, the analysis still did not assign any explicit role to the rate of interest and to the quantity of money in the determination of output. Despite these weaknesses, the neo-classical analysis is an important development in monetary theory and has great influence on the development of monetary theory in the subsequent years. We shall see how Keynes explored and modified the analysis into his Liquidity Preference analysis in the next section.

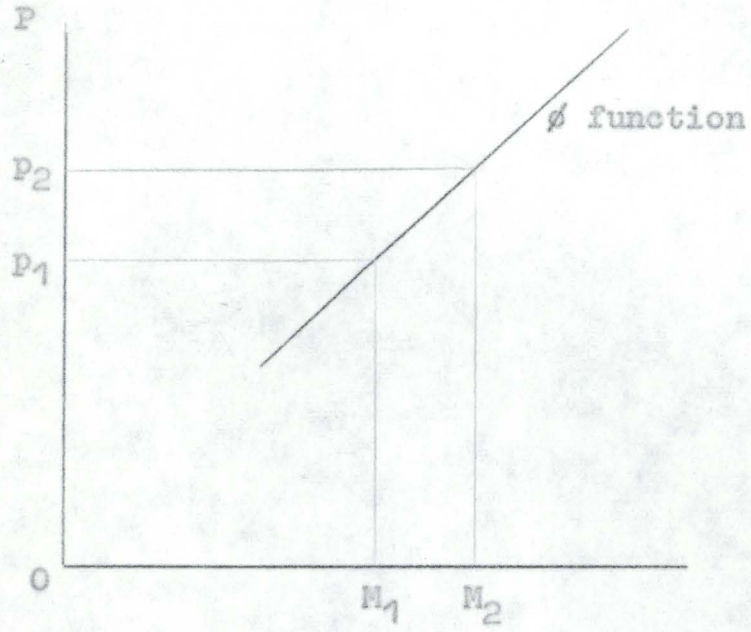


Figure 1

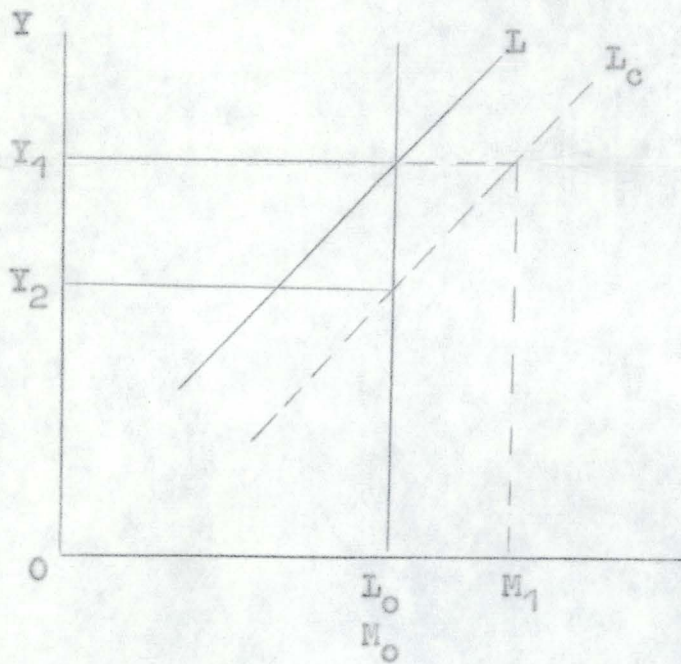


Figure 2

Note : Both figures are adapted from Hansen ((9, p.50, p.52))

B. Keynesian Monetary Theory

Being a witness of the Great Depression of the 1930's, Keynes was particularly interested in the problem of employment and income determination. He was probably the first economist who had so explicitly related the role of money and interest rate to employment and income determination. Before entering the discussion of his monetary theory in The General Theory of Employment, Interest, and Money ((9)), let us first examine his attack on his predecessors' writings.

Keynes started by attacking the various assumptions upon which the classical (and neo-classical)** theoretical framework was based.

These assumptions were:

- 1) The real wage rate was equal to the marginal disutility of the existing employment;
- 2) There was no such thing as involuntary unemployment in the strict sense;
- 3) Supply created its own demand in the sense that the aggregate demand price was equal to the aggregate supply price for all levels of output and employment (i.e. the Say's Law).

Keynes argued that the wage rate was not as flexible as the classicists (and the neo-classicists) might think, and the level of employment may not be wage-elastic. "A fall in real wages due to a rise in prices, with money wages unaltered, does not as a rule, cause the supply of available labour on offer at the current wage to fall below the amount of actual employment prior to the rise of price." ((p.13))

** "Classical economists" in Keynes's definition includes some of the so-called "Neo-classical economists", for examples, Marshall, Edgeworth, Pigou, etc. ((9, p. 3))

On the other hand, "there may exist no expedient by which labour as a whole can reduce its real wage to a given figure by making revised money bargains with the entrepreneurs" ((p.13)); and there is no method available to labour as a whole whereby it can bring the real wage into conformity with the marginal disutility of existing employment or into conformity with a rise in the cost of living ((pp. 13-15)). It follows that involuntary unemployment may exist if the assumption that the real wage is equal to the marginal disutility of employment does not hold good ((pp. 15-16)).

Keynes regarded Say's Law as implying that "the whole of the costs of production must necessarily be spent in the aggregate, directly or indirectly, on purchasing the product" ((p. 18)). As a corollary of the same doctrine, it follows that peoples's savings (abstaining from present consumption) equals investment. However, Keynes, using the concept of propensity to consume, observed that "when aggregate real income is increased aggregate consumption is increased, but not by so much as income. Thus, to justify any given amount of employment, there must be an amount of current investment sufficient to absorb the excess of total output over what the community chooses to consume when employment is at the given level" ((p. 27)). (It must be noted that by 'investment', Keynes did not include increases in stocks, though in some places, e.g. on page 63, he did include increases in stocks when he defined current investment as equal to the value of the part of current output which is not consumed.) Current investment would be determined by the marginal efficiency of capital schedule and the complex of interest rates. Thus, given the propensity to consume and the rate of new investment, there would be only one level of employment consistent with equilibrium. Keynes asserted that there was no reason in general for expecting it to be equal to full employment. ((p. 28))

With regard to the Quantity Theory of Money, Keynes gave quite

a unique version. He stated that if certain assumptions were fulfilled, the Quantity Theory could be interpreted as follows:

a) In a situation of unemployment, an increase in the quantity of money would result in a proportional increase in employment;

B) At a time of full employment, any increase in the volume of money would cause a proportional rise in prices.

The assumptions to be fulfilled were:

1) There was a perfectly elastic supply of factors of production so long as there was unemployment, and a perfectly inelastic supply as soon as full employment was reached;

2) Effective demand changes in the same proportion as the quantity of money.

However, Keynes observed that in reality, resources were not homogeneous and not inter-changeable (thus they would not yield constant returns nor would they be fully employed in the course of industrial expansion); remuneration of the factors would not change in the same proportion among themselves; and effective demand would not change at exactly the same rate as the quantity of money ((pp. 295-6)). Thus, the quantity of money as a whole did not appear to be an important or useful datum in Keynes's version of the classical system. We will now see how he developed a new monetary theory.

First of all, Keynes specifically emphasised the role of interest rate in the determination of investment and employment, an element which was much ignored by his predecessors and by most of his contemporaries. In his analysis, he focused on the effect of changes in the quantity of money on interest rates and investment rather than the effect on prices. In what he called the 'Liquidity Preference Analysis', he divided the amount of cash an individual holds (or demands) into two parts:

$$M = M_1 + M_2 = L_1(Y) + L_2(r)$$

M_1 is the part of money kept for transactions and precautionary motives, M_2 is that part held for the speculative motive; liquidity function L_1 is a function corresponding to an income Y , liquidity function L_2 is a function of the rate of interest r .

He gave two cases in which M may be increased: 1) an increase in the returns to the activities of gold-miners, and 2) an increase in currency to meet Government current expenditure. He stated that since the new gold or new money accrues as someone's income, changes in M in both cases were directly associated with changes in Y ((p. 200)). We may term this as the direct or primary effect of the increase of money on Y .

He further stated that the new level of income would not continue sufficiently high for the requirements of M_1 to absorb the whole of the increase in M . Some portion of the money would seek an outlet in buying securities or other assets until r had fallen so as to bring about an increase in M_2 and at the same time to stimulate a rise in Y ((p.200)). This may be termed the indirect or secondary effect of the increase in M .

However, he reminded us that there were no simple direct links between quantity of money and the rate of interest, between interest rate and investment, and between investment and employment. An increase in M may not reduce r if the liquidity preference of the public were increasing more than the quantity of money, i.e. if there was a shift in the liquidity preference schedule towards greater liquidity. Similarly, a decline in the rate of interest may not increase the volume of investment if the schedule of the marginal efficiency of capital was falling more rapidly than the rate of interest. An increase in the volume of investment would not increase employment if the propensity to consume was falling off. ((p. 173))

On the velocity of circulation of money, Keynes preferred the concept of income-velocity of money, which he defines as the ratio of Y to M_1 :

$$V = \frac{Y}{M_1} = \frac{Y}{L_1(Y)}$$

or, $L_1(Y) = \frac{Y}{V} = M_1$

To him, there was no reason for supposing that V was constant. It was mainly (but not totally) an institutional factor, dependent on the character of banking and industrial organization, on social habits, on the distribution of income between different classes and on the effective cost of holding idle cash. Nevertheless, he believed that within a short period of time, V could be considered as nearly enough constant. ((p. 201))

It is interesting to note that V was so little mentioned in his General Theory. In his system, V was treated as a random variable rather than a parameter. The existing rate of interest, the propensity to consume of the community, the marginal efficiency of capital, and the state of public confidence and expectation were only significant factors that determined the relations between M and r , and between r and investment and income. Thus, to associate M or M_1 to Y_1 by the introduction of an unstable, mainly exogeneously determined variable V , was unnecessary in Keynes's analytical framework. Keynes even went further to state that the use of the term V "obscures the real character of the causation, and has led to nothing but confusion" ((p. 299)). Incidentally, this comment is very similar to the criticism by some early economists that the quantity of money was nothing but a 'veil' behind which the action of real economic forces is concealed.

The split of M into M_1 and M_2 was indeed an important innovation in the analysis of the demand for money. However, one always

finds it difficult to grasp any definite relationship between M_2 and r , and between M_1 and Y in Keynes's presentation inside his General Theory. Keynes regarded the rate of interest as a highly psychological phenomenon. He thought that uncertainty as to the future course of the rate of interest was the sole intelligible explanation of the type of L_2 and the magnitude of M_2 . It follows that a given M_2 does not have a definite quantitative relation to a given rate of interest. What matters is not the absolute level of r , but rather the degree of its divergence from what is considered a fairly safe level of r , Keynes said. A fall in r , nevertheless, will be associated with an increase in M_2 for two reasons. Firstly, every fall in r reduces the market rate relatively to the "safe" rate and therefore increases the risk of illiquidity; and secondly, every fall in r reduces the earnings from parting with one's liquidity. However, he reminded us that there was a limit for the interest rate to fall; beyond this limit the demand for M_2 would be insatiable or perfectly interest-elastic ((p. 202)).

With regard to the efficacy of monetary policy in a depression in reducing the long-term rate of interest to stimulate investment and employment, Keynes again brought the factor of mass psychology onto the stage. A monetary policy which strikes public opinion as being experimental in character or easily liable to change may fail in its objective of greatly reducing the long-term rate of interest, because M_2 may tend to increase almost without limit in response to a reduction of r below a certain limit. Nevertheless, he did not deny that the same policy may prove easily successful if it appealed to public opinion as being reasonable and practicable and in the public interest, rooted in strong conviction, and promoted by an authority unlikely to be superseded ((p.203)).

Other limitations of monetary policy in stimulating investment and employment can be summarised as follows:

- 1) In open-market operations, the monetary authority may not

be willing to deal with securities of different maturities and of varying degree of risks. This would limit the effectiveness of the open-market operation in ~~influencing~~^{influencing} the complex of interest rates, and thereby would obstruct any direct relationship between interest rates and the quantity of money.

2) Money-lending institutions usually levy a service charge of bringing the borrower and the ultimate lender together, and also an allowance for risk, besides the pure rate of interest. Therefore as the pure rate of interest declined, it did not follow that the allowances for expense and risk would decline *pari passu*. This would make it more difficult for the monetary authority to establish a given level of interest, especially at a low level.

3) Inability to achieve high employment would also arise if we had a fickle marginal efficiency of capital even though the rate of interest was fairly low and stable ((pp. 204-8)).

Keynes did not go into details about the working mechanism and the effectiveness of fiscal policy in his General Theory. (Yet his name has always been associated with fiscal policy.) The necessity of State control, he said, was to bring about an adjustment between the propensity to consume and the inducement to invest ((p. 379)). Sceptical of the success of a merely monetary policy directed towards ~~influencing~~^{influencing} the rate of interest, he stated: "I expect to see that the State, which is in a position to calculate the marginal efficiency of capital-goods on long views and on the basis of the general advantage, taking an ever greater responsibility for directly organising investment." ((p. 164)) This was a recommendation for direct State investment and intervention in the capital markets.

He thought that individual decisions to spend and save depended partly on the fiscal policy of the Government. He also considered that the range of possible changes in fiscal policy would be greater, in

expectation at least, than would changes for the rate of interest itself. If fiscal policy was used as a deliberate instrument for the more equal distribution of incomes, its effect in increasing the propensity to consume would be all the greater ((p. 95)). This was a suggestion for the adoption of progressive taxation to alter the propensity to consume, and hence to stimulate the effective demand and employment to a desired level.

He also stated that a change-over from a policy of Government borrowing to a policy of providing 'sinking fund' (or vice versa) was capable of causing a severe contraction (or marked expansion) of effective demand ((pp. 94-5)). This was a proposal for public debt management as a means of influencing liquidity and effective demand. It is more or less a combination of both monetary and fiscal policy.

In a period of progressive increase in unemployment, the State may be forced to provide relief out of borrowed funds ((p. 251)). This was a motion for variations in the State current outlay to adjust the effective demand to a desired level.

* * * * *

Keynes's theory has been refined and elaborated by many subsequent economists, and his theoretical framework has been vigorously explored by his followers. Hicks's article "Mr Keynes and the Classics" ((10)) threw much light on Keynes's General Theory** . He simplified Keynes's system by using three equations representing:

- i) the demand function for money, $M = L(Y, r)$,
- ii) the investment function, $I = I(r)$,
- iii) the saving function, $S = S(r)$,

together with the famous LM-IS diagram.

** Like Keynes, early Hicks classified 'classics' to include the neo-classical writers. Hick's 'classical' money-income equation, $M = kY$, is in fact a neo-classical product of Professors Pigou and Marshall.

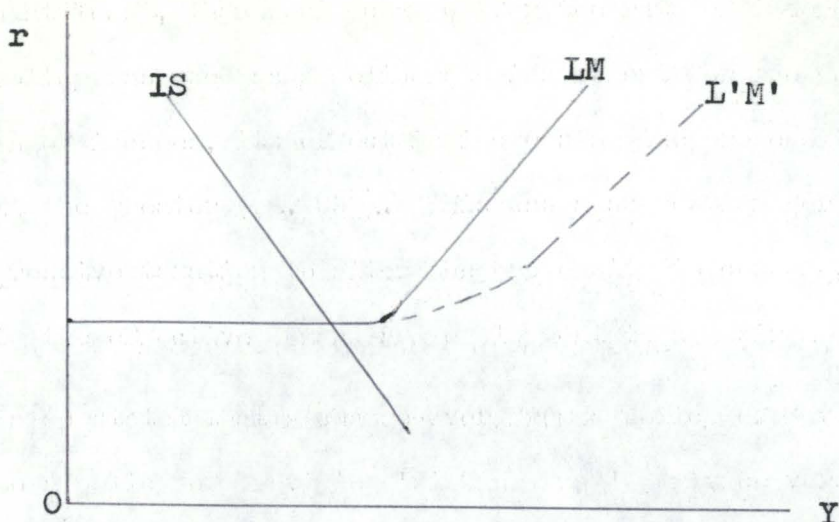


Figure 3

The important contribution of Hicks was his analysis of the 'liquidity trap' situation. An increase in the supply of money will cause LM to shift to the right, but the horizontal portion of the LM curve will remain unchanged. It is this 'liquidity trap' that makes monetary action useless to restore full employment and upsets the 'classical' theory. The case where IS intersects at the liquidity trap is a special case of depression. So the General Theory, as Hicks remarked, is the Economics of Depression ((Ibid)).

D. Dillard pointed out that Keynes had referred to his General Theory as the theory of a monetary economy. The role of money, in Dillard's interpretation, plays a very important part in the Keynesian theory. The control of the supply of money, Dillard believed, was "one of the most effective and least objectionable methods of controlling output and employment" ((11, p. 163)). However, despite Dillard's and others effort to stress the significance of money in the Keynesian economics, the development of Keynesianism gradually turned from a theory in which money was important into a theory in which money was unimportant.

L.R. Klein regarded Keynes's theory of employment and output as a revolutionary theory in the sense that the theory implies that a

capitalistic, frictionless, perfectly competitive system does not possess the ability to adjust itself to full employment, as the classical economists had thought. Klein regarded this as the essential innovation of what he called the "Keynesian Revolution" ((12, p. 42)). Klein's modification of the Keynesian model is as follows. Firstly, he pointed out that Keynes's aggregate income is defined as money income. Klein, however, favoured the neo-classical approach in which the equilibrium system was stated in terms of real income. Employment was directly related to real income, not money income, he said. Secondly, he also adopted the classical and neo-classical postulate of homogeneity. His refined system is

$$S (r, Y) = I (r, Y),$$

$$\frac{M}{P} = L (r, Y),$$

where M/P is the real stock of money. He also introduced the supply and demand functions for labour in his system. The public sector and the foreign trade sector were also included in the model. His Klein-Goldberger model (1955) for the United States, which contained sixteen equations with statistically estimated coefficients and four definitional identities, was one of the first Keynesian empirical models. One of the effects of the emergence of this type of simultaneous-equation macro-models in subsequent years was that the models gradually reduced the role of money and even propagated the view that "money does not matter".

Regarding Keynes's attack on Say's law, H.G. Johnson ((13)) said that Keynes had attacked it for the wrong reason. Properly understood, the significance of Say's law is not that it makes the decision to save identical with the decision to invest but that it excludes money altogether from any influence on economic behaviour. Assessing the contribution of the General Theory, Johnson said that the contribution lies in the general nature of Keynes's approach to the problem of income and employment. In the first place, Keynes's expenditure relationships are much easier to

understand and apply than the quantity theory relationship, and provides, in the multiplier analysis, a key to dynamic process of change. In the second place, he provided a useful macroeconomic general equilibrium model for the analysis of a monetary economy in which capital accumulation is a specialized activity financed by the issue of marketable securities. The model, which consists of a four-market system comprising goods, labour, money, and bonds, specifies the important variables and relationships in a form suitable for statistical measurement and testing. Johnson also pointed out that, though in the General Theory Keynes assigned an essential role for money and the demand for it to play in the economy, the majority of his followers did not allow money, and consequently monetary policy, an important role in determining the level of economic activity. Johnson thought that one of the reasons why such a theory in which money was important should have turned into a theory that money was unimportant was that the 'vulger Keynesians' seized on the simplest and most striking version of the Keynesian system -- autonomous investment and the multiplier -- as the essence of it, ignoring the monetary analysis as an important complication. Johnson also pointed out that Keynes's theory of liquidity preference had, in a more indirect way, played a part in the evolution of the modern theory of central banking, according to which the function of the central bank was the broad one of controlling the liquidity of the economy rather than the narrow one of controlling the quantity of currency and demand deposits ((Ibid)).

A. Leijonhufvnd ((14)) has also pointed out that the arguments for fiscal policy were in the main put forward by later Keynesians. Similarly, the arguments against monetary policy that were current in the forties, and of which one still hears occasional echoes, were not due to Keynes. Yet the doctrine of the ineffectiveness of monetary policy has become firmly associated with his name ((14, pp. 402-3)). Though Keynes did pose a case against reliance on monetary policy for the pursuit of certain

objectives under certain conditions, one does not find the sweeping thesis that monetary policy in general and by its nature is ineffective. When Keynes expressed himself skeptical of the effectiveness of monetary policy in his General Theory, he was merely drawing on his personal diagnosis of the nature of the problems facing Britain in the interwar period and also on his judgments of the kinds of policy that were politically feasible in that context. These time - and place-bound considerations naturally cannot without further ado be invoked in judging the prospective success of monetary measurement in different countries in different times under different situations ((pp. 404-5)).

The impact of Keynes's General Theory on recent development in monetary theory is enormous. The impact has been so great, as Johnson wrote, that most of recent theory and research on money can be classified either as application and extension of Keynesian ideas or as counter-revolutionary attack on them ((15)). We will examine these two streams of development in the next section.

C. Modern Monetary Theory

In the immediate years after the publication of Keynes's General Theory, there followed much zealous research in the computation of national income, in the development of Keynesian income-expenditure and growth models, and in the theoretical and econometric studies on consumption and investment functions. The studies were initiated by some of the most distinguished and influential economists of today.

The field of monetary economics was virtually neglected in this immediate prewar and postwar periods. It was not until the 1950's that monetary problems once again attracted the attention of a large number of economists. This renewed interest was largely the result of the revival of monetary policy in Europe under the impact of postwar inflation. The other major factor which stimulated this new attention on monetary issues was the recognition of the problems posed for both policy and theory by certain institutional characteristics of the modern economy (notably the widespread holding of liquid assets) and by potential conflicts between the diverse policy objectives. The interest of many professional economists in this field has been directly enlisted in the preparation of the testimony and studies for a succession of large scale enquiries into contemporary monetary policy and institutions, for examples, the Patman Hearings in the U.S. (1951), the Radcliffe Report in Britain (1959), the Report of the Commission on Money and Credit of the U.S. (1961), and the Report of the Royal Commission on Banking and Finance in Canada (1964), etc. ((15; 16, p. 3))

The dispute over the definition of monetary magnitude

One of the characteristic features in recent monetary economics is the great attention paid to the demand for money substitutes in the analysis of the demand for money. The recognition of the substitutability between money and the wide range of alternative financial assets, and between money and the access to credit, has raised new topics for debate among contemporary monetary theorists. One of these topics is the empirical question concerning the definition of an appropriate monetary magnitude. According to H.G. Johnson ((15)), the definition of the monetary magnitude is crucial in the discussion of the importance of the quantity of 'money' in monetary theory and monetary policy, for unless the demand for 'money' can be shown to be a stable function of a few key variables, the quantity of 'money' must be a subordinate and not a strategic element in both the explanation and the control of economic activity.

In the United Kingdom, the Radcliffe Committee and some Keynesians strongly believe in the similarity and substitutability between money and other realizable assets or means of financing purchases. Hence, they disregard the money stock as an important quantity, and instead favour some much broader concept of monetary magnitude. The Radcliffe Committee regarded 'liquidity in the broad sense' and 'liquidity conditions' as the monetary variables relevant to spending decisions ((17, pp. 131-133)). Further, they did not believe in the stability of the demand for money and regarded the velocity of circulation as a meaningless number. The control of the supply of money alone, according to them, could not be expected to do

much in influencing the level of economic activity.

In the United States, a substantial number of Keynesians, particularly those associated with the Federal Reserve Board, regard 'credit conditions' as the variable that matters. 'Credit conditions' include, among other things, interest rates on a wide variety of securities, the volume of activity in the various financial markets, bank reserve positions, credit extensions by commercial banks, and the flow of funds into and out of other financial institutions. For many years, the Federal Reserve adhered essentially to a credit, rather than a strictly monetary, approach. Indeed, it frequently shied away from the term 'monetary policy' in favour of the broader 'monetary and credit policy' ((18, pp. 49-52)).

The modern quantity theorists consider both the money stock, whether narrowly or broadly defined, and the monetary base as strategic monetary variables ((19)). The money stock when narrowly defined consists of non-bank public's holding of demand deposits plus currency; and when broadly defined includes also the time deposits of non-bank public. The monetary base consists of bank reserves plus currency held by the public and is under direct control of the monetary authorities.. Changes in monetary base will cause changes in money stock, which in turn result directly and indirectly in increased expenditures on a whole spectrum of capital and consumer goods ((Ibid)).

With regard to the adoption of credit conditions as a measurement of monetary magnitude, Friedman ((20)) points out that such a quantification has been a source of difficulties in two respects. First, the specific features of credit conditions examined have time and again turned out to be misleading indicators of monetary conditions as judged after the event by consequences. He cites studies by

L. Anderson and J. Levine which had shown that there is often little relation between credit conditions and the rate of monetary growth. Second, it has so far proved impossible to find a satisfactory objective quantitative measure of credit conditions that would command widespread acceptance by the participants in the formation of monetary policy and be interpreted by all of them alike ((20, p.144)).

In the following survey, we limit our scope to examine only some of the important works of the modern quantity theorists. Criticism on modern quantity theorists from the other schools of thoughts and the debates between them and the new quantity theorists will be briefly examined at the end of this section of survey.

Elements of Modern Quantity Theory

H.G. Johnson describes the modern quantity theorists as mainly a group of monetarists associated with the University of Chicago, inspired by Milton Friedman and claiming allegiance to be the quantity theory as handled down in the oral tradition of Chicago ((15)). In his first formal restatement of the quantity theory, Friedman ((21)) pointed out that the Chicago theoretical approach insisted that money did matter, and that any interpretation of short-term movements in economic activity was likely to be seriously at fault if it neglected monetary changes and repercussions. The elements of the restatement can be summarised as follows:

- 1) The quantity theory is a theory of the demand for money, not of output, money income, or prices. Money is treated as an asset or capital good, so that the theory of the demand of money is a special topic in the theory of capital.
- 2) The modern quantity approach does not use the distinction

between active (or transaction) balance and idle (or speculative) balance that is used in the Keynesian liquidity preference analysis.

3) The demand for money of the ultimate wealth-owning units depends on three major sets of factors: (i) the total wealth to be held by the units (which may be kept in five different forms: money, bonds, equities, physical goods, and human capital; (ii) the price of and return on money and alternative forms of wealth; (iii) the tastes and preference of the wealth-owning units.

4) The demand for real balances can be expressed in the following equation:

$$\frac{M}{P} = f \left(r_b, r_e, \frac{1}{P} \frac{dP}{dt}, w, \frac{Y}{P}, u \right)$$

where r_b is the rate of return on bonds, r_e is the yield rate on equities, $\frac{1}{P} \frac{dP}{dt}$ is changes in price level, w is the ratio of non-human to human wealth, Y/P is the real income, and u is a random term to represent tastes and preference. The equation can be re-written in the usual quantity theory form:

$$Y = V \left(r_b, r_e, \frac{1}{P} \frac{dP}{dt}, w, \frac{Y}{P}, u \right) : M$$

where V is income velocity.

5) The income velocity, V , is regarded as being endogenously determined and not exogenously given or constant. The demand for money is quite inelastic with respect to the variables that influence V . They accept the empirical hypothesis that the demand for money is highly stable -- more stable than functions such as the consumption function that are offered as alternative key relations.

6) The new quantity theorists also regard the demand function for money as playing a vital role in determining important variables in the macro-analysis of the economy such as money income and price level.

The new quantity theorists, unlike the Keynesians, do not argue in terms of structural models which specify the manner of operation of various factors. Their conclusions are based on direct historical evidence or statistical associations. For example, in one of the empirical studies, Friedman casts serious doubt on the acceptability of the Keynesian separation of money into transaction, speculative, and precautionary money, and also on the importance of the speculative money ((20)). In the same study, he finds that there is a secular decline in the income velocity of money, which would be explained by the hypothesis that the demand for money increases more rapidly than income, a finding apparently inconsistent with the fact that income and velocity vary together over the cycle. Friedman resolves the paradox by hypothesizing that the demand for real balance is an elastic function of permanent income.

In another empirical investigation "Money and Business Cycles", Friedman and A.J. Schwartz show that the stock of money displayed a systematic cyclical behaviour in the U.S. for the period 1870-1960 ((22)). The rate of change in the money stock regularly reached a peak before the reference peak and a trough before the reference trough. For all the cycles in the period, the average lead was 7 months at the peak and 4 months at the trough. The amplitude of the cyclical movement in money was closely correlated with the amplitude of the cyclical movement in general business and was about half as large as the amplitude of cyclical movements in money income. The stock of money, they concluded, was much more closely and systematically related to income over business cycles than was investment or autonomous expenditures. They also concluded that changes in the stock of money played an important independent role in money income fluctuations and asserted that there was an extremely strong case for

the proposition that sizable changes in the rate of change in the money stock were a necessary and sufficient condition for sizable changes in the rate of change of money income.

In another study by A.J. Schwartz ((25)), it has been found that for the U.K. in the period between 1881 to 1967, year-to-year percentage changes in money stock and in money income were closely correlated, with a correlation coefficient of 0.77, compared with the 0.70 for the correlation between year-to-year changes in money stock and money income for the U.S. in the period from 1870 to 1963.

These close statistical associations between money and income and similar evidence constitute the main force of argument of the modern quantity theorists for the importance of money in determining the level of economic activity. However, there are still a substantial number of contemporary economists who are not convinced by their findings and the interpretations and arguments affiliated with them. We will examine this controversy in the following paragraphs.

The Importance of Money in Modern Quantity Theory

In the Restatement and in many of his theoretical and empirical works, Friedman is still moderately conservative in stating the importance of money by confining its influence to only price level and money income.

The lead of money at peaks and troughs found in the empirical investigations is emphatically regarded by modern monetarists as a decisive evidence of the independent influence of money. However, they are not unaware of the limitation of this timing evidence as an 'empirical proof' for the influence of money. Friedman, for example, has once stated that "changes in the money stockare a consequence as well as an independent source of changes in money income and

changes in tastes and technology. Finally, monetary policy can contribute to offsetting major disturbances in the economic system: for example, offsetting the inflationary pressure of a deficit federal budget by restraining the rate of monetary growth, or easing the transition of resources during a period of emergency by increasing the rate of monetary growth. To avoid the evil effect of drastic changes in money supply, he states again that the best monetary measure is a stable growth in money supply, at a rate of something like 3 to 5 per cent per year. **

This proposal for constant monetary growth is often interpreted by the rival schools as implying disapproval towards discretionary changes in money supply (for example, N. Kaldor ((32))).

K. Brunner, however, argues that such an interpretation is quite erroneous. On the contrary, he says, monetarist analysis has not abandoned hope for a more 'activist use' of monetary policy. The proposal for the strategy of constant monetary growth follows from a diffuse uncertainty about the detailed structure of monetary mechanisms rather than from the uncertainty of the lag associated with monetary impulses ((33)).

In brief, modern monetarists assign great significance to the role of money and monetary policy in modern economy. Appropriate control on the supply of money, according to them, is crucial in the attempt to stabilize level of economic activity and price movements.

** A similar proposal for steady monetary growth was first published in his article "A Monetary And Fiscal Framework For Economic Stability" in American Economic Review, Vol. 38, 1948.

Their conviction does not emerge without challenges, however. We will examine the disputes in the following paragraphs.

Debate on the Efficacy of Monetary and Fiscal Policy

The growing popularity of modern monetary economics in a period when Keynesian influence is overwhelming inevitably results in debates on whether monetary policy or fiscal policy is a more effective stabilization strategy.

First of all, there are economists who attack the lag in effect and the inflexibility of monetary policy. T. Mayer ((27)), for example, shows that monetary policy is much too slow to be reversed quickly and that it cannot offset more than 10% of the fluctuation in industrial production during most business cycles. He finds that in the U.S., the effects of a new monetary policy on the current income level would require 11 months to grow to the point where they would outweigh the effects of policy applied in the previous cycle phase. However, Mayer still believes that monetary policy can be used to prevent the occurrence of a liquidity crisis, and even more ambitiously be used to limit inflation during a boom and to stimulate investment during a depression.

W.L. Smith ((28)) believes that the great advantage of fiscal policy is that it has a direct and powerful impact on the income stream, whereas monetary policy's first impact is on the asset structure and only through its effects on this structure does it indirectly and with some delay affect the income stream. He warns us that it would be a dangerous mistake to over-rate monetary policy's potency and to place major reliance on its stabilizing power to the neglect of fiscal policy.

The Radcliffe Committee also believed that fiscal measures had advantage over monetary policy in having "a more certain impact effect" ((17, p. 184)). Also, there are those who express skepticism on the efficacy of monetary policy based on the arguments that:

i) the effectiveness of monetary controls is asymmetrical: they are more effective against booms than against recessions **;

ii) the ever changing velocity of circulation of money adds another uncertainty to the impact of monetary policy besides the uncertainty of the lag in effect;

iii) demand elasticities with respect to market interest rates are usually rather low for most real investment and even in financial investment;

iv) price rigidities and downward wage inflexibility are likely to make monetary policy very uncertain in their effectiveness in stabilizing economic activity;

v) there are possible conflicts between domestic objectives and the maintenance of reasonable stability in the foreign exchange markets;

vi) there may be inflationary pressures or deflationary elements beyond the control of monetary measures, such as excessive market power of business firms or of unions, shifts in the composition of aggregate demand, etc.;

vii) the "automatic stabilizers" in the economic system also substantially limits the effectiveness of general monetary policy.

** This argument seems to be inconsistent with the findings of Friedman ((22)) which indicate that the average lead of the rate of change of money stock was 7 months at the peak, and 4 months at the trough of a business cycle. L.S. Ritter and W.L. Silber also point out that econometric models reveal no such asymmetry ((18, p. 58)).

For instance, due to the effect of automatic stabilizers, consumer expenditures may not be affected by discretionary monetary controls.

Some fiscalists, for example, J.W. Angell ((28)), argue that government expenditures, which comprise more than one fifth of the GNP in the U.S., are almost completely immune to any direct impact from general monetary controls, at least in the short-run. He believes that for the correction of cyclical instability, the best measure relies on fiscal policy.

According to H.G. Johnson ((15)), the modern skepticism regarding the effectiveness of monetary policy is largely due to the belief that no known mechanism suffices to explain how a change in money supply can have any great effect upon expenditure. The monetarists have to rely heavily on empirical research to derive evidence to prove the significance of money and monetary policy. Their empirical studies and the interpretations and conclusions affiliated with the studies are also targets of attack by scholars from other schools of thought.

James Tobin ((30)) contends that the time evidence of the empirical studies on money of Friedman and his associates cannot be accepted as "empirical proof of propositions about causation". But Friedman replies that Tobin does not give a satisfactory explanation of why it cannot be and, even more important, what its proper role is ((31)).

Nicholas Kaldor also complains that the new quantity theorists, unlike the Keynesians, do not argue in terms of structural models which specify the manner of operation of various factors. The transmission mechanism of the influence of money is hardly considered by the orthodox Friedman school ((32)). Kaldor also seems to be not fully persuaded by the argument that a high correlation between money

and income indicates a cause-and-effect relationship. Irrespective of whether the money increase is a cause or an effect, he says, there is every reason for supposing that the rise in the money supply should precede the rise in income. An increase in the demand for money will evoke an increase in the supply of money and money substitutes (credit cards, promissory notes, for example) to 'accommodate' itself to the needs of transactions. And the budget of Government sector, a borrower with 'unlimited borrowing power', may also exert great influence on the changes of money supply. A deficit budget, for example, will involve an increase in money supply; and a surplus budget, a decrease in money supply. ** Thus, the large observed fluctuations in the money supply, preceding in time the business cycle, may merely be a reflection of the operation of the built-in fiscal stabilizer. He believes that the forces of private demand, exports and wage increases also exert impact on the supply of money in the U.K. Supply of money, he concludes, is endogenously and not exogenously determined ((Ibid)).

Karl Brunner ((33)), replying to Kaldor's criticism, states that it is true that Friedman defined his monetarist version in terms of assigning the dominant influence of money and relative independence to major changes in the money stock. However, not all monetarists have taken the exogeneity of money stock for granted, he says. ++ The exogeneity of the money stock, he argues, is not a necessary

** His simple regression study on short-run changes in money supply and net government borrowing in the U.K. shows that 74% of the variation in the money supply can be explained by the borrowing of the government sector alone ((32)).

++ As we have pointed out previously, Friedman did mention that changes in money stock can be "a consequence as well as an independent source of changes in money income and prices" ((24, p. 695)). Friedman does not take the exogeneity of money stock for granted either.

condition of the monetarist thesis; it is not the crux of the issue. Kaldor's assertion about the dominant role of government borrowing requirement is neither a deadly criticism nor an embarrassment to the monetarists, he says.

With regards to the argument of low interest elasticity of demand for money balances put forward by the rival schools, R.L. Teigen argues that the low interest elasticity serves as a basis for the inference of the stability of velocity of circulation in response to a monetary shift. A substantial interest elasticity of demand for money, said to be the Keynesian position, is viewed as implying unstable velocity ((34)).

C.A.E. Goodhart ((35)) states that it is difficult to chart and to measure the transmission of the effects of monetary policy. If, however, the sole aim of monetary policy is to affect the level of money incomes, it does not necessarily matter whether it is possible to observe and to understand the transmission mechanism in detail, he says. It is enough to be able to relate the response of a change in money incomes to a prior change in the level of the money stock. The validity of the statistical relationship between movements in the money stock and in money incomes depends heavily on the assumption that the money supply is exogenously determined. He believes that the relationship between movements in the money stock and in money incomes is a two-way relationship. The investigation of the extent to which changes in the money stock lead, or lag, changes in money incomes could be of considerable importance in any attempt to distinguish the main direction of causality. A consistent lead, he says, is a prima facie indication of causation.

In the counter-attack, K. Brunner points out that the

Keynesian analysis has conditioned many people to a simple faith in the 'multiplier'. Such an analysis emphasizes the 'direct' effect of fiscal policy and regards monetary policy as exerting only an 'indirect' impact on the economy. Brunner argues that the multiplier of government expenditure is relatively small and quite unreliable due to the fact that the relative price adjustments set in motion by government expenditure often involve 'cross currents' which seriously diminish the net effect on private demand and thus on total demand. He also argues that short-term tax changes (except for excise taxes) exert little effect on economic activity and price movement. He is skeptical whether expenditure policy and short-term tax changes are useful for general stabilization purposes ((33)).

Let us now look at the empirical evidence presented by the modern quantity theorists to support their view that monetary policy is a better stabilization measure than fiscal policy.

Friedman and Meiselman ((36)), using U.S. data for a period of 62 years (1897-1958), derive the empirical results indicating that

- 1) the income velocity of circulation of money is consistently and decidedly more stable than the investment multiplier except only during the early years of the Great Depression after 1929;

- 2) there is a close and consistent relation between the stock of money and consumption or income, and between year-to-year changes in the stock of money and in consumption or income;

- 3) there is a much weaker and less consistent relation between autonomous expenditures (net private domestic investment

plus government deficit plus net foreign balance) and consumption, except in the years of Depression;

4) there is essentially no consistent relation between year-to-year changes in autonomous expenditures and consumption. For the post-war period, in which quarterly data are available, the picture is much the same. They conclude that "the stock of money is unquestionably far more critical in interpreting movements in income than is autonomous expenditures", and that "the quantity-theory approach to income change is likely to be more fruitful than the income-expenditure theory approach" and also that "control over the ^E sock of money is a far more useful tool for affecting the level of aggregate money demand than control over autonomous expenditures."

A more recent approach in the empirical investigation of the relative efficacy of monetary and fiscal policy is applied in the work of Anderson and Jordan of the St. Louis Federal Reserve Bank ((19)). Using U.S. quarterly data for the period from 1952-1 to 1968-11, they obtain results in their test which indicate that monetary changes had an impact on GNP which was greater, more certain and more immediate than that of fiscal changes. Their work has been widely quoted by the monetarists in defence of their contention that monetary policy is effective and more effective than fiscal policy in economic stabilization. However, a very similar test carried out by Artis and Nobay ((37)) for the U.K. derives an opposite result: fiscal policy was more effective than monetary policy.

Besides this controversy over the results of the tests, there also arise challenges and criticisms on Anderson's and

Jordan's approach and their interpretation affiliated with the test, which we will examine in the next section.

PART TWO

THE ST. LOUIS TEST AND
ITS REPLICATION FOR NEW ZEALAND

A. Introduction

Recent interest in the relative importance of monetary and fiscal influences on economic activity (by no means a new topic of discussion in the field of monetary economics,) is mainly the result of the econometric work of Leonall Andersen and Jerry Jordan of the Federal Reserve Bank of St. Louis, which showed that monetary influences had a larger, more predictable, and faster effect on economic activity than fiscal influences in the United States during the period from 1955 to 1968.

Since the publication of the Andersen-Jordan (A-J) article, a considerable amount of associated literature has emerged. As experiments, many researchers have attempted to replicate the A-J approach with data of different periods or subperiods, data of different nations, and data of slightly different definition and modification. Even the method itself has been attempted in several modified forms, according to the ideas of the researchers to deal with certain statistical and methodological problems encountered in their tests.

Without doubt, the A-J article is an important contribution to the development of monetary economics and to the continuing debate on the relative effectiveness of monetary and fiscal policy in economic stabilization. Since its publication, the work has been widely quoted by modern monetary theorists in their propaganda

on the importance of monetary policy; e.g., Milton Friedman cited the work as important evidence to substantiate his view on the effectiveness of monetary policy during the famous debate with his rival fiscalist Walter Heller. ((38))

The second part of this dissertation will be devoted to examine briefly the work of Anderson and Jordan, and to review a sample of criticisms and modifications made by other economists in connection with the A-J article. As an experiment, we will also attempt to replicate the test with New Zealand data, to see whether we can obtain some similar results for the case of New Zealand.

B. The St. Louis Test

The aim of the St. Louis test is to challenge the commonly held propositions that the response of economic activity to fiscal actions relative to that of monetary actions is (i) greater, (ii) more predictable, and (iii) faster.

First of all, they assumed that fiscal actions and monetary actions are exogeneous variables in the economy, i.e., they are determined outside the economy and not by the interplay of market forces. Quarterly changes in total spending for goods and services (GNP at current prices) were used to represent changes in the levels of economic activity. Quarterly changes in money supply was used as the independent variable representing monetary actions. Three forms of measures of fiscal actions were used: high-employment government receipts, high-employment government expenditures, and high-employment budget surplus.

Two methods to compute changes in variables were attempted:

i) The conventional first differences were calculated by subtracting the value for the preceding quarter from the value for the present quarter. Expressed in algebraic form:

$$X_t = X_t - X_{t-1}$$

ii) The central differences were calculated by averaging the forward differences and the backward differences. Expressed in algebraic form:

$$\begin{aligned} X_t &= \frac{(X_{t+1} - X_t) + (X_t - X_{t-1})}{2} \\ &= \frac{X_{t+1} - X_{t-1}}{2} \end{aligned}$$

Using single-equation models, Andersen and Jordan regressed changes in total spending on current and lagged values of monetary and fiscal variables. The structure of lags was estimated by using the Almon technique. This lag structure tends to eliminate multicollinearity arising from the close correlations among the explanatory variables.

The results of the test can be summarised as follows:

- (1) The regression coefficients and sums of regression coefficients for money stock and monetary base are greater than those for fiscal variables.
- (2) The partial coefficients of determination and sums of the partial coefficients of determination for money stock and monetary base are greater than those for fiscal variables.
- (3) By simulation, they found that monetary expansion stimulated greater increase in GNP than did an equivalent increase in government expenditures.
- (4) The regression coefficients for monetary variables possess greater t values than fiscal variables.

(5) The "beta coefficients"*** and sum of "beta coefficients" for the money stock and monetary base are greater than those for fiscal variables.

Based on results (1), (2), and (3) Andersen and Jordan derived the conclusion that the proposition that the response of total demand to fiscal actions was greater than that of monetary actions was not confirmed by their study. Result (4) implies that there is more confidence or reliability in the estimated regression coefficients for monetary variables than in the estimated regression coefficients for fiscal variables. Thus result (4) refutes the proposition that the response of economic activity to fiscal actions is more predictable than the response to monetary influence. The third proposition that the major impact of fiscal influence on economic activity occurs faster than monetary influence is also not confirmed (result (5)). Andersen and Jordan thus suggested that an alternative set of propositions would be consistent with their empirical evidence. These alternative propositions were: The response of economic activity to monetary actions compared with that of fiscal actions is

- (1) larger,
- (11) more predictable, and
- (111) faster.

C. Comments and Modifications of the St. Louis test

(i) De Leeuw and Kalchbrenner ((39)) were particularly skeptical about the exogeneity of the explanatory variables in the A-J

** The beta coefficient for a particular explanatory variable is calculated as the product of the regression coefficients for that variable times the ratio of the standard deviation of the variable to the standard deviation of GNP.

models. They considered the assumption of the exogeneity of the explanatory variables as a crucial statistical requirement of single-equation models. By exogeneity, they mean that (i) the variable does not respond to current movements in endogenous variable, and (ii) the variables are subject to control by policy-makers. If the explanatory variable does not meet the first requirement, then it is impossible to know what is influencing what, or how serious the problem of bias is in the equation. If it does not meet the second requirement, then it cannot be considered as an effective policy instrument.

De Leeuw and Kalchbrenner attempted certain adjustments in the explanatory variables. Firstly, they adjusted government receipts by taking into account changes of price index in the attempt to eliminate the influence of inflation. Secondly, they adjusted the monetary base by excluding member bank borrowing and also by excluding currency. Using the same A-J method, but with adjusted variables in government receipts and monetary base, they derived results which showed that the sum of the coefficients for fiscal policy variables had increased considerably and possessed larger t values, while the sum of the coefficients for the adjusted monetary base had decreased and so had the t values. Also, the beta coefficients for the adjusted monetary variables suggested longer lags for monetary policy than had the result of Anderson and Jordan suggested.

De Leeuw and Kalchbrenner thus expressed serious doubt on the A-J conclusion about fiscal policy. According to their study, both fiscal policy and monetary policy appeared to exert significant influence on changes in GNP.

(ii) R.D. Davis ((40)) was also not entirely convinced by the results of the A-J study. Using the A-J type equations but with differing sub-periods and using different degree of polynomial and different number of lagged variables, he derived the following findings:

(1) The equation showed very little explanatory power when fitted to the 1952-60 data. It seemed to fit the data well only in the 1960's. Davis regarded the poor performance of the A-J equation for the 1952-60 subperiod as a "distinct embarrassment".

(2) If the nonborrowed monetary base or nonborrowed member bank reserves were used as the exogenous variable rather than the money supply, or the total monetary base, explanatory power dropped rather substantially. So did the sizes of the coefficients.

Some of Davis's findings, however, favoured the A-J approach:

(3) The coefficients were reasonably stable over time when the A-J equations covering differing time periods were used.

(4) The specific variable GNP seemed to contribute little extra to explaining the variance in monetary changes beyond what was explained by the policy variables. Hence, only a relatively modest part of the gross relationship between money and GNP exhibited in the A-J equations seemed to reflect a feedback effect from GNP to money.

On balance, Davis concluded that it would seem fair to say that the A-J equations had not been devastated by the critical scrutiny to which they had been subjected. On the other hand, he thought, it was equally obvious that some distinctly troublesome questions existed regarding the equations. The main deficiency of the approach, he said, was the omission of the transmission mechanism. He suggested that only after transmission process had been

translated into an econometric model with a reasonable degree of structural detail, would most economists really be prepared to believe that money matters as much as the A-J study shows.

(iii) Adopting the A-J approach, M.W. Keran ((41)) extended the period of investigation back to 1919, using proxy measures of quarterly GNP for periods whose data on quarterly GNP were not available. He also divided the whole period of investigation (1919 - 1969) into several sub-periods and carried out tests for each of these sub-periods.

For the whole period and for each of the sub-periods (except the war years 1939-1946), the relative impacts of monetary and fiscal influences had been remarkably stable. Changes in the money stock consistently had had a larger, more predictable, and faster impact on changes in economic activity than had changes in Federal Government spending. When regressing changes in money stock on changes in GNP and on the changes in the monetary base, he found that i) the monetary base was the dominant factor in determining movements in the money stock; ii) the monetary authorities were the dominant factor in determining movements in the monetary base. Thus he concluded that money stock had met the statistical requirement as an exogenous variable representing monetary policy of the monetary authorities in all sub-periods.

His general conclusion was that his work had provided strong support for the case that monetary influences have a significant impact on economic activity over the business cycle. The important implication of the results, he considered, was that monetary policy should be given a central role in any economic stabilization programme.

(iv) As an experiment, M.J. Artis and A.R. Nobay ((37)) attempted to replicate with United Kingdom data the kinds of test employed in the A-J article. Firstly, they used a stepwise regression programme to find out the most important explanatory variables and to estimate appropriate lags for the variables. The results showed that fiscal policy variables had greater coefficients and t values than monetary policy variables. They also estimated that the average lag with which fiscal measures exerted their effect was shorter than was the lag in effect of money supply. Secondly, they employed the most promising representatives of fiscal and of monetary policy found in the stepwise regressions to Almon lag structure regressions. The results showed that:

- a) the regressions had a very poor fit;
- b) the beta coefficients for the monetary policy variable was slightly greater than that for the fiscal policy variable, but the fiscal policy variable was faster acting;
- c) when changes in gross domestic expenditures were regressed exclusively upon changes in the fiscal policy variable or upon changes in monetary policy variable, all the terms in the fiscal measure equation proved significant, whereas only two of those in the money supply equation were significant.

Whilst on the formal level the results of this experiment were the reverse of some of those obtained by Andersen and Jordan, Artis and Nobay were not totally confident with their findings. They doubted the reliability of the method itself. They were doubtful whether the regression equations employed could properly be held to represent a 'reduced' form of a structural system unless the characteristics of that system were specified in advance. Without

such a prior specification, they maintained, it was not really possible to determine what the signs and size of the coefficients attached to the variables 'should be', nor how far they should be interpreted as representing an effect of monetary or fiscal policy variables on gross expenditures rather than the other way around.

(v) Keith Carlson and Denis Karnosky ((42)) were particularly skeptical of the A-J approach of regressing GNP directly on monetary and fiscal variables as a test of effectiveness of monetary and fiscal policy. They argued that a truly effective policy (monetary or fiscal) would necessarily be unrelated to the observed data on GNP. The reason: If the policy variable were changed to offset all movements (e.g. random shocks) tending to direct GNP from its high-employment growth path, a low degree of significance between the policy variable and GNP would be expected. They too concluded that a proper analysis of monetary and fiscal policy would require some indication of economic structure. To assess the impact of monetary and fiscal variables on some economic variable, say GNP, one needed to specify the other factors influencing GNP before the impact of monetary and fiscal actions could be isolated. Monetary and fiscal policy were not independent and should always be viewed jointly, and they thought that simultaneous equations models would be more appropriate for the purpose of testing the efficacy of monetary and fiscal policy.

We have briefly examined a sample of criticisms and modifications of the St. Louis test. To summarise, the two major technical problems in the St. Louis test are:

The first problem concerns the exogeneity or independence of the explanatory variables. As De Leeuw and Kalchbrenner have pointed

out, the assumption of the exogeneity of the explanatory variables is a crucial statistical requirement of single-equation models. Andersen and Jordan have certainly made some effort to deal with this problem. The application of 'monetary base' as one of the measures of money stock, full-employment government receipts, full-employment government expenditures and full-employment budget surplus as measures of fiscal policy variables is an attempt to make their explanatory variables as 'independent' or as 'exogeneous' as possible. Regardless of the extent to which the attempt succeeded in eliminating the endogeneity of the explanatory variables, the effort was indeed an improvement over previous similar empirical studies made by other researchers.

The second technical problem is that the introduction of lagged explanatory variables has the risk of resulting intercorrelation among the explanatory variables which may lead to very imprecise estimates of the lagged coefficients and great difficulty in making useful inferences about them. To solve this problem, Andersen and Jordan applied Shirley Almon's lag structure ** in the regressions. This is another improvement in the A-J study.

Besides the two major problems just mentioned, there is also the big question concerning the reliability of the single-equation 'reduced' model as a test of effectiveness of policy measures. The main deficiency of the approach is the omission of the transmission mechanism.

** The original work of Almon appeared in Econometrica, Vol. 33, No. 1, titled as "The Distributed Lag Between Capital Appropriations and Expenditures". ((43)) A more comprehensible description of the Almon technique is found in J. Johnston's second-edition Econometric Methods, pp. 294-7. ((44))

Andersen and Jordan have made it clear that their test "does not attempt to test the rival economic theories of the mechanism by which monetary and fiscal actions influence economic activity", and agree that more elaborate procedures than those used in their test would be required in order to test any theories underlying the familiar statements regarding results expected from monetary and fiscal actions.

D. Replication of the St. Louis test
 for New Zealand

In the A-J study, seasonally adjusted quarterly data were used, while in the work of Artis and Nobay, seasonally unadjusted data were employed. In our test, we tried both unadjusted and adjusted data. **

The structure of lags in the A-J test was estimated with the use of the Almon lag technique. In Artis's and Nobay's study, both fixed-point lag and Almon lag structures were attempted. In our test, we attempted both fixed-point and Almon lag structures. We shall refer to regressions with a fixed-point lag structure as ordinary least-square (OLS) regressions, and regressions with Almon lag structure as Almon regressions.

The period of investigation in our test covers a ten-year period starting from 1961-I to 1970-IV. Two measurements of the level of economic activity were used. They were: (i) Y1, which was quarterly aggregate expenditure excluding farm stocks, and (ii) Y2, which was quarterly aggregate expenditure including farm stocks. Total government expenditure (E), ^{*}total government expenditure plus change in imprest balances (E), total government receipts (R) and total government receipts plus change in suspense balances ^{*}(R) were used in the test as measurements of government expenditures

** The author is thankful to the Economics Department of the Reserve Bank of New Zealand for supplying seasonally adjusted data used in the test.

and receipts. ⁺⁺ Seasonally adjusted figures were available only for ^{*}E and ^{*}R. Two definitions of budget surplus were computed. They were (R-E) and (^{*}R-^{*}E).

The above-mentioned fiscal policy variables were not adjusted to the 'high-employment' concept, due to the fact that the rate of unemployment in the period of investigation was negligibly low^{**}.

In the initial test, two monetary magnitudes were attempted. They were: (i) narrowly defined money supply (M^1), which is composed of currency, notes and coins of public and their demand deposits in trading banks; and (ii) broadly defined money supply (M^5), which is composed of M^1 plus other demand deposits and time deposits. (M^5 is equivalent to M7 of the N.Z. Reserve Bank data base print-out.) It was found in the initial test that M^5 was not performing as well as M^1 in the OLS regressions, and we decided to use only M^1 in the rest of the test. (Theoretically, M^1 is more subject to monetary control than is M^5 ; and thus M^1 is a better measure of monetary actions than is M^5 . Also, M^1 is that money stock which is owned and disposable by the private sector and thus is more independent from the influence of the 'monetary impact' of fiscal policy.)

In the A-J test, changes in all variables were computed by

⁺⁺ Seasonally unadjusted Y1 and Y2 were taken from columns 20 and 21 respectively of Table 4 on p. 15 in New Data For Economic Research ((45)). Seasonally unadjusted fiscal variables were taken from pp. 30-34 of the same publication.

^{**} The highest unemployment figure in the period occurred during the 1967-68 recession when unemployment rose to an annual average peak of about 7,000. However, this figure was still very low by international standards, being considerably less than one per cent of the total labour force.

methods of first-difference and central-difference. In the initial test, we used both methods to calculate changes in variables. We found in the test that OLS regressions in which central-difference variables were employed turned out to be slightly inferior overall to the same regressions in which first-difference variables were used. To save time, we decided to use only first-difference variables in the rest of the test.

In the initial test where seasonally unadjusted data were used, seasonal dummies were introduced to trace the significance of seasonal factors in the regressions. It was found that seasonal dummies were very significant explanatory variables when included in the regressions.

In the exercise of Almon regressions, to follow closely the example of Andersen and Jordan, we adapted a fourth degree polynomial for our lag structure and limited our lag period to $t-3$.

Before examining the results of the regressions, we should point out two problems we encountered in replicating the St. Louis test for New Zealand. They are:

(1) In New Zealand, a great proportion of government expenditures was financed through borrowing from the private sector. Seasonal loans in the June, September, and December quarters averaged about 28% of the quarterly government expenditures. (Most of the loans were paid back during the March quarter; the yearly average of net borrowing was about 9% of yearly government expenditures.)**

** The figures were calculated from data shown on pp. 30-34 of New Data For Economic Research ((45)).

Thus, it is expected that changes in government expenditures should bear considerable impact in the financial system. The fact that the government sector claims more than 50% of the total money supply and liquid assets (i.e. M^3) should also be taken into account when considering the impact of fiscal policy variables in the financial system. Adjustments in the fiscal variables, especially in E , \bar{E} , $(R-E)$, and $(\bar{R}-\bar{E})$, seemed to be necessary in a test in which we compared the relative influence of monetary and fiscal variables. Strictly speaking, only if such an adjustment is made, do we have a comparable basis for judging the relative performance of monetary and fiscal variables. Much more research in the theoretical background and in the empirical observations is needed in this respect. However, at this stage, we decided to use original fiscal variables in the test.

(2) In New Zealand, the monetary authority has a bias towards direct monetary controls. These include ceilings on bank advances, hire-purchase regulations, variable government security ratios for non-banks, building industry programming restrictions, officially controlled interest rates, etc. These monetary actions are exceedingly difficult to quantify in an objective statistical manner and we were skeptical that the impacts of all these monetary actions would be quantitatively reflected in changes in M^1 . In short, we did not think that the modern quantity theorists' definition of monetary policy would be suitable for the case of New Zealand, where monetary actions are mostly direct, qualitative controls.**

** Criticisms of direct monetary controls are found, for example, in:
(1) R.S. Deane, "The New Zealand Financial System: Operation and Policy" (Unpublished lecture), September, 1971, Reserve Bank of New Zealand. ((47))
(2) R.S. Deane, Towards a Model of the New Zealand Economy, 1971, Reserve Bank of New Zealand. ((46, p. 7))

Thus, throughout the test, we hesitate to refer to changes in M^1 as 'monetary policy' variable, or to refer to our test as a test of the comparative efficacy of 'monetary policy' and 'fiscal policy'. Instead, we prefer to call changes in the supply of M^1 simply the 'monetary variable', and to refer to our test as a test of the relative influence of monetary and fiscal variables on changes in aggregate expenditures.

* * * * *

The whole empirical work can be divided into three parts: Test One, Test Two, and Test Three. Test One comprises OLS regressions in which seasonally unadjusted data were used; while Test Two comprises OLS regressions in which seasonally adjusted data were used. Test One and Test Two were intended to serve as an initial test as well as a supplementary test to Test Three, which comprises four sets of Almon regressions. Let us now examine briefly the results of the regressions, with the main attention being focused on comparing the relative performance of monetary and fiscal variables.

Test One:

There are three sets of OLS regressions in Test One. In Set (I), first-difference seasonally unadjusted variables of Y_2 , E , R , $(R-E)$, M^1 , and M^5 were employed. In Set (II), central-difference seasonally unadjusted variables of the same set of data were employed. In Set (III), first-difference seasonally unadjusted variables of Y_1 , E^* , R^* , (R^*-E^*) , and M^1 were used.

Set (I) (pp. 70-80):

Comparing the model A's with the model B's, C's, and

D's, we found that fiscal policy variables, as a whole, were performing equally well as monetary variables in the regressions (except in models B.1, C.1, D.1, and D.2, in which no lagged variable or insufficient lagged variables were included in the models). In this set of regressions we also attempted to introduce seasonal dummy variables into the models. The two models with seasonal dummies presented in each of the tables represent the best two regressions we obtained in the programme. Seasonal dummy variables were significant in models A's and B's, but not in C's and D's. One interesting feature of the inclusion of seasonal dummies is that they tended to upset the role of current M^1 and E in the regressions, causing 'wrong' signs for them, or reducing their coefficients and statistical significance.

In the model E's, F's, and G's, where both monetary and fiscal variables were included, there were improvements in the \bar{R}^2 's. Judging from the sizes and significance of coefficients, we could not observe any consistent superiority of either monetary or fiscal variables in the regressions. It appeared that monetary variables were more superior in some models, while in other models, fiscal variables acted as superior partners.

In this initial test, we also tried to introduce ΔM^5 to substitute ΔM^1 in the regressions (pp. 77-80). Judging from the sizes of coefficients and their significance, the \bar{R}^2 's, the SEE's, and the F-statistics, it seemed that ΔM^5 did not show itself to be a better monetary magnitude than ΔM^1 in the regressions.

Set (II) (pp. 81-91):

In Set (II), central-difference variables were employed in

the same regression models we attempted in Set (I). The over-all results of these models did not seem to be better than those of models in Set (I); and the relative performance of monetary and fiscal variables was much the same as that in Set (I). Again, no conclusive answer could be obtained for the question whether monetary or fiscal variables have greater and more reliable influence on changes in Y_2 . Also, ΔM^5 did not prove itself to be a better explanatory variable than ΔM^1 .

From the results of this initial test, we came to the decisions that, to save time and effort,

i) we would apply only first-difference variables in the rest of the test;

ii) we would use only ΔM^1 as the monetary variable in the rest of the test.

Set (III) (pp. 92-98):

In Set (III), seasonally unadjusted data of Y_1 , \bar{E}^* , \bar{R}^* , and $(R-E)^*$ were employed as an alternative set of data in the similar OLS regressions. The purpose of the programme is to see whether we would obtain a better over-all results in the regressions, and to see whether there would be any change in the relative performance of monetary and fiscal variables.

The alternative set of data produced much inferior over-all results in the OLS models compared with those in the previous two sets of regressions. On the average, the sizes of coefficients and sums of coefficients were smaller than those in Set (I) and Set (II). Again, we still could not obtain a conclusive answer to the relative performance of monetary and fiscal variables. In some models, monetary variables exerted greater influence than fiscal variables;

while in other models, fiscal variables played the dominant role.

Seasonal dummies appeared to be quite significant in this set of regressions. An interesting feature in the models where seasonal dummies were included is that the role of ΔM^1_t was totally demolished, which might suggest that the seasonal dummies had dominated the role of current ΔM^1 in the regressions. On the other hand, the inclusion of seasonal dummies seemed to favour the performance of $\Delta \bar{E}^*$, especially in models B's. As a whole, the inclusion of seasonal dummies increased the 'goodness of fit' of the regressions.

* * * * *

Test Two:

The significance of seasonal dummy variables and the interesting impact of their inclusion in the regressions observed in Test One, gave rise to the necessity (and curiosity) to attempt similar OLS regressions with seasonally adjusted data. As seasonally adjusted were available only to Y_1 , Y_2 , \bar{E}^* , \bar{R}^* , $(\bar{R}-\bar{E})^*$, and M^1 at the time we were doing the programme, we limited our regressions to only two sets. In Set (I), ΔY_1 was the dependent variable; and in Set (II), ΔY_2 was the dependent variable.

Set (I) (pp. 99-105):

All regressions in this set possessed few significant coefficients and surprisingly low \bar{R}^2 and F statistics. On the average, the sizes of the coefficients and the sums of coefficients are much the same as those in regressions where seasonally unadjusted

data were employed. The role of ΔM^1_t was demolished in the regressions, and ΔM^1_{t-1} became the most important monetary variable in the regressions. (Incidentally, this feature seemed to assimilate or conform to what we observed previously when seasonal dummy variables were included in regressions in which seasonally unadjusted data were employed.) Still no notable disparity between the performance of monetary and fiscal variables could be traced.

Set (II) (pp. 106-112):

In this set of regressions, where ΔY_2 was the dependent variable, the performance of ΔM^1 began to improve, while the performance of the fiscal variables, especially that of ΔR^* and $\Delta(R-E)^{**}$, was deteriorating. It can be said that, in terms of the sizes, the 'right' signs, and the sums of coefficients, and number of significant coefficients, monetary variable seemed to be exerting slightly greater and more reliable influence than fiscal variables to Y_2 in these models. However, due to the very low values of \bar{R}^2 and F statistics in these regressions, this intuitive comparison should not be taken too seriously.

Test Three:

In the initial tests, we found that seasonal factors were reasonably significant in the regressions. This indicated that we should apply seasonally adjusted data when we do our Almon regressions in Test Three. However, as regressions in which seasonally unadjusted data were employed turned out to possess much higher \bar{R}^2 's, it seemed worthwhile to run an additional set of Almon

regressions using seasonally unadjusted data. It had appeared to us that, in terms of \bar{R}^2 's, Set (I) of Test One was the best among the three sets of regressions. Thus we decided to apply data used in this set of OLS regressions (i.e., unadjusted Y_2 , E , R , $(R-E)$, and M^1) to our first set of Almon regressions -- Set (I). In the second set of Almon regressions, seasonally adjusted Y_1 , E^* , R^* , $(R-E)^*$, and M^1 were employed. In the third set, we substituted ΔY_1 with ΔY_2 as the dependent variable. In Set (IV), we introduced $\Delta(Y_1-E)^*$ as measure of changes in the level of economic activity (of the private sector). The reasons for introducing $\Delta(Y_1-E)^*$ as the dependent variable will be explained later when we examine the regressions of this set.

Set (I) (pp. 113-117):

The first set of Almon regressions turned out to be quite similar in certain respects to their corresponding counterparts in the OLS regressions in Test One. The application of Almon lag technique seemed to improve the sums of coefficients in most equations. As a whole, the best two regressors in the set were ΔM^1 and ΔE . However, neither ΔM^1 nor ΔE showed consistent superiority over the other. In model 1.1, ΔM^1 had a slightly larger sum of coefficients than ΔE in model 1.2. However, in model 1.5, ΔE possessed much a greater sum of coefficients than did ΔM^1 . In model 1.6, ΔM^1 had a sum of coefficients of 3.559; while in model 1.7, the sum of coefficients of ΔE dropped to only 0.954.

Strictly speaking, the regression coefficients we have just examined are not appropriate for the purpose of comparing the relative influence of monetary and fiscal variables on ΔY_2 . An

appropriate measure can be developed by changing these regression coefficients to 'beta coefficients'. These beta coefficients are calculated as the products of the regression coefficient for the respective variable times the ratio of the standard deviation of the variable to the standard deviation of the dependent variable. A comparison of the beta coefficients (p. 116) clearly indicated that ΔE and ΔR exerted greater influence on changes in Y_2 than did ΔM^1 .

The t-statistic is a measure of the confidence in the estimated regression coefficients, and hence can be used as a measure of the reliability of the monetary and fiscal influence on changes in Y_2 . As far as the t-statistics are concerned, ΔM^1 seemed to be more reliable than fiscal variables in its influence to ΔY_2 .

The speed of the influence of monetary and fiscal variables can be observed by plotting the beta coefficients on charts. On p. 117, the beta coefficients of models 1.5 and 1.6 were plotted. The charts show that ΔY_2 responded equally fast to changes in monetary and fiscal variables.

To summarise, in this first set of Almon regressions, we found that:

- i) ΔE and ΔR exerted greater influence on ΔY_2 than did ΔM^1 ;
- ii) the response of ΔY_2 to ΔM^1 was more predictable than the response of ΔY_2 to the fiscal variables
- iii) the response of ΔY_2 was equally fast to both fiscal and monetary variables.

Set (II) (pp. 118-122):

In Set (II), seasonally adjusted data were employed. The

most disappointing feature of these regressions was that these regressions possessed very low \bar{R}^2 's. The t-statistics too were much smaller than those in Set (I). Another disappointing feature was the appearance of many 'wrong' signs for ΔR^* in model 2.5 and 2.6. A comparison of the beta coefficients on p. 121 indicated that, on the average, ΔE^* and $\Delta(R-E)^{**}$ possessed greater beta coefficients than did ΔM^1 . The two charts on p. 122 also exhibited that ΔE^* and $\Delta(R-E)^{**}$ exerted faster influence on $\Delta Y1$ than did $\Delta M1$. A comparison of the t-statistics indicated that $\Delta(R-E)^{**}$ and ΔE^* had greater t-statistics than ΔM^1 . To summarise, we found that ΔE^* and $\Delta(R-E)^{**}$ exerted

- i) greater,
- ii) more predictable, and
- iii) faster

influence on $\Delta Y2$ than did ΔM^1 . In short, our results in Set (II) were just the reverse of those obtained by Andersen and Jordan for the United States.

Set (III) (pp. 123-127):

In Set (III), $\Delta Y2$ was the dependent variable. Again we obtained very disappointingly low \bar{R}^2 's. The performance of ΔM^1 was much improved compared with that in Set (II); while on the other hand, the performance of ΔR^* and $\Delta(R-E)^{**}$ deteriorate. Leaving aside ΔR^* and $\Delta(R-E)^{**}$, let us compare the relative importance of ΔM^1 and ΔE^* in the regressions. On the average, ΔE^* possessed a slightly larger sum of beta coefficients than did ΔM^1 . However, as far as the t-statistics are concerned, ΔM^1 seemed to possess a slightly higher average t-statistic than did ΔE^* . The charts of the lag response (p. 127) showed that ΔE^* was

acting faster than ΔM^1 , but ΔM^1 was acting faster than ΔR^* (and $\Delta(R-E)^*$, which was not shown in the charts).

To summarise, the results in this set of regressions were quite inconclusive with regard to the relative influence of monetary and fiscal variables to ΔY_2 . ΔM^1 and ΔE^* were equally important (or equally unimportant) in the regressions; however, it seemed that ΔM^1 acted slightly more slowly than ΔE^* but still faster than ΔR^* or $\Delta(R-E)^*$.

Set (IV) (pp. 128-132):

In all the tests we have examined above, Y_1 and Y_2 were used as measures of the level of economic activity. In this test (set (IV)), we want to introduce a new measure of the level of economic activity in the regressions. We have observed a slight superiority of the performance of government expenditures variables over that of monetary variable in the previous three sets of Almon regressions. We suspect that this slight superiority of ΔE or ΔE^* might be due to the fact that government expenditures itself is a big component of Y_1 or Y_2 , and thus bears the same pattern of fluctuations as that of Y_1 or Y_2 . Therefore to apply ΔY_1 or ΔY_2 as the dependent variable in the regressions may tend to favour the performance of ΔE or ΔE^* .

We feel that in applying the St. Louis type equations, we have to make sure not only that the explanatory variables we employ are exogeneous, but also that the dependent variable should be a priori 'responsive' to our explanatory variables. The item of government expenditures is commonly regarded by economists as a component of GNP that is relatively less responsive to or dependent on the forces of market mechanism or monetary actions. (In

fact, it is often referred to as an autonomous variable.) Thus, we suspect that the application of Y1 or Y2 (in which government expenditures occupies a big portion, of about 25% to 30%) might have impaired the performance of monetary variable.

In this set of regressions, we employed $\Delta(Y1-E)^*$ as a measure of changes in the level of economic activity (of the private sector.) Using the same Almon lag structure as that of the Set (II), we regressed $\Delta(Y1-E)^*$ on the monetary and fiscal variables. These regressions had roughly the same R^2 's as those in Set (II). The performance of ΔM^1 , did not improve. There was a considerable deterioration of the performance of ΔE^* , and $\Delta(R-E)^{**}$ took over as the best regressor in the set.

E. Conclusion of the Test

The very poor 'goodness of fit' in both OLS and Almon regressions in which seasonally adjusted data were employed is perhaps the most disappointing feature in the whole test. In many respects, the Almon regressions were quite similiar to their respective counterparts in the OLS regressions. They had almost the same \bar{R}^2 's and SEE's; the sizes of coefficients, sums of coefficients, and even the relative performance of the monetary and fiscal variables were quite alike in the two types of regressions.

Although most of the regressions seemed to produce inconclusive and sometimes inconsistent results on the relative performance of monetary and fiscal variables, we have an intuitive impression that the average performance of M^1 was slightly inferior to

the average performance of ΔE or ΔE^* , which were the best fiscal regressors in the first three sets of Almon regressions. An indication of the slight inferiority of ΔM^1 to ΔE or ΔE^* in these three sets of regressions is shown by its slower impact on $\Delta Y1$ or $\Delta Y2$. In particular, the speed of response of $\Delta Y1$ or $\Delta Y2$ to changes in M^1 was greatly impaired by application of seasonally adjusted data (and the introduction of seasonal dummies, in the case of OLS regressions.) In these regressions, the role of ΔM^1_t was demolished, and ΔM^1_{t-1} took the dominant role as the most important monetary variable.

Except in the fourth set of Almon regressions, ΔM^1 , on the average, performed slightly better than other fiscal variables, namely, ΔR , ΔR^* , $\Delta(R-E)$, $\Delta(R-E)^*$. These fiscal variables, on the whole, possessed smaller t-statistics, and in many cases, possessed sums of coefficients of the 'wrong' signs.

To put it in a more specific manner, our conclusions of the test in which $\Delta Y1$ or $\Delta Y2$ was employed as the dependent variable are:

(i) Changes in the supply of M^1 exerted equally important influence, in terms of magnitude and reliability, on changes in $Y1$ and $Y2$ compared with the same influence exerted by changes in government expenditures.

(ii) In regressions where seasonal dummy variables were included or where seasonally adjusted data were applied, the influence of current-period changes in M^1 (i.e. ΔM^1_t) was greatly impaired, resulting in a lag of one quarter-period behind government expenditures variables in its impact on changes in $Y1$ or $Y2$.

(iii) On the average, ΔM^1 exerted a slightly more reliable impact on changes in Y_1 or Y_2 than did government revenue or budget surplus variables.

The application of $\Delta(Y_1 - \bar{E})$ as the dependent variable in the fourth set of Almon regressions turned out results that are contrary to those we obtained in the previous regressions. $\Delta(R - \bar{E})$ became the most important regressor while the performance of $\Delta \bar{E}$ had deteriorated greatly. With regard to the loss of influence of $\Delta \bar{E}$ in this set of regressions, we derive two conclusions:

(iv) The slight superiority of the performance of $\Delta \bar{E}$ and $\Delta \bar{E}$ found in the previous sets of regressions was largely due to the fact that \bar{E} or \bar{E} itself was a big component of Y_1 or Y_2 .

(v) $\Delta \bar{E}$ did not exert any significant or reliable influence on changes in the level of economic activity of the private sector (i.e. $\Delta(Y_1 - \bar{E})$).

In addition, the very good performance of $\Delta(R - \bar{E})$ in this set of regressions may indicate that

(vi) Changes in budget surplus was an important and reliable variable influencing changes in the level of economic activity of the private sector.

However, due to the fact that we obtained very low \bar{R}^2 's in many regressions, we should not put a high degree of confidence in these conclusions. We should also point out that two factors should be taken into account when assessing the reliability of the results of this test. The first one concerns the fact that the financing of government expenditures relied considerably on borrowing from the private sector, and thus it follows that changes in government expenditures would exert certain 'monetary impact' on

the economy. Therefore the influence of changes in government expenditures observed in this test should not be regarded as the pure or genuine influence of changes in government expenditures. The second factor is that in New Zealand, most monetary actions are direct, qualitative controls, and thus we do not think that the modern monetarists' definition of monetary policy will be suitable for New Zealand. This implies that even if the above conclusions (i) and (ii) are accepted as valid evidence, it does not necessarily mean that 'monetary actions' in New Zealand acted more slowly than government expenditures in influencing changes in aggregate expenditures.

APPENDIX : RESULTS OF TEST

Glossary

- Sum : Sum of coefficients
- Cont. : Constant term
- R^2 : Coefficient of determination
- \bar{R}^2 : R^2 adjusted for degrees of freedom
- F : F - statistic
- SEE : Standard error of estimate
- D-W : Durbin - Watson statistic
- D_2 , D_3 , D_4 : Seasonal dummy variables for June, September, and December quarters respectively
- + , ++ : Denotes coefficients which are statistically significant at the 10 per cent and 5 per cent levels respectively

TEST ONE

ORDINARY LEAST-SQUARES REGRESSIONS

Seasonally unadjusted data

SET (I) : pp. 70-80

SET (II) : pp. 81-91

SET (III) : pp. 92-98

MODELS A's : $\Delta Y_2 = f (\Delta M^1)$

	<u>Models</u>						
	<u>A.1</u>	<u>A.2</u>	<u>A.3</u>	<u>A.4</u>	<u>A.5</u>	<u>A.6</u>	<u>A.7</u>
ΔM^1							
t	1.59 ⁺	2.46 ⁺	2.46 ⁺⁺	1.80 ⁺⁺	1.11 ⁺	.01	-.02
t-1		1.22 ⁺⁺	1.24 ⁺⁺	.79 ⁺⁺	1.06 ⁺⁺	1.16 ⁺⁺	1.13 ⁺⁺
t-2			.04	-.69 ⁺	-.51		-.13
t-3				-1.04 ⁺⁺	-.74 ⁺⁺		.54
t-4					1.06 ⁺⁺		
D ₂						138.53 ⁺⁺	172.76 ⁺⁺
D ₃						24.86	-5.36
D ₄						286.16 ⁺⁺	325.15 ⁺⁺
Sum	1.59	3.67	3.73	.86	1.98	1.17	1.52
Cont.	16.32	8.48	8.26	18.72	16.58	-89.94	-101.47
\bar{R}^2	.51	.65	.64	.70	.73	.68	.66
F	33.28	29.86	19.23	18.72	17.32	15.28	10.59
SEE	71	60	61	56	53	58	59

MODELS B's, : $\Delta Y_2 = f(\Delta E)$

	<u>Models</u>						
	<u>B.1</u>	<u>B.2</u>	<u>B.3</u>	<u>B.4</u>	<u>B.5</u>	<u>B.6</u>	<u>B.7</u>
ΔE							
t	-.35 ⁺⁺	1.00 ⁺⁺	.88 ⁺⁺	1.23 ⁺⁺	1.50 ⁺⁺	-.66 ⁺	-.37
t-1		1.72 ⁺⁺	.96 ⁺⁺	1.34 ⁺⁺	1.02 ⁺	.74 ⁺	1.07 ⁺⁺
t-2			-.86 ⁺⁺	-.45	-.85	.18	.83
t-3				.39	-.01		.81
t-4					-.63		
D ₂						-123.56 ⁺	-183.87 ⁺⁺
D ₃						42.90	7.24
D ₄						104.74 ⁺	79.14
Sum	-.35	2.72	.98	2.49	1.04	.26	2.34
Cont.	24.77	3.04	12.96	4.44	11.26	19.23	39.25
\bar{R}^2	.03	.63	.75	.75	.75	.72	.73
F	1.98	27.81	32.44	24.19	19.45	15.68	14.35
SEE	100	61	50	51	51	53	53

MODELS C's : $\Delta Y_2 = f(\Delta E, \Delta R)$

	<u>Models</u>						
	<u>C.1</u>	<u>C.2</u>	<u>C.3</u>	<u>C.4</u>	<u>C.5</u>	<u>C.6</u>	<u>C.7</u>
ΔE							
t	-.59	.51	.69	.95 ⁺	.84 ⁺	-.02	-.20
t-1		2.06 ⁺	-.13	.38	-.00	.78	1.00
t-2			.09	.53 ⁺	.01	.64	1.13
t-3				.64	.26		.76
t-4					-.45		
ΔR							
t	.10	-.10	-.16	-.34	-.31	-.18	-.28
t-1		-.36 ⁺	-.20 ⁺	-.48	-.01	.27	-.07
t-2			-.69 ⁺	-.92 ⁺	-.40	-.27	-.19
t-3				-.29	.24		-.01
t-4					.54 ⁺		
D ₂						-220.42	-275.65
D ₃						118.83	-27.92
D ₄						28.18	3.02
ΔE							
Sum	-.59	2.56	.65	2.50	.66	1.40	2.69
ΔR	.10	-.46	-1.05	-2.03	.06	-.18	-.55
Cont.	25.82	5.72	22.98	18.12	16.80	38.38	91.06
R ²	.07	.67	.87	.87	.87	.71	.69
F	1.16	17.98	35.40	18.12	16.80	10.11	7.93
SEE	101	57	37	37	37	55	57

MODELS D's : $\Delta Y_2 = f (\Delta(R-E))$

	<u>Models</u>						
	<u>D.1</u>	<u>D.2</u>	<u>D.3</u>	<u>D.4</u>	<u>D.5</u>	<u>D.6</u>	<u>D.7</u>
$\Delta(R-E)$							
t	-.06	-.05	-.25 ⁺⁺	-.46 ⁺	-.53	-.34	-.27
t-1		.01	-.50 ⁺⁺	-.71 ⁺⁺	-.36	.01	.10
t-2			-.73 ⁺⁺	-.96 ⁺⁺	-.60	-.69 ⁺⁺	-.62 ⁺
t-3				-.23	.16		.11
t-4					.46		
D ₂						-172.40	-183.01
D ₃						44.03	41.99
D ₄						-39.73	-55.44
Sum	-.06	-.04	-1.48	-2.36	-.87	-1.02	-.68
Cont.	22.50	22.52	21.82	22.29	21.12	68.82	75.74
R ²	-.03	-.06	.85	.85	.86	.69	.68
F	.25	.12	60.29	44.48	37.45	13.77	11.41
SEE	103	104	39	39	39	57	57

MODELS E's : $\Delta Y_2 = f(\Delta E, \Delta M^1)$

	<u>Models</u>						
	<u>E.1</u>	<u>E.2</u>	<u>E.3</u>	<u>E.4</u>	<u>E.5</u>	<u>E.6</u>	<u>E.7</u>
ΔE							
t	.33 ⁺	.74 ⁺⁺	.07	.66	.57	-.60 ⁺	-.44
t-1		1.03 ⁺⁺	.23	.74	.77	.77 ⁺⁺	.92 ⁺
t-2			-1.09 ⁺⁺	-.31	-.26		.49
t-3				.69 ⁺	.62		.73
t-4					.04		
ΔM^1							
t	1.88 ⁺⁺	1.35 ⁺⁺	.91 ⁺	.76 ⁺⁺	.53	-.38	-.22
t-1		.44	1.23	1.02 ⁺⁺	1.07 ⁺⁺	1.17 ⁺⁺	1.00 ⁺
t-2			-.19	-.56	-.54		-.36
t-3				-.63 ⁺	-.46		.62
t-4					.44		
D ₂						21.24	-10.95
D ₃						106.33 ⁺⁺	13.25
D ₄						226.03 ⁺⁺	216.12 ⁺⁺
ΔE	.33	1.77	-.79	1.77	1.74	.03	1.70
Sum ΔM^1	1.88	1.79	1.95	.69	1.04	.79	1.04
Cont.	13.12	3.12	17.16	8.25	7.84	-65.20	-39.41
R ²	.53	.73	.80	.81	.80	.76	.75
F	18.67	21.92	21.35	17.26	13.09	16.35	10.24
SEE	69	53	46	45	46	50	51

MODELS F's : $\Delta Y_2 = f(\Delta E, \Delta R, \Delta M^1)$

	<u>Models</u>						
	<u>F.1</u>	<u>F.2</u>	<u>F.3</u>	<u>F.4</u>	<u>F.5</u>	<u>F.6</u>	<u>F.7</u>
ΔE							
t	-.32	.37	.65 ⁺	.60	.32	.06	-.27
t-1		1.31 ⁺⁺	-.29	-.26	-.11	.81	.54
t-2			.03	.13	.42	.38	.65
t-3				.03	.28		.45
t-4					.46		
ΔR							
t	.30 ⁺⁺	-.06	-.44 ⁺⁺	-.36	-.40	-.14	-.23
t-1		-.20	-.26 ⁺⁺	-.20	-.11	.29	-.03
t-2			-.84 ⁺⁺	-.83 ⁺⁺	-.76 ⁺	-.27	-.31
t-3				.08	.21		.14
t-4					.12		
ΔM^1							
t	2.14 ⁺⁺	1.14 ⁺⁺	-.22	-.25	-.41	-.46	-.38
t-1		.64	1.08 ⁺⁺	1.08 ⁺⁺	1.16 ⁺⁺	1.04 ⁺	1.00 ⁺
t-2			-.24	-.20	-.29	-.38	-.29
t-3				.32	.29		.75
t-4							
D ₂						-40.94	-101.49
D ₃						179.89	-16.01
D ₄						161.65	90.26
ΔE	-.32	1.68	.44	.50	1.36	1.25	1.37
Sum ΔR	.30	-.26	-1.54	-1.31	-1.14	-.12	-.43
ΔM^1	2.14	1.78	.62	.95	.71	.21	1.09
Cont.	14.77	4.59	24.47	21.70	16.96	-55.29	25.55
R ²	.63	.72	.91	.90	.88	.73	.71
F	18.79	14.32	34.00	23.31	16.77	8.53	6.51
SEE	61	54	31	33	35	53	55

MODELS G's : $\Delta Y_2 = f (\Delta(R-E) , \Delta M^1)$

	<u>Models</u>						
	<u>G.1</u>	<u>G.2</u>	<u>G.3</u>	<u>G.4</u>	<u>G.5</u>	<u>G.6</u>	<u>G.7</u>
$\Delta(R-E)$							
t	.29 ⁺⁺	.15	-.58 ⁺⁺	-.50 ⁺	-.57 ⁺	-.43 ⁺	-.25
t-1		.02	-.48 ⁺⁺	-.38	-.44	.01	.27
t-2			-.92 ⁺⁺	-.89 ⁺⁺	-.94 ⁺⁺	-.69 ⁺	-.54
t-3				.13	.00		.38
t-4					.05		
ΔM^1							
t	2.15 ⁺⁺	2.39 ⁺⁺	-.29	-.37 ⁺	-.40	-.32	-.55
t-1		.74	.80 ⁺⁺	.86 ⁺⁺	.78 ⁺	.91 ⁺	1.00 ⁺
t-2			-.58	-.49	-.48	-.41	-.14
t-3				.30	.39		.85 ⁺
t-4					.35		
D_2						-50.57	-65.66
D_3						65.61	33.99
D_4						70.65	60.93
$\Delta(R-E)$	.29	.37	-1.98	-1.64	-1.90	-1.11	-.14
Sum ΔM^1	2.15	3.13	-.07	.33	.64	.18	1.16
Cont.	14.35	10.64	21.91	20.30	20.06	5.07	16.10
\bar{R}^2	.65	.64	.88	.87	.86	.70	.70
F	29.32	14.64	38.74	27.58	20.68	9.71	8.31
SEE	60.26	61.00	35.16	36.15	37.37	56.02	55.53

MODELS H's : $\Delta Y_2 = f (\Delta M^3)$

	<u>Models</u>					
	<u>H.1</u>	<u>H.2</u>	<u>H.3</u>	<u>H.4</u>	<u>H.5</u>	<u>H.6</u>
ΔM^3						
t	1.06 ⁺⁺	1.40 ⁺⁺	1.33 ⁺⁺	.93 ⁺⁺	.55 ⁺	.55 ⁺
t-1		.56 ⁺⁺	.79 ⁺⁺	.65 ⁺⁺	.73 ⁺⁺	.59 ⁺
t-2			.42 ⁺	-.02	.00	.04
t-3				-.87 ⁺⁺	-.79 ⁺⁺	-.78 ⁺⁺
t-4					.55	.58 ⁺
t-5						.22
Sum	1.06	1.96	2.54	.69	1.04	1.20
Cont.	-16.56	-48.90	-69.04	-6.41	-16.55	-20.71
R ²	.42	.48	.50	.63	.64	.63
F	23.47	15.33	11.53	14.11	12.21	9.97
SEE	77.15	73.03	71.30	61.75	60.46	61.26

MODELS I's : $\Delta Y_2 = f (\Delta E , \Delta M^3)$

	<u>Models</u>				
	<u>I.1</u>	<u>I.2</u>	<u>I.3</u>	<u>I.4</u>	<u>I.5</u>
ΔE					
t	.22	.99 ⁺	.51	.80 ⁺	.83
t-1		1.35 ⁺	.35	.16	.06
t-2			-1.22 ⁺	-.95 ⁺	-1.07
t-3				.03	-.11
t-4					-.13
ΔM^3					
t	1.20 ⁺	.64 ⁺	.18	.22	.21
t-1		.04	.69 ⁺	.47 ⁺	.47
t-2			.38	.46 ⁺	.49
t-3				-.58 ⁺	-.56 ⁺
t-4					.05
ΔE	.22	2.33	-.36	.04	-.42
Sum ΔM^3	1.20	.67	1.24	.57	.66
Cont.	-23.01	-18.78	-22.66	-2.11	-2.53
\bar{R}^2	.42	.70	.78	.79	.77
F	12.17	18.99	19.32	15.81	11.58
SEE	77	56	48	46	48

MODELS J's : $\Delta Y_2 = f(\Delta E, \Delta R, \Delta M^3)$

	<u>Models</u>				
	<u>J.1</u>	<u>J.2</u>	<u>J.3</u>	<u>J.4</u>	<u>J.5</u>
ΔE					
t	-.69 ⁺	.31	.42	.93 ⁺	.89
t-1		1.39 ⁺	-.52	-.09	-.58
t-2			-.25	.41	-.18
t-3				.71	-.11
t-4					-.77
ΔR					
t	.46 ⁺	.11	-.03	-.38	-.61
t-1		-.19	-.12	-.53	-.21
t-2			-.58 ⁺	-1.04 ⁺	-.60
t-3				-.53	-.04
t-4					.78
ΔM^3					
t	1.66 ⁺	.64 ⁺	.32	.52 ⁺	.42
t-1		-.08	.24	.01	-.23
t-2			.24	.12	.44
t-3				-.15	-.01
t-4					.18
ΔE	-.69	1.70	-.35	1.96	-.75
Sum ΔR	.46	-.08	-.73	-2.48	-.68
ΔM^3	1.66	.56	.80	.50	.70
Cont.	-36.54	-10.58	-.79	5.79	1.32
R^2	.63	.69	.87	.86	.86
F	18.58	12.43	23.99	17.16	13.75
SEE	62	57	37	38	38

MODELS K's : $\Delta Y_2 = f (\Delta(R-E) , \Delta M^3)$

	<u>Models</u>				
	<u>K.1</u>	<u>K.2</u>	<u>K.3</u>	<u>K.4</u>	<u>K.5</u>
$\Delta(R-E)$					
t	.40 ⁺	.50 ⁺	-.17	-.50 ⁺	-.75 ⁺
t-1		.05	-.50 ⁺	-.89 ⁺	-.43
t-2			-.65 ⁺	-1.10 ⁺	-.50
t-3				-.43	.15
t-4					1.04 ⁺
ΔM^3					
t	1.72 ⁺	1.72 ⁺	.16	.25	.19
t-1		-.23	-.04	-.22	-.57 ⁺
t-2			.19	.11	.46 ⁺
t-3				.13	.27
t-4					.24
$\Delta(R-E)$	.40	.55	-1.32	-2.92	-.49
Sum ΔM^3	1.72	1.49	.31	.27	.59
Cont.	-40.32	-32.02	10.96	14.05	2.20
\bar{R}^2	.63	.62	.84	.83	.87
F	27.26	13.56	26.99	20.31	21.45
SEE	61.73	62.59	40.63	41.42	36.76

MODELS Λ 's : $\Delta Y_2 = f (\Delta M^1)$

	<u>Models</u>					
	<u>A.1</u>	<u>A.2</u>	<u>A.3</u>	<u>A.4</u>	<u>A.5</u>	<u>A.6</u>
ΔM^1						
t	2.10 ⁺	1.94 ⁺	.91 ⁺	.95 ⁺	.83 ⁺	.84 ⁺
t-1		1.20 ⁺	1.59 ⁺	1.53 ⁺	.68	.66
t-2			-1.53 ⁺	-1.48 ⁺	-.26	-.46
t-3				-.07	-1.04 ⁺	-.75
t-4					1.46 ⁺	1.23 ⁺
t-5						.34
Sum	2.10	3.14	.96	.93	1.67	1.86
Cont.	12.00	8.80	16.74	16.83	15.56	15.26
R ²	.45	.59	.71	.70	.76	.76
F	25.61	22.34	25.89	18.71	20.29	16.56
SEE	39.72	34.43	28.69	29.22	26.10	26.43

MODELS B's : $\Delta Y_2 = f(\Delta E)$

	<u>Models</u>				
	<u>B.1</u>	<u>B.2</u>	<u>B.3</u>	<u>B.4</u>	<u>B.5</u>
ΔE					
t	1.61 ⁺⁺	1.65 ⁺⁺	1.05 ⁺⁺	1.17 ⁺⁺	1.12 ⁺⁺
t-1		.82 ⁺⁺	.77 ⁺⁺	.34	.33
t-2			-.73 ⁺	-.07 ⁺	-.59
t-3				-.48	-.48
t-4					.12
Sum	1.61	2.47	1.09	.96	.50
Cont.	8.43	3.11	12.20	16.41	15.78
R ²	.54	.66	.68	.68	.67
F	35.97	30.43	22.44	17.10	13.20
SEE	36	31	30	30	31

MODELS C's : $\Delta Y_2 = f (\Delta E , \Delta R)$

	<u>Models</u>				
	<u>C.1</u>	<u>C.2</u>	<u>C.3</u>	<u>C.4</u>	<u>C.5</u>
ΔE					
t	1.12 ⁺	.16	.56 ⁺	.56 ⁺	.31
t-1		-.08	-.20	-.38	-.20
t-2			.30	.43	-.02
t-3				-.16	.10
t-4					-.40
ΔR					
t	.38 ⁺	.51 ⁺	-.14	-.25	-.07
t-1		-.30 ⁺	-.26 ⁺	.33	.09
t-2			-.71	-.85 ⁺	.25
t-3				.64 ⁺	.41
t-4					1.01 ⁺
ΔE					
Sum	1.12	.08	.66	.45	-.21
ΔR					
	.38	.21	-1.11	-.15	1.69
Cont.	10.79	18.60	22.36	18.79	14.01
\bar{R}^2	.82	.88	.88	.88	.91
F	71.12	53.92	37.04	29.13	30.27
SEE	23	19	19	18	16

MODELS D's : $\Delta Y_2 = f (\Delta(R-E))$

	<u>Models</u>				
	<u>D.1</u>	<u>D.2</u>	<u>D.3</u>	<u>D.4</u>	<u>D.5</u>
$\Delta(R-E)$					
t	.43 ⁺	.44 ⁺	-.22	-.22	-.11
t-1		-.50 ⁺	-.50 ⁺	-.35	-.35
t-2			-.71 ⁺	-.71 ⁺	-.04
t-3				.16	.16
t-4					.60 ⁺
Sum	.43	-.06	-1.43	-1.12	.16
Cont.	20.57	20.12	20.09	20.11	20.20
R^2	.34	.85	.86	.86	.86
F	16.71	86.33	63.20	45.97	39.13
SEE	43	21	20	20	20

MODELS E's : $\Delta Y_2 = f (\Delta E , \Delta M^1)$

	<u>Models</u>				
	<u>E.1</u>	<u>E.2</u>	<u>E.3</u>	<u>E.4</u>	<u>E.5</u>
ΔE					
t	1.13 ⁺	1.36 ⁺	.68 ⁺	.80 ⁺	.62 ⁺
t-1		.16	-.08	-.37	-.48
t-2			-.63 ⁺	-.61 ⁺	-.32
t-3				-.16	-.19
t-4					.27
ΔM^1					
t	.95 ⁺	.55 ⁺	.11	.46	.48
t-1		1.27 ⁺	1.67 ⁺	1.23 ⁺	.86 ⁺
t-2			-.76 ⁺	-.26	.20
t-3				-.66	-1.16 ⁺
t-4					.74 ⁺
ΔE	1.13	1.52	-.03	-.34	-.10
Sum ΔM^1	.95	1.82	1.02	.77	.92
Cont.	8.41	3.33	16.44	18.44	17.20
R^2	.57	.78	.82	.82	.82
F	20.97	26.50	24.21	17.96	14.67
SEE	35	26	23	23	23

MODELS F's : $\Delta Y_2 = f(\Delta E, \Delta R, \Delta M^1)$

	<u>Models</u>				
	<u>F.1</u>	<u>F.2</u>	<u>F.3</u>	<u>F.4</u>	<u>F.5</u>
ΔE					
t	.73 ⁺	.22	.61 ⁺	.61 ⁺	.38
t-1		-.19	-.36 ⁺	-.46	-.25
t-2			.15	.23	.02
t-3				-.13	.31
t-4					-.34
ΔR					
t	.37 ⁺	.40 ⁺	-.44	-.47	-.46
t-1		-.32 ⁺	-.22 ⁺	.16	-.27
t-2			-.90 ⁺	-.95 ⁺	-.06
t-3				.45	-.12
t-4					1.09 ⁺
ΔM^1					
t	.79 ⁺	.08	.31	.18	.76
t-1		.87 ⁺	.74 ⁺	.70 ⁺	-.03
t-2			.15	.21	.42
t-3				-.03	-.06
t-4					.37
ΔE	.73	.03	.40	.25	.12
Sum ΔR	.37	.08	-1.56	-.81	.18
ΔM^1	.79	.95	1.20	1.07	1.46
Cont.	10.71	16.33	22.34	19.94	15.72
R^2	.85	.91	.91	.90	.92
F	58.82	48.82	34.43	23.91	23.62
SEE	21	17	16	17	15

MODELS G's : $\Delta Y_2 = f (\Delta(R-E) , \Delta M^1)$

	<u>Models</u>				
	<u>G.1</u>	<u>G.2</u>	<u>G.3</u>	<u>G.4</u>	<u>G.5</u>
$\Delta(R-E)$					
t	.38 ⁺	.30 ⁺	-.11	-.15	-.19
t-1		-.49 ⁺	-.45 ⁺	-.50	-.64 ⁺
t-2			-.45	-.53	.02
t-3				-.07	-.37
t-4					.71 ⁺
ΔM^1					
t	1.91 ⁺	.17	.23	.12	.57
t-1		.76 ⁺	.66 ⁺	.80 ⁺	.09
t-2			-.16	-.36	.06
t-3				.32	.07
t-4					.65 ⁺
<hr/>					
Sum $\Delta(R-E)$	.38	-.16	-1.01	-1.25	-.47
Sum ΔM^1	1.91	.93	.73	.88	1.44
Cont.	13.87	16.74	17.47	17.15	16.09
R ²	.73	.87	.87	.86	.88
F	41.60	52.69	34.64	24.36	22.78
SEE	28	19	19	20	19

MODELS H's : $\Delta Y_2 = f (\Delta M^3)$

	<u>Models</u>					
	<u>H.1</u>	<u>H.2</u>	<u>H.3</u>	<u>H.4</u>	<u>H.5</u>	<u>H.6</u>
ΔM^3						
t	.88 ⁺	.81 ⁺⁺	.63 ⁺⁺	.74 ⁺⁺	.55 ⁺	.56 ⁺
t-1		1.30 ⁺⁺	1.05 ⁺⁺	.85 ⁺⁺	.81 ⁺⁺	.47
t-2			-.59 ⁺	-.54 ⁺	-.36	-.51 ⁺
t-3				-.54 ⁺	-.56 ⁺	-.36
t-4					.60 ⁺	.47
t-5						.79 ⁺⁺
Sum	.88	2.11	1.09	.41	1.04	1.42
Cont.	-11.45	-44.28	-18.94	.17	-15.62	-27.07
\bar{R}^2	.13	.31	.34	.37	.40	.47
F	5.42	7.63	6.12	5.35	5.01	5.45
SEE	50	45	44	43	42	39

MODELS I's : $\Delta Y_2 = f (\Delta E , \Delta M^3)$

	<u>Models</u>				
	<u>I.1</u>	<u>I.2</u>	<u>I.3</u>	<u>I.4</u>	<u>I.5</u>
ΔE					
t	1.65 ⁺	1.52 ⁺	.88 ⁺	1.03 ⁺	.88 ⁺
t-1		.59 ⁺	.51 ⁺	.14	.06
t-2			-.81 ⁺	-.69 ⁺	-.48
t-3				-.30	-.30
t-4					.39
ΔM^3					
t	-.06	.07	.05	.07	.05
t-1		.48 ⁺	.52 ⁺	.46 ⁺	.52 ⁺
t-2			.05	.09	.11
t-3				-.26	-.26
t-4					.00
ΔE	1.65	2.11	.58	.18	.54
Sum					
ΔM^3	-.06	.55	.62	.36	.42
Cont.	10.22	-13.47	-5.88	5.29	1.18
R ²	.52	.67	.69	.68	.66
F	17.40	16.39	12.03	8.91	6.69
SEE	37	31	30	30	31

MODELS J's : $\Delta Y_2 = f (\Delta E , \Delta R , \Delta M^3)$

	<u>Models</u>				
	<u>J.1</u>	<u>J.2</u>	<u>J.3</u>	<u>J.4</u>	<u>J.5</u>
ΔE					
t	.94 ⁺⁺	.08	.46	.50	.09
t-1		-.23	-.34	-.43	-.16
t-2			.22	.33	.02
t-3				-.08	.25
t-4					-.32
ΔR					
t	.40 ⁺⁺	.51 ⁺⁺	-.19	-.31	-.24
t-1		-.28 ⁺⁺	-.23 ⁺⁺	.30	-.17
t-2			-.75 ⁺	-.91	.02
t-3				.60	.12
t-4					1.00 ⁺⁺
ΔM^3					
t	.28 ⁺	.16	.22	.16	.20
t-1		.32 ⁺⁺	.23	.19	.09
t-2			.15	.22	.15
t-3				-.03	.16
t-4					.22
ΔE	.94	-.15	.34	.32	-.12
sum ΔR	.40	.23	-1.17	-.32	.73
ΔM^3	.28	.48	.60	.60	.82
Cont.	2.05	3.59	3.99	2.09	-8.67
R^2	.83	.89	.89	.88	.91
F	49.53	40.23	26.66	19.42	20.40
SEE	22	18	18	19	16

MODELS K's : $\Delta Y_2 = f (\Delta(R-E), \Delta M^3)$

	<u>Models</u>				
	<u>K.1</u>	<u>K.2</u>	<u>K.3</u>	<u>K.4</u>	<u>K.5</u>
$\Delta(R-E)$					
t	.48 ⁺	.41 ⁺	-.12	-.12	-.21
t-1		-.46 ⁺	-.46 ⁺	-.40	-.53 ⁺
t-2			-.59	-.61	-.02
t-3				.08	-.11
t-4					.81 ⁺
ΔM^3					
t	1.08 ⁺	.18	.21	.18	.17
t-1		.27 ⁺	.13	.14	-.02
t-2			.04	.05	.06
t-3				.15	.30 ⁺
t-4					.38
Sum					
$\Delta(R-E)$	.48	-.05	-1.16	-1.05	-.06
ΔM^3	1.08	.45	.38	.52	.69
Cont.	-17.07	4.53	6.94	2.45	-8.32
R^2	.57	.86	.86	.85	.88
F	21.05	45.87	30.45	21.57	23.65
SEE	35	20	20	21	18

MODELS A's : $\Delta Y_1 = f(\Delta M^1)$

	<u>Models</u>					
	<u>A.1</u>	<u>A.2</u>	<u>A.3</u>	<u>A.4</u>	<u>A.5</u>	<u>A.6</u>
ΔM^1						
t	.62 ⁺⁺	.38 ⁺⁺	.37 ⁺⁺	.32 ⁺	-.02	-.03
t-1		-.33 ⁺⁺	.02	-.02	.38 ⁺	.38 ⁺
t-2			.47 ⁺⁺	.41 ⁺⁺	.11	.14
t-3				-.08		.14
D ₂					104.12 ⁺⁺	108.67 ⁺⁺
D ₃					20.31	13.86
D ₄					98.55 ⁺⁺	106.94 ⁺⁺
Sum	.62	.05	.86	.63	.47	.63
Cont.	17.73	19.50	17.09	17.82	-37.20	-39.28
R ²	.43	.48	.59	.58	.64	.63
F	26.58	16.49	17.60	12.88	11.11	9.31
SEE	32	31	27	27	25	26

Models B's : $\Delta Y_1 = f (\Delta \bar{E}^*)$

	<u>Models</u>					
	<u>B.1</u>	<u>B.2</u>	<u>B.3</u>	<u>B.4</u>	<u>B.5</u>	<u>B.6</u>
$\Delta \bar{E}^*$						
t	.35	.38	.31	.43	.83 [†]	.81 [†]
t-1		.33	.29	.57	.49 [†]	.43 [†]
t-2			-.19	.65		-.30
t-3				.58		.29
D ₂					74.21 [†]	65.48 [†]
D ₃					- 18.54 [†]	-29.87 [†]
D ₄					44.57 [†]	40.81 [†]
Sum	.35	.71	.41	2.22	1.32	1.23
Cont.	18.65	16.69	18.32	12.07	-12.98	-6.28
R ²	-.01	-.02	-.04	-.04	.74	.76
F	.81	.74	.53	.71	20.55	15.99
SEE	42	43	43	43	22	21

MODELS C's : $\Delta Y_1 = f (\Delta \bar{E}^* , \Delta \bar{R}^*)$

	<u>Models</u>					
	<u>C.1</u>	<u>C.2</u>	<u>C.3</u>	<u>C.4</u>	<u>C.5</u>	<u>C.6</u>
$\Delta \bar{E}^*$						
t	.25	.70 ⁺⁺	.74 ⁺⁺	.68 ⁺⁺	.87 ⁺⁺	.92 ⁺⁺
t-1		.56 ⁺⁺	.27	.21	.18	-.02
t-2			.22	.26		.48
t-3				.06		-.23
$\Delta \bar{R}^*$						
t	-.16 ⁺⁺	-.09 ⁺⁺	-.10 ⁺⁺	-.07 ⁺⁺	-.21 ⁺⁺	-.35 ⁺⁺
t-1		.11 ⁺⁺	.06 ⁺	.07 ⁺⁺	.01	.02
t-2			-.09 ⁺⁺	-.07 ⁺⁺		-.05
t-3				.05		.09 ⁺⁺
D ₂					-38.95	-130.09 ⁺
D ₃					-70.33 ⁺⁺	-83.95 ⁺⁺
D ₄					-23.23	-108.17 ⁺⁺
$\Delta \bar{E}^*$						
Sum	.25	1.26	1.23	1.20	1.05	1.15
$\Delta \bar{R}^*$						
	-.16	.02	-.13	-.02	-.20	-.29
Cont.	19.17	10.69	17.18	13.55	47.87	94.05
R ²	.51	.64	.74	.74	.77	.80
F	18.64	16.16	17.18	13.35	17.40	13.15
SEE	30	25	22	21	20	19

MODELS D's : $\Delta Y_1 = f (\Delta(\overset{*}{R}-\overset{*}{E}))$

	<u>Models</u>					
	<u>D.1</u>	<u>D.2</u>	<u>D.3</u>	<u>D.4</u>	<u>D.5</u>	<u>D.6</u>
$\Delta(\overset{*}{R}-\overset{*}{E})$						
t	-.17 ⁺	-.11 ⁺	-.13 ⁺	-.19	-.34 ⁺	-.33 ⁺
t-1		.08 ⁺	.01	-.05	-.12 ⁺	-.11
t-2			-.09 ⁺	-.16		.03
t-3				-.06		-.02
D ₂					-57.70 ⁺	-53.22
D ₃					-104.92 ⁺	-107.52 ⁺
D ₄					-39.90	-23.59
Sum	-.17	-.03	-.23	-.46	-.46	-.42
Cont.	19.72	20.08	19.81	19.76	70.52	66.06
R ²	.52	.59	.68	.71	.75	.73
F	38.27	25.06	24.70	17.99	21.07	14.17
SEE	29	27	24	24	21	22

MODELS E's : $\Delta Y_1 = f (\Delta \overset{*}{E}, \Delta M^1)$

	<u>Models</u>					
	<u>E.1</u>	<u>E.2</u>	<u>E.3</u>	<u>E.4</u>	<u>E.5</u>	<u>E.6</u>
$\Delta \overset{*}{E}$						
t	.18	.17	.61 ⁺	.79 ⁺	.83 ⁺	.82 ⁺
t-1		.08	.17	.21	.58 ⁺	.36
t-2			-.48 ⁺	-.40		-.60 ⁺
t-3				.19		.07
ΔM^1						
t	.61 ⁺	.35 ⁺	.30 ⁺	.11	-.19	-.01
t-1		-.35 ⁺	.26	.15	.34 ⁺	.54 ⁺
t-2			.77 ⁺	.54 ⁺		.08
t-3				-.33 ⁺		-.14
D ₂					125.48 ⁺	113.71 ⁺
D ₃					2.26	-.23
D ₄					95.99 ⁺	74.37 ⁺
$\Delta \overset{*}{E}$	<hr/>					
Sum	.18	.25	.30	.79	1.41	.65
ΔM^1	.61	-.00	1.33	.46	.15	.47
Cont.	16.57	18.12	13.16	13.32	-44.73	-32.90
R ²	.42	.45	.67	.68	.75	.77
F	13.21	7.91	12.54	10.01	15.79	11.06
SEE	32	31	24	24	21	21

MODELS F's : $\Delta Y_1 = f (\Delta \overset{*}{E}, \Delta \overset{*}{R}, \Delta M^1)$

	<u>Models</u>					
	<u>F.1</u>	<u>F.2</u>	<u>F.3</u>	<u>F.4</u>	<u>F.5</u>	<u>F.6</u>
$\Delta \overset{*}{E}_t$	.19	.73 ⁺	.83 ⁺	.88 ⁺	.90 ⁺	.95 ⁺
t-1		.13	.10	.06	.17	-.10
t-2			-.01	-.07		.24
t-3				-.32		-.37
$\Delta \overset{*}{R}_t$	-.12 ⁺	-.16 ⁺	-.16 ⁺	-.16 ⁺	-.23 ⁺	-.34 ⁺
t-1		.13 ⁺	.07 ⁺	.06 ⁺	.03	.05
t-2			-.07 ⁺	-.05 ⁺		-.06
t-3				.03		.06 ⁺
ΔM^1_t	.32 ⁺	.43 ⁺	.24 ⁺	-.00	-.07	.06
t-1		.66 ⁺	.65 ⁺	.67 ⁺	.53 ⁺	.50 ⁺
t-2			.20	.18		.09
t-3				-.17		-.10
D ₂					4.80	-91.04
D ₃					-45.86 ⁺	-51.44 ⁺
D ₄					23.37	-72.76
$\Delta \overset{*}{E}$	.19	.86	.92	.55	1.07	.72
Sum $\Delta \overset{*}{R}$	-.12	-.03	-.16	-.14	-.20	-.29
ΔM^1	.32	1.09	1.09	.68	.46	.55
Cont.	17.92	9.14	11.30	13.58	17.11	67.77
R ²	.58	.71	.79	.80	.81	.79
F	16.36	15.07	14.77	12.50	16.63	9.66
SEE	28	23	20	19	19	19

MODELS G's : $\Delta Y_1 = f (\Delta(\overset{*}{R}-\overset{*}{E}) , \Delta M^1)$

	<u>Models</u>					
	<u>G.1</u>	<u>G.2</u>	<u>G.3</u>	<u>G.4</u>	<u>G.5</u>	<u>G.6</u>
$\Delta(\overset{*}{R}-\overset{*}{E})$						
t	-.12	-.16	-.23	-.13	-.39	-.37
t-1		.08	-.04	.08	-.15	-.12
t-2			-.10	.05		.06
t-3				.14		
ΔM^1						
t	.32	.45	.06	.01	-.16	-.11
t-1		.56	.59	.65	.53	.57
t-2			.23	.21		.12
t-3				-.21		
D ₂					-6.09	-9.45
D ₃					-93.80	-94.71
D ₄					10.45	23.47
Sum						
$\Delta(\overset{*}{R}-\overset{*}{E})$	-.12	-.08	-.37	.14	-.54	-.43
ΔM^1	.32	1.01	.88	.66	.37	.58
Cont.	18.38	16.41	16.80	17.57	41.10	38.29
R ²	.59	.69	.71	.70	.78	.77
F	25.26	19.94	14.61	10.70	18.64	13.91
SEE	27	24	23	23	20	20

TEST TWO

ORDINARY LEAST-SQUARES REGRESSIONS

Seasonally adjusted data

SET (I) : pp. 99-105

SET (II) : pp.106-112

MODELS A's : $\Delta Y_1 = f(\Delta M^1)$

	<u>Models</u>				
	<u>A.1</u>	<u>A.2</u>	<u>A.3</u>	<u>A.4</u>	<u>A.5</u>
ΔM^1					
t	-.09	-.04	-.05	-.04	-.06
t-1		.43 ⁺	.47 ⁺	.48 ⁺	.46 ⁺
t-2			.25	.22	.20
t-3				-.21	-.17
t-4					.22
Sum	-.09	.39	.67	.45	.65
Cont.	20.86	18.93	17.99	18.71	18.36
\bar{R}^2	-.03	.04	.04	.04	.03
F	.13	1.63	1.48	1.30	1.18
SEE	22	21	21	21	21

MODELS B's : $\Delta Y_1 = f (\Delta \bar{E}^*)$

	<u>Models</u>				
	<u>B.1</u>	<u>B.2</u>	<u>B.3</u>	<u>B.4</u>	<u>B.5</u>
$\Delta \bar{E}^*$					
t	.76 ^{††}	.79 ^{††}	.79 ^{††}	.81 ^{††}	.83 ^{††}
t-1		.25	.21	.20	.28
t-2			-.20	-.21	-.25
t-3				-.06	-.17
t-4					-.32
Sum	.76	1.04	.78	.74	.38
Cont.	15.52	13.96	15.16	15.43	16.88
\bar{R}^2	.15	.13	.11	.08	.07
F	6.59	3.50	2.38	1.73	1.48
SEE	19.77	19.92	20.15	20.48	20.63

MODELS C'S : $\Delta Y_1 = f (\Delta \overset{*}{E}, \Delta \overset{*}{R})$

	<u>Models</u>				
	<u>C.1</u>	<u>C.2</u>	<u>C.3</u>	<u>C.4</u>	<u>C.5</u>
$\Delta \overset{*}{E}$					
t	1.10 ⁺	1.15 ⁺	1.18 ⁺	1.06 ⁺	1.02 ⁺
t-1		.05	.02	.03	.04
t-2			.19	.10	-.12
t-3				.07	-.23
t-4					-.79 ⁺
$\Delta \overset{*}{R}$					
t	-.38 ⁺	-.46 ⁺	-.50 ⁺	-.45 ⁺	-.38
t-1		-.14	-.04	-.02	.23
t-2			.11	.26	.61 ⁺
t-3				.17	.31
t-4					.16
$\Delta \overset{*}{E}$	1.10	1.20	1.39	1.26	-.08
Sum					
$\Delta \overset{*}{R}$	-.38	-.60	-.43	-.04	.93
Cont.	15.78	16.37	14.50	13.39	14.36
\bar{R}^2	.24	.20	.16	.11	.12
F	6.13	3.01	2.01	1.49	1.46
SEE	19	19	20	20	20

MODELS D's : $\Delta Y_1 = f (\Delta(\overset{*}{R}-\overset{*}{E}))$

	<u>Models</u>				
	<u>D.1</u>	<u>D.2</u>	<u>D.3</u>	<u>D.4</u>	<u>D.5</u>
$\Delta(\overset{*}{R}-\overset{*}{E})$					
t	-.43 ⁺	-.45 ⁺	-.40 ⁺	-.38 ⁺	-.35 ⁺
t-1		-.07	.02	.03	.09
t-2			.24	.27	.32
t-3				.05	.12
t-4					.11
Sum	-.43	-.52	-.14	-.03	.29
Cont.	20.04	19.88	20.18	20.33	20.67
\bar{R}^2	.12	.10	.11	.08	.06
F	5.53	2.75	2.36	1.73	1.41
SEE	20.04	20.32	20.17	20.49	20.74

MODELS E's : $\Delta Y_1 = f(\Delta \bar{E}^*, \Delta M^1)$

	<u>Models</u>				
	<u>E.1</u>	<u>E.2</u>	<u>E.3</u>	<u>E.4</u>	<u>E.5</u>
$\Delta \bar{E}^*$					
t	.75 ⁺	.69 ⁺	.68 ⁺	.91 ⁺	.90 ⁺
t-1		.32	.15	.13	.16
t-2			-.32	-.32	-.33
t-3				-.46	-.57
t-4					-.19
ΔM^1					
t	-.03	-.05	.03	.01	-.05
t-1		.34 ⁺	.42 ⁺	.46 ⁺	.45 ⁺
t-2			.20	.22	.26
t-3				-.36 ⁺	-.30
t-4					.19
Sum					
$\Delta \bar{E}^*$	.75	1.01	.51	.26	-.03
ΔM^1	-.03	.29	.65	.33	.55
Cont.	15.67	13.03	14.44	16.13	16.97
\bar{R}^2	.12	.14	.12	.16	.11
F	3.20	2.29	1.74	1.76	1.42
SEE	20	20	20	20	20

MODELS F's : $\Delta Y_1 = f (\Delta \overset{*}{E}, \Delta \overset{*}{R}, \Delta M^1)$

	<u>Models</u>				
	<u>F.1</u>	<u>F.2</u>	<u>F.3</u>	<u>F.4</u>	<u>F.5</u>
$\Delta \overset{*}{E}_t$	1.10 ⁺⁺	1.12 ⁺⁺	1.12 ⁺⁺	.99 ⁺⁺	.92 ⁺⁺
t-1		.08	.06	.07	.09
t-2			.13	-.10	-.31
t-3				-.34	-.54
t-4					-.70
$\Delta \overset{*}{R}_t$	-.39 ⁺⁺	-.59 ⁺⁺	-.60 ⁺⁺	-.34	-.23
t-1		-.19	-.15	.06	.18
t-2			.05	.29	.60
t-3				.27	.34
t-4					.16
ΔM^1_t	-.06	-.01	-.03	-.10	-.16
t-1		.50 ⁺⁺	.48 ⁺⁺	.51 ⁺⁺	.35
t-2			.04	.03	.20
t-3				-.18	-.21
t-4					.18
$\Delta \overset{*}{E}$	1.10	1.20	1.31	.62	-.54
Sum $\Delta \overset{*}{R}$	-.39	-.78	-.70	.28	1.05
ΔM^1	-.06	.49	.49	.26	.36
Cont.	16.03	15.50	14.47	13.77	14.87
R^2	.21	.27	.18	.13	.07
F	3.98	3.02	1.83	1.42	1.16
SEE	19	18	19	20	21

MODELS G's : $\Delta Y_1 = f (\Delta(\overset{*}{R}-\overset{*}{E}) , \Delta M^1)$

		<u>Models</u>				
		<u>G.1</u>	<u>G.2</u>	<u>G.3</u>	<u>G.4</u>	<u>G.5</u>
$\Delta(\overset{*}{R}-\overset{*}{E})$						
t		-.43 ⁺⁺	-.49 ⁺⁺	-.40 ⁺⁺	-.33 ⁺	-.22
t-1			-.07	.02	.07	.04
t-2				.25	.33 ⁺	.46 ⁺
t-3					.16	.20
t-4						.10
ΔM^1						
t		-.10	-.06	.00	-.03	-.05
t-1			.49 ⁺⁺	.50 ⁺⁺	.54 ⁺⁺	.49 ⁺⁺
t-2				.10	.12	.18
t-3					-.04	-.07
t-4						.33
Sum	$\Delta(\overset{*}{R}-\overset{*}{E})$	-.43	-.56	-.13	.23	.58
	ΔM^1	-.10	.43	.60	.59	.88
Cont.		20.43	18.07	17.82	18.36	18.13
\bar{R}^2		.10	.17	.16	.11	.09
F		2.79	2.69	2.04	1.52	1.32
SEE		20	20	20	20	20

MODELS A's : $\Delta Y_2 = f (\Delta M^1)$

	<u>Models</u>				
	<u>A.1</u>	<u>A.2</u>	<u>A.3</u>	<u>A.4</u>	<u>A.5</u>
ΔM^1					
t	-.09	.02	.02	.02	-.00
t-1		1.00 ⁺	.95 ⁺	.95 ⁺	.94 ⁺
t-2			-.20	-.19	-.20
t-3				.05	.09
t-4					.21
Sum	-.09	1.02	.77	.83	1.04
Cont.	20.31	15.95	16.67	16.50	16.16
\bar{R}^2	-.03	.18	.17	.14	.12
F	.06	4.65	3.18	2.31	1.88
SEE	31	28	28	28	29

MODELS B's : $\Delta Y_2 = f (\Delta \bar{E})$

	<u>Models</u>				
	<u>B.1</u>	<u>B.2</u>	<u>B.3</u>	<u>B.4</u>	<u>B.5</u>
$\Delta \bar{E}$					
t	.44	.42	.41	.24	.27
t-1		-.16	-.08	-.02	.06
t-2			.34	.51	.47
t-3				.64	.53
t-4					-.33
Sum	.44	.26	.67	1.37	.99
Cont.	17.09	18.06	15.99	13.01	14.50
\bar{R}^2	-.00	-.03	-.05	-.05	-.08
F	.93	.49	.45	.60	.52
SEE	30	31	31	31	32

MODELS C's : $\Delta Y_2 = f (\Delta \overset{*}{E}, \Delta \overset{*}{R})$

	<u>Models</u>				
	<u>C.1</u>	<u>C.2</u>	<u>C.3</u>	<u>C.4</u>	<u>C.5</u>
$\Delta \overset{*}{E}$					
t	.17	.01	.05	.14	-.13
t-1		-.10	-.08	-.02	-.44
t-2			.18	.37	.02
t-3				.29	-.45
t-4					-.81
$\Delta \overset{*}{R}$					
t	.30	.58 ⁺	.52	.39	.63
t-1		.47 ⁺	.44	.26	.88 ⁺
t-2			-.06	-.23	.43
t-3				-.22	.60
t-4					.88 ⁺
$\Delta \overset{*}{E}$	.17	-.09	.15	.78	-1.82
Sum $\Delta \overset{*}{R}$	.30	1.05	.90	.20	3.42
Cont.	16.90	14.44	14.01	14.37	11.25
\bar{R}^2	.00	-.01	-.08	-.15	.00
F	1.03	.94	.60	.47	1.01
SEE	30	31	32	33	30

MODELS D's : $\Delta Y_2 = f (\Delta(R-E)^*)$

	<u>Models</u>				
	<u>D.1</u>	<u>D.2</u>	<u>D.3</u>	<u>D.4</u>	<u>D.5</u>
$\Delta(R-E)^*$					
t	.30	.33	.32	.27	.44 ⁺
t-1		.11	.09	.04	.37
t-2			-.06	-.13	.18
t-3				-.14	.31
t-4					.71 ⁺
Sum	.30	.44	.35	.04	1.99
Cont.	20.31	20.56	20.49	20.06	22.16
R ²	.01	-.02	-.06	-.08	.07
F	1.18	.64	.43	.36	1.48
SEE	30	31	32	32	30

MODELS E's : $\Delta Y_2 = f (\Delta \bar{E}^*, \Delta M^1)$

	<u>Models</u>				
	<u>E.1</u>	<u>E.2</u>	<u>E.3</u>	<u>E.4</u>	<u>E.5</u>
$\Delta \bar{E}^*$					
t	.43	.17	.19	.08	.07
t-1		-.03	.06	.12	.11
t-2			.04	.16	.17
t-3				.46	.42
t-4					.00
ΔM^1					
t	-.05	.03	.02	.04	.02
t-1		.95 ⁺	.92 ⁺	.84 ⁺	.84 ⁺
t-2			-.21	-.29	-.29
t-3				.04	.07
t-4					.18
$\Delta \bar{E}^*$	.43	.14	.29	.72	.77
Sum					
ΔM^1	-.05	.98	.73	.63	.82
Cont.	17.34	15.04	15.09	13.16	13.09
\bar{R}^2	-.03	.13	.08	.02	-.05
F	.46	2.23	1.47	1.10	.84
SEE	31	28	29	30	31

MODELS F's : $\Delta Y_2 = f (\Delta \bar{E}^*, \Delta \bar{R}^*, \Delta M^1)$

	<u>Models</u>				
	<u>F.1</u>	<u>F.2</u>	<u>F.3</u>	<u>F.4</u>	<u>F.5</u>
$\Delta \bar{E}^*$					
t	.17	-.06	.07	.12	-.16
t-1		-.05	.08	.03	-.36
t-2			.22	.27	-.04
t-3				-.15	-.75
t-4					-.32
$\Delta \bar{R}^*$					
t	.30	.36	.23	.16	.63
t-1		.39	.30	.33	.85
t-2			-.20	-.28	.25
t-3				-.03	.65 ⁺
t-4					.76
ΔM^1					
t	-.04	-.01	-.07	-.11	-.14
t-1		.87 ⁺	.87 ⁺	.91 ⁺	.66 ⁺
t-2			-.27	-.26	-.08
t-3				.15	-.19
t-4					-.07
$\Delta \bar{E}^*$	.17	-.11	.37	.27	- 1.63
Sum $\Delta \bar{R}^*$	.30	.75	.33	.18	3.14
ΔM^1	-.04	.86	.53	.69	.18
Cont.	17.06	12.92	13.84	14.49	10.99
\bar{R}^2	-.03	.12	.04	-.10	-.11
F	.67	1.72	1.14	.76	.78
SEE	31	29	30	32	32

MODELS G's : $\Delta Y_2 = f (\Delta(\overset{*}{R}-\overset{*}{E}) , \Delta M^1)$

	<u>Models</u>					
	<u>G.1</u>	<u>G.2</u>	<u>G.3</u>	<u>G.4</u>	<u>G.5</u>	
$\Delta(\overset{*}{R}-\overset{*}{E})$						
t	.30	.27	.21	.22	.57 ⁺	
t-1		.11	.08	.09	.29	
t-2			-.08	-.07	.34	
t-3				.02	.40	
t-4					.65 ⁺	
ΔM^1						
t	-.08	.03	.01	.01	-.02	
t-1		.95 ⁺	.94 ⁺	.94 ⁺	.76 ⁺	
t-2			-.12	-.12	.17	
t-3				-.01	-.09	
t-4					.41	
Sum	$\Delta(\overset{*}{R}-\overset{*}{E})$.30	.38	.21	.26	2.24
	ΔM^1	-.08	.98	.83	.82	1.22
Cont.		20.61	16.52	16.89	16.98	18.30
\bar{R}^2		-.03	.15	.10	.02	.10
F		.60	2.49	1.59	1.10	1.39
SEE		31	28	29	30	29

TEST THREE

ALMON REGRESSIONS

SET (I) : pp.113-117

SET (II) : pp.118-122

SET (III) : pp.123-127

SET (IV) : pp.128-132

ALMON REGRESSIONS -- SET (I) :

Seasonally unadjusted Y2, E, R, (R-E), & M¹;
 ΔY_2 as dependent variable.

	<u>Model 1.1</u>	<u>Model 1.2</u>	<u>Model 1.3</u>	<u>Model 1.4</u>
	ΔM^1	ΔE	ΔR	$\Delta(R-E)$
t	1.669 ⁺⁺ (4.263)	.936 ⁺⁺ (2.095)	-.106 (.490)	-.034 (.075)
t-1	.999 ⁺⁺ (2.540)	.948 ⁺⁺ (1.876)	-.350 ⁺ (1.598)	-.059 (.689)
t-2	.315 (.757)	-.081 (.168)	-.580 ⁺⁺ (2.520)	-.046 (.838)
t-3	-.271 (.684)	.393 (.911)	.117 (.513)	.012 (.023)
Sum	2.712	2.196	-.919	-.127
R ²	.680	.544	.825	.617
\bar{R}^2	.625	.496	.795	.551
SEE	60	71	44	65
D-W	2.603	2.323	2.908	2.767

ALMON REGRESSIONS -- SET (I) :

ΔY_2 as dependent variable

	<u>Model 1.5</u>		<u>Model 1.6</u>	
	ΔE	ΔM^1	ΔR	ΔM^1
t	.993 ⁺⁺ (2.146)	.673 ⁺ (1.455)	-.199 (.467)	-.295 (.695)
t-1	1.310 ⁺⁺ (2.732)	.720 ⁺ (1.501)	-.376 (1.060)	.637 ⁺⁺ (1.796)
t-2	.835 ⁺⁺ (1.840)	.720 ⁺ (1.587)	-.780 ⁺⁺ (2.060)	1.255 ⁺⁺ (3.314)
t-3	.974 ⁺⁺ (2.102)	.853 ⁺⁺ (1.841)	-.031 (.067)	1.962 ⁺⁺ (4.292)
Sum	4.111	2.966	-1.286	3.559
R ²	.760		.865	
\bar{R}^2	.660		.809	
SEE	57		43	
D-W	2.380		2.638	

ALMON REGRESSIONS -- SET (I) :

ΔY_2 as dependent variable

	<u>Model 1.7</u>		<u>Model 1.8</u>	
	ΔE	ΔR	$\Delta(R-E)$	ΔM^1
t	.341 (.965)	-.185 (.522)	-.031 (.044)	1.169 ⁺ (1.653)
t-1	.387 (1.008)	-.386 (1.006)	-.047 (.065)	.835 (1.146)
t-2	.123 (.330)	-.584 ⁺ (1.566)	-.043 (.052)	.477 (.574)
t-3	.103 (.324)	-.108 (.343)	-.016 (.019)	.158 (.638)
Sum	.954	-1.264	-.137	2.639
R^2	.841		.821	
\bar{R}^2	.775		.747	
SEE	46		61	
D-W	2.073		2.847	

Beta Coefficients

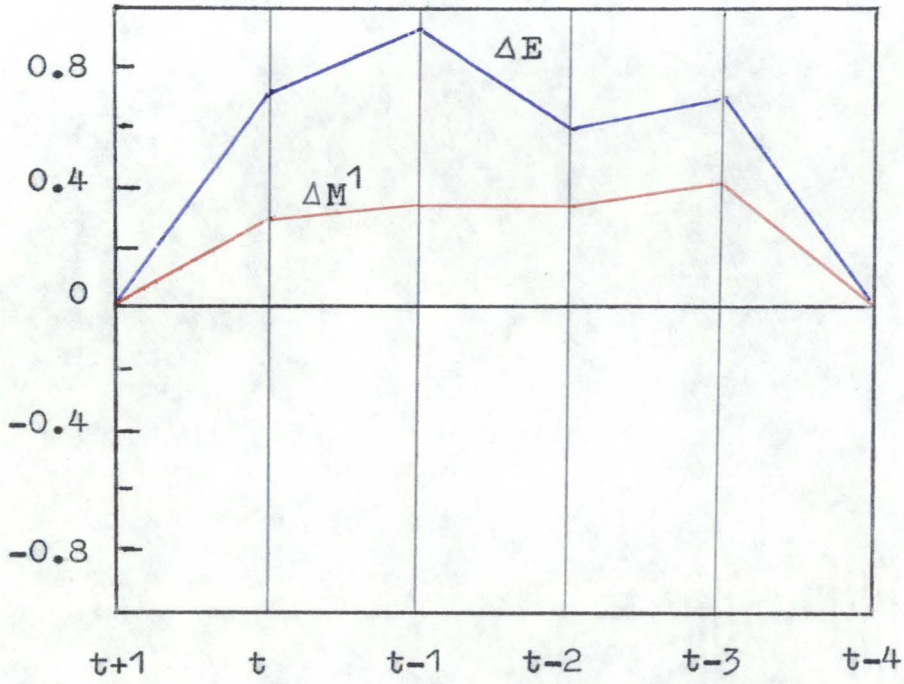
	<u>Model 1.1</u>	<u>Model 1.2</u>	<u>Model 1.3</u>	<u>Model 1.4</u>
	ΔM^1	ΔE	ΔR	$\Delta(R-E)$
t	.768	.665	-.223	-.052
t-1	.460	.673	-.735	-.091
t-2	.145	-.058	-1.218	-.071
t-3	-.125	.279	.246	.019
Sum	<u>1.248</u>	<u>1.559</u>	<u>-1.195</u>	<u>-.195</u>

	<u>Model 1.5</u>		<u>Model 1.6</u>	
	ΔE	ΔM	ΔR	ΔM
t	.705	.310	-.417	-.136
t-1	.930	.331	-.790	.293
t-2	.593	.331	-1.639	.577
t-3	.691	.392	-.064	.902
Sum	<u>2.919</u>	<u>1.364</u>	<u>-2.909</u>	<u>1.636</u>

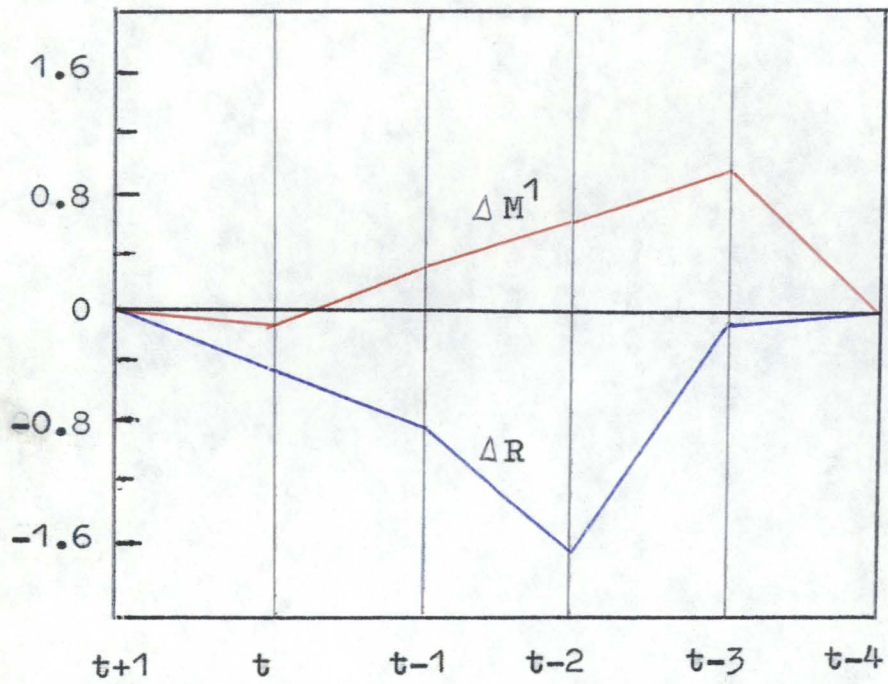
	<u>Model 1.7</u>		<u>Model 1.8</u>	
	ΔE	ΔR	$\Delta(R-E)$	ΔM^1
t	.242	-.388	-.048	.538
t-1	.275	-.811	-.073	.384
t-2	.087	-1.227	-.066	.219
t-3	.073	-.227	-.025	.072
Sum	<u>.677</u>	<u>-2.653</u>	<u>-.212</u>	<u>1.213</u>

Measures of Lag Response

Model 1.5



Model 1.6



ALMON REGRESSIONS -- SET (II)

Seasonally adjusted Y_1 , \bar{E} , \bar{R} , $(\bar{R}-\bar{E})$, & M^1 ;
 ΔY_1 as dependent variable.

	<u>Model 2.1</u>	<u>Model 2.2</u>	<u>Model 2.3</u>	<u>Model 2.4</u>
	ΔM^1	$\Delta \bar{E}$	$\Delta \bar{R}$	$\Delta(\bar{R}-\bar{E})$
t	-.030 (.123)	.810 ⁺ (2.535)	-.118 (.637)	-.489 ⁺ (2.273)
t-1	.489 ⁺ (2.110)	.228 (.702)	.257 (1.197)	-.230 (.967)
t-2	.199 (.851)	-.164 (.490)	.544 ⁺ (2.414)	.203 (.739)
t-3	-.225 (.944)	-.051 (.133)	.316 ⁺ (1.487)	.024 (.106)
Sum	.433	.823	1.000	-.491
R^2	.164	.201	.170	.257
\bar{R}^2	.020	.062	.026	.129
SEE	21	21	21	20
D-W	2.058	2.335	2.382	2.329

ALMON REGRESSIONS -- SET (II)

ΔY_1 as dependent variable

	<u>Model 2.5</u>		<u>Model 2.6</u>	
	ΔE^*	ΔM^1	ΔR^*	ΔM^1
t	.914 ⁺ (2.185)	.039 (.093)	-.144 (.415)	-.165 (.476)
t-1	.194 (.462)	.471 (1.122)	.263 (.891)	.446 ⁺ (1.510)
t-2	-.243 (.577)	.168 (.399)	.589 ⁺ (1.895)	.043 (.138)
t-3	-.435 (.861)	-.352 (.697)	.338 (1.088)	-.312 (.753)
Sum	.430	.326	1.046	.012
R^2	.379		.350	
\bar{R}^2	.121		.080	
SEE	20		20	
D-W	2.496		2.205	

ALMON REGRESSIONS -- SET (II) :

ΔY_1 as dependent variable

	<u>Model 2.7</u>		<u>Model 2.8</u>	
	$\Delta \bar{E}$	$\Delta \bar{R}$	$\Delta(\bar{R}-\bar{E})$	ΔM^1
t	1.250 ⁺⁺ (3.971)	-.624 ⁺⁺ (1.983)	-.558 ⁺ (1.629)	.047 (.137)
t-1	.085 (.244)	-.056 (.161)	-.253 (.765)	.560 ⁺ (1.694)
t-2	.264 (.754)	.202 (.575)	.254 (.739)	-.086 (.250)
t-3	.123 (.276)	-.037 (.083)	.113 (.302)	-.250 (.667)
Sum	1.722	-.515	-.444	.271
R^2	.452		.454	
\bar{R}^2	.224		.227	
SEE	19		19	
D-W	2.635		2.283	

Beta Coefficients

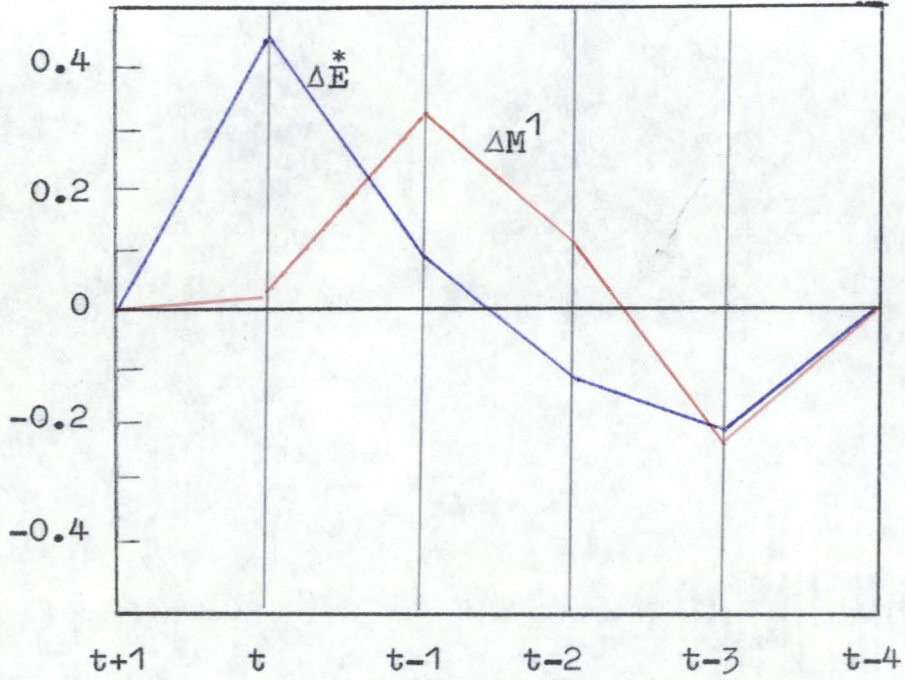
	<u>Model 2.1</u>	<u>Model 2.2</u>	<u>Model 2.3</u>	<u>Model 2.4</u>
	ΔM^1	$\Delta \bar{E}$	$\Delta \bar{R}$	$\Delta(\bar{R}-\bar{E})$
t	-.021	.405	-.111	-.440
t-1	.349	.113	.242	-.207
t-2	.142	-.082	.512	.183
t-3	-.161	-.025	.297	.022
Sum	.309	.411	.940	-.442

	<u>Model 2.5</u>		<u>Model 2.6</u>	
	$\Delta \bar{E}$	ΔM^1	$\Delta \bar{R}$	ΔM^1
t	.457	.028	-.135	-.118
t-1	.092	.336	.247	.318
t-2	-.122	.120	.553	.031
t-3	-.217	-.251	.318	-.223
Sum	.215	.233	.983	.009

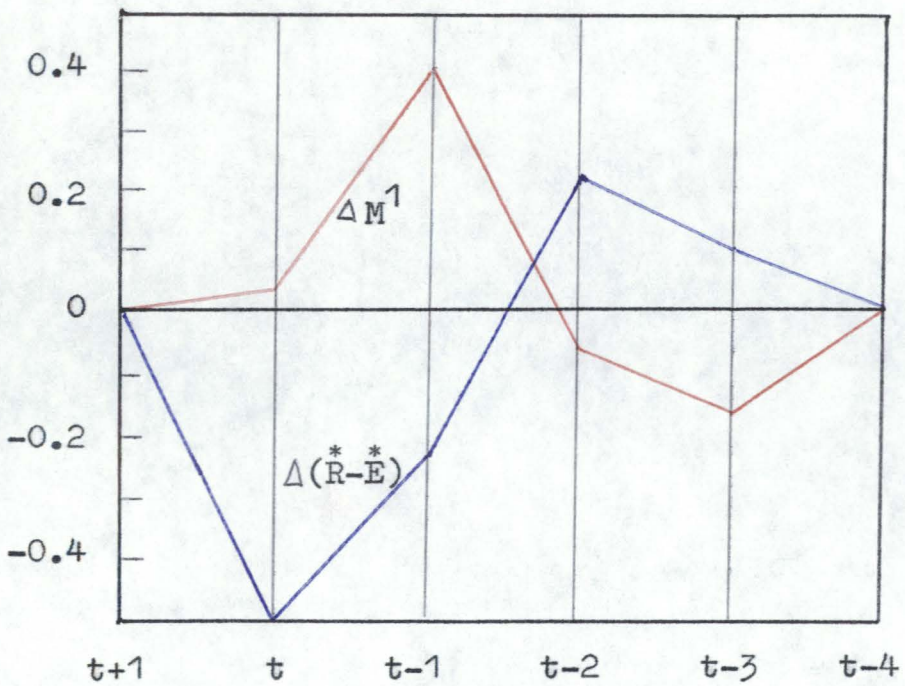
	<u>Model 2.7</u>		<u>Model 2.8</u>	
	$\Delta \bar{E}$	$\Delta \bar{R}$	$\Delta(\bar{R}-\bar{E})$	ΔM^1
t	.625	-.587	-.502	.034
t-1	.043	-.053	-.228	.400
t-2	.132	.190	.229	-.061
t-3	.061	-.035	.102	-.179
Sum	.861	-.484	-.400	.195

Measures of Lag Response

Model 2.5



Model 2.8



ALMON REGRESSIONS -- SET (III)

Seasonally adjusted Y_2 , \bar{E} , \bar{R} , $(\bar{R}-\bar{E})$, & M^1 ;
 ΔY_2 as dependent variable.

	<u>Model 3.1</u>	<u>Model 3.2</u>	<u>Model 3.3</u>	<u>Model 3.4</u>
	ΔM^1	$\Delta \bar{E}$	$\Delta \bar{R}$	$\Delta (\bar{R}-\bar{E})$
t	.039 (.118)	.218 (.449)	.404 ⁺ (1.496)	.111 (.334)
t-1	.877 (.270)	-.052 (.106)	.417 ⁺ (1.327)	.213 (.579)
t-2	-.207 (.426)	.474 (.926)	-.072 (.220)	-.059 (.138)
t-3	-.004 (.013)	.623 (1.066)	-.163 (.526)	-.269 (.768)
Sum	.705	1.263	.586	-.004
R^2	.216	.072	.109	.108
\bar{R}^2	.069	-.088	-.044	-.045
SEE	29	31	31	31
D-W	2.769	2.802	2.715	2.654

ALMON REGRESSIONS -- SET (III) :

ΔY_2 as dependent variable

	<u>Model 3.5</u>		<u>Model 3.6</u>	
	$\Delta \hat{E}$	ΔM^1	$\Delta \hat{R}$	ΔM^1
t	.104 (.159)	.149 (.229)	.120 (.235)	-.076 (.150)
t-1	-.047 (.072)	.784 (1.201)	.240 (.554)	.922 [†] (2.130)
t-2	.127 (.193)	-.309 (.472)	-.243 (.534)	-.235 (.516)
t-3	.489 (.622)	-.023 (.029)	.023 (.038)	.213 (.351)
Sum	.673	.601	.140	.824
R^2	.246	.246	.300	
\bar{R}^2		-.067	.010	
SEE	31		30	
D-W		2.802		2.796

ALMON REGRESSIONS -- SET (III) :

ΔY_2 as dependent variable

	<u>Model 3.7</u>		<u>Model 3.8</u>	
	$\Delta \bar{E}^*$	$\Delta \bar{R}^*$	$\Delta(\bar{R}^* - \bar{E}^*)$	ΔM^1
t	.452 (.820)	.035 (.063)	-.075 (.140)	-.218 (.405)
t-1	-.118 (.194)	.241 (.395)	.199 (.384)	.899 ⁺ (1.734)
t-2	.730 (1.188)	-.327 (.532)	-.005 (.010)	-.405 (.751)
t-3	.337 (.432)	-.420 (.538)	.084 (.142)	.086 (.146)
Sum	1.401	-.471	.203	.362
R^2	.157		.327	
\bar{R}^2	-.193		.047	
SEE	33		30	
D-W	2.696		2.446	

Beta Coefficients

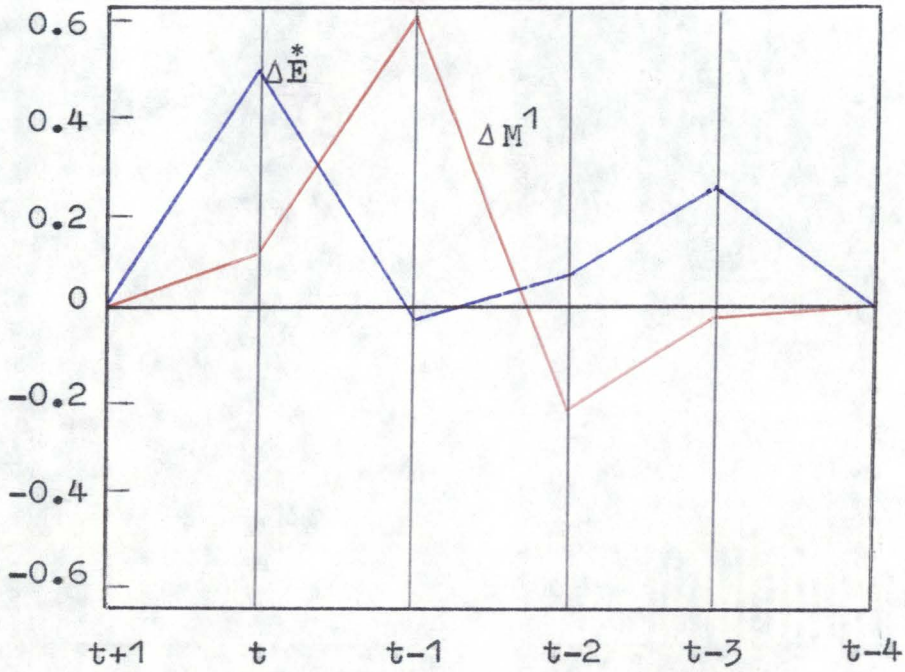
	<u>Model 3.1</u>	<u>Model 3.2</u>	<u>Model 3.3</u>	<u>Model 3.4</u>
	ΔM^1	$\Delta \bar{E}$	$\Delta \bar{R}$	$\Delta(\bar{R}-\bar{E})$
t	.028	.109	.380	.070
t-1	.626	-.026	.392	.134
t-2	-.148	.237	-.068	-.036
t-3	-.003	.311	-.153	-.170
Sum	.503	.631	.551	-.002

	<u>Model 3.5</u>		<u>Model 3.6</u>	
	$\Delta \bar{E}$	ΔM^1	$\Delta \bar{R}$	ΔM^1
t	.502	.106	.113	-.054
t-1	-.023	.600	.226	.658
t-2	.063	-.221	-.228	-.168
t-3	.245	-.016	.022	.152
Sum	.337	.429	.132	.588

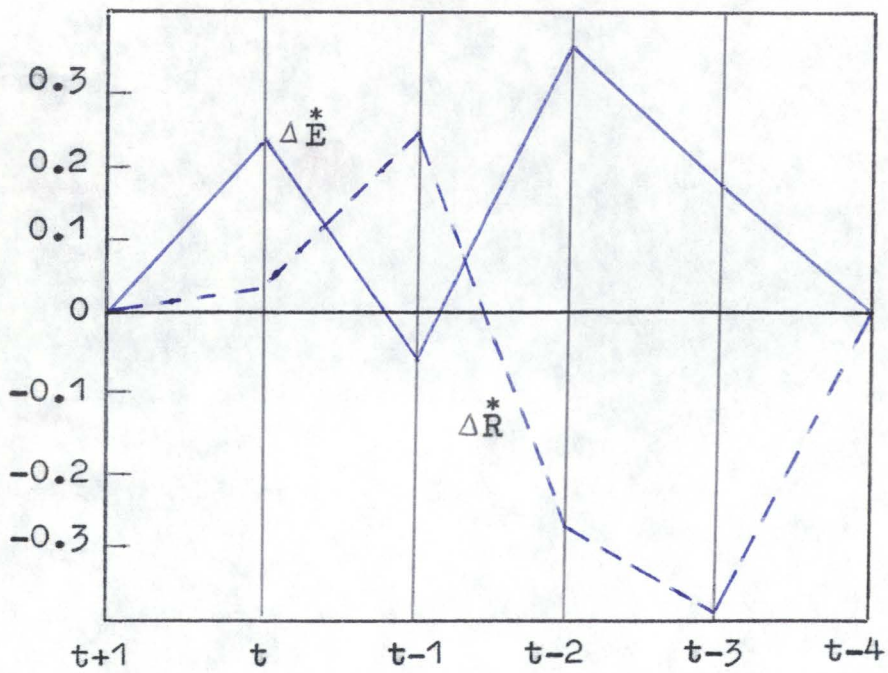
	<u>Model 3.7</u>		<u>Model 3.8</u>	
	$\Delta \bar{E}$	$\Delta \bar{R}$	$\Delta(\bar{R}-\bar{E})$	ΔM^1
t	.226	.033	-.047	-.156
t-1	-.059	.227	.126	.642
t-2	.365	-.307	-.003	-.289
t-3	.168	-.395	-.053	.061
Sum	.701	-.442	.128	.258

Measures of Lag Response

Model 3.5



Model 3.7



ALMON REGRESSIONS -- SET (IV)

Seasonally adjusted $(Y1-\bar{E})$, \bar{E} , \bar{R} , $(\bar{R}-\bar{E})$, & M^1 ;
 $\Delta(Y1-\bar{E})$ as dependent variable.

	<u>Model 4.1</u>	<u>Model 4.2</u>	<u>Model 4.3</u>	<u>Model 4.4</u>
	ΔM^1	$\Delta \bar{E}$	$\Delta \bar{R}$	$\Delta(\bar{R}-\bar{E})$
t	.035 (.157)	-.026 (.079)	-.426 ⁺ (2.598)	-.460 ⁺ (2.211)
t-1	.410 ⁺ (1.889)	.300 (.901)	.163 (.856)	-.185 (.804)
t-2	.145 (.678)	-.247 (.719)	.325 ⁺ (1.625)	.167 (.626)
t-3	-.472 ⁺ (2.163)	-.241 (.609)	.004 (.021)	-.070 (.320)
Sum	.118	-.214	.066	-.548
R^2	.223	.062	.275	.226
\bar{R}^2	.089	-.100	.150	.093
SEE	19	21	19	19
D-W	2.524	2.522	2.385	2.354

ALMON REGRESSIONS -- SET (IV) :

$\Delta(Y1-\bar{E})$ as dependent variable

	<u>Model 4.5</u>		<u>Model 4.6</u>	
	$\Delta \bar{E}$	ΔM^1	$\Delta \bar{R}$	ΔM^1
t	.111 (.273)	.022 (.054)	-.423 ⁺ (1.453)	.042 (.144)
t-1	.276 (.677)	.544 (1.334)	.194 (.782)	.398 ⁺ (1.605)
t-2	-.316 (.773)	.196 (.479)	.402 ⁺ (1.540)	.012 (.046)
t-3	-.702 ⁺ (1.430)	-.510 (1.039)	-.057 (.164)	-.437 (1.256)
Sum	-.631	.252	.116	.015
R^2		.349		.491
\bar{R}^2		.080		.279
SEE		19		17
D-W		2.717		2.391

ALMON REGRESSIONS -- SET (IV) :

$\Delta(Y1-\bar{E}^*)$ as dependent variable

	<u>Model 4.7</u>		<u>Model 4.8</u>	
	$\Delta \bar{E}^*$	$\Delta \bar{R}^*$	$\Delta(\bar{R}^*-\bar{E}^*)$	ΔM^1
t	.479 ⁺ (1.448)	-.659 ⁺ (1.992)	-.479 ⁺ (1.488)	.270 (.839)
t-1	.041 (.112)	.025 (.068)	-.188 (.605)	.391 (1.258)
t-2	.285 (.773)	.133 (.361)	.273 (.845)	-.085 (.263)
t-3	.061 (.130)	-.185 (.395)	-.109 (.309)	-.534 ⁺ (1.516)
Sum	.866	-.686	-.503	.042
R^2	.327		.465	
\bar{R}^2	.061		.242	
SEE	20		18	
D-W	2.464		2.629	

Beta Coefficients :

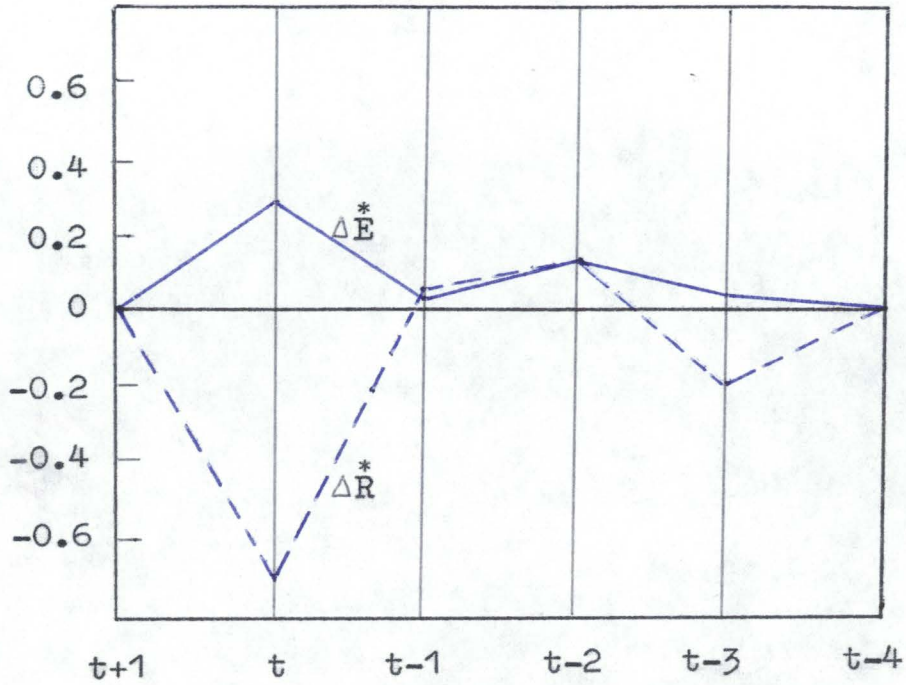
	<u>Model 4.1</u>	<u>Model 4.2</u>	<u>Model 4.3</u>	<u>Model 4.4</u>
	ΔM^1	$\Delta \bar{E}$	$\Delta \bar{R}$	$\Delta(\bar{R}-\bar{E})$
t	.027	-.013	-.452	-.438
t-1	.315	.149	.173	-.176
t-2	.112	-.123	.345	.159
t-3	-.363	-.120	.004	-.067
Sum	.091	-.106	.070	-.522

	<u>Model 4.5</u>		<u>Model 4.6</u>	
	$\Delta \bar{E}$	ΔM^1	$\Delta \bar{R}$	ΔM^1
t	.055	.017	-.449	.032
t-1	.137	.418	.206	.306
t-2	-.157	.151	.427	.009
t-3	-.348	-.392	-.061	-.336
Sum	-.313	.194	.123	.012

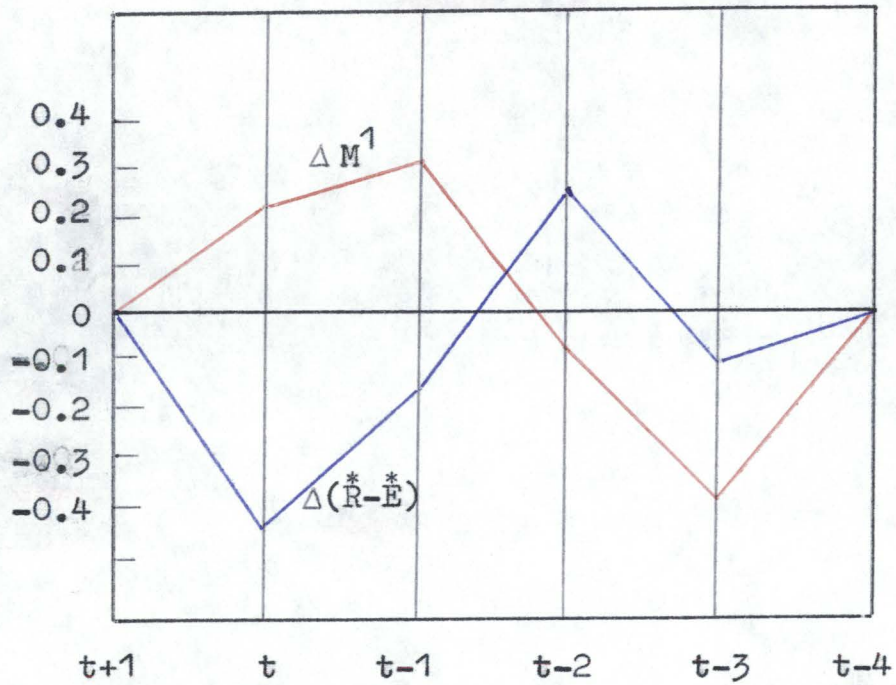
	<u>Model 4.7</u>		<u>Model 4.8</u>	
	$\Delta \bar{E}$	$\Delta \bar{R}$	$\Delta(\bar{R}-\bar{E})$	ΔM^1
t	.238	-.699	-.456	.208
t-1	.020	.027	-.179	.301
t-2	.141	.141	.260	-.065
t-3	.030	-.196	-.104	-.411
Sum	.430	-.728	-.479	.032

Measures of Lag Response

Model 4.7



Model 4.8



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