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Money and Money-Income: An Essay on the "Transmission Mechanism"
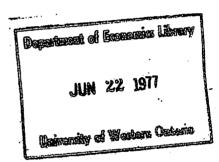
David Laidler

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by

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I. INTRODUCTION

Until recently, questions about the linkage between monetary policy and variations in the level of money income seemed to be mainly empirical in nature. Debates were about quantitative rather than qualitative matters, and dealt with questions framed in terms of a common theoretical structure. That structure was inevitably one form or another of the IS-LM model, which proved extremely flexible in its ability to accommodate opposing points of view as to how the macro-economy operated. Disagreements thus seemed susceptible to resolution in terms of empirical tests designed to throw light upon one or another of the parameters of such a model. It provided an agenda for empirical research in macroeconomics, whose results were expected to lead to, among other things, a consensus on the role of money in the macroeconomy and hence on the appropriate design of monetary policy.

Quantitative knowledge has grown rapidly in recent years. However, instead of now being in the position of having largely filled the gaps in our knowledge about quantitative aspects of an economic model whose qualitative nature is uncontroversial, we find ourselves lacking a broadly accepted theoretical framework in terms of which much of our quantitative knowledge can be organized and interpreted. Research on price-output interaction, the effects of fiscal policy on the behavior of the money supply, and on questions prompted by the openness of cer-tain economies, particularly as that research has focussed on the role of inflation expectations, has generated grave doubts about the extent of the IS-LM model's relevance. In this paper I shall give an account of these developments in macroeconomics. I shall pay particular

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attention to what they imply for questions about the nature of the causative links between money and money income, to which I shall refer as "the transmission mechanism". I shall begin, though, with an account of the evidence about the transmission mechanism generated by studies conceived of, either implicitly or explicitly, in IS-LM terms. Since there already exist at least three recent surveys of various subsets of this evidence, the account given here can be reasonably brief.[1]

II. THE TRANSMISSION MECHANISM IN AN IS-LM CONTEXT

The basic IS-LM model is well known. Where E is real private expenditure, A is autonomous real private expenditure, Y is real income, G is real government expenditure, M the quantity of nominal money and P the general price level, its static form can be written, in linear terms for simplicity

$$Y-G = E = A + k(1 - t)Y - ar \tag{1}$$

$$\frac{M}{P} = mY - \ell r \tag{2}$$

The IS-LM model, which, for empirical purposes, is inevitably dynamized by introducing distributed lags into the structural equations that make it up, is concerned with the determination of aggregate demand. If we adopt the standard textbook "reverse L" shaped aggregate supply curve, and consider the horizontal section of it along which the price level is constant, we may derive the following reduced form equation for income

$$Y = \frac{1}{1 - [(1-t)k - \frac{a}{\ell} m]} (A + G) + \frac{1}{\frac{\ell}{a}(1 - [(1-t)k - \frac{a}{\ell}m])} \frac{M}{P} \tag{3}$$

Clearly, in terms of this model, questions about the relationship between money and income concern the second term on the right-hand

side of this reduced form, and these questions may be divided into two groups. First the appropriateness of treating the behavior of the quantity of money as determining that of money income has often been disputed: this is the "reverse causation" question. Secondly, there are questions about the stability and size of the money multiplier considered in isolation, and compared with the autonomous expenditure multiplier.

The reverse causation question need not detain us long at this stage though we will have a good deal to say about it below. Let it simply be noted that it has long been widely recognized that the monetary authorities can act in such a way as to ensure that variations in the quantity of money are the effect rather than the cause of variations in income--for example, by gearing their open market operations to pegging the rate of interest at a particular value. It is also indisputable that there have been historical episodes in which this has been done explicitly, for example, in the United States over the period 1941-51. Questions about reverse causation have usually been treated as being, by their very nature, questions about the conduct of monetary policy during particular historical episodes.

Questions about the money multiplier seem, from the point of view of the IS-LM research agenda, to be of a fundamentally different nature. They concern behavioral relationships in the private sector of the economy whose characteristics are to be regarded as independent of the conduct of policy. Thus quantitative knowledge about the money multiplier is to be thought of as conferring not only the power to

answer questions about the channels whereby a given monetary policy

did influence economic activity during a particular episode, but also

to answer questions about how alternative monetary policies would have

influenced activity had they instead been implemented. Moreover, such

knowledge is also to be viewed as enabling predictions about the con-

sequences of future policies to be made so that their design may be improved.

As we shall see below, much recent work questions the proposition

that the structure of the economy is independent of the nature of the

policy being carried out, but that proposition is a fundamental premise

of the research on the transmission mechanism of monetary policy which

is now to be discussed.[2]

It is obvious from equation (3) that if the value of the money

multiplier is to remain stable over time, then so must the parameters

of both the demand for money function and the aggregate expenditure

function. It is equally obvious, not to say well known, that its value,

both absolute and relative to the autonomous expenditure multiplier, is

particularly sensitive to the values of the parameters a and ℓ which

measure the interest sensitivity of expenditure and demand for money.[3]

Thus, it is hardly surprising that the role of interest rates in in-

fluencing agents' behavior has been at the center of empirical research

concerned with the transmission mechanisms of monetary policy. I have

elsewhere extensively surveyed both theoretical and empirical work on

the demand for money function.[4] Suffice it here to say that the existence

of a stable aggregate demand for money function is well established by

empirical work, and in particular, that a clearly defined negative relation-

ship between the demand for money and an interest rate variable is a

salient characteristic of that function. There is no question of the extreme "quantity theory" special case of the IS-LM model being supported by empirical evidence; this fact implies that, if we take that model seriously, the nature of the relationships underlying the parameter a, both qualitative and quantitative, is of central importance to the linkage between money and economic activity.

The aggregate private sector expenditure function embodied in equation (1) is a convenient simplification. Expenditure on currently produced goods and services by the private sector involves the behavior of both firms and households. Firms' expenditure may be on producer durable goods as well as on inventories of raw materials and finished output. Households, on the other hand, buy both nondurable and durable goods. Even so, the qualitative nature of the linkage between money and expenditure which the IS-LM model attempts to summarize has not been a subject of much substantive controversy. Money is commonly regarded as one of a spectrum of assets held by firms and households, whose (not always very clearly specified) services yield diminishing marginal utility (or product) to their consumer. An increase in the quantity of money in an economy initially in asset equilibrium thus induces a disequilibrium in the structure of asset holding because the implicit yield on money is thereby driven down. A generalized substitution from money into other assets takes place, driving down their rates of return. Some of these rates of return are observable interest rates on securities, set by specialist dealers in response

to supply and demand conditions in organized markets, some are observable borrowing and lending rates set by financial intermediaries of one sort or another, and others are implicit, nonobservable, rates of return on assets such as consumer durables. Such a general fall in rates of return involves an increase in the present value of the income streams yielded by existing assets, and a rise in their market values above the supply price of newly produced assets. The output of durables, both consumer and producer, therefore increases. At the same time, the price of current consumption in terms of future consumption foregone has fallen so that in principle an increase in expenditure on nondurables might also be expected to occur.[5] Whatever the category of expenditure upon which impact effects fall, they are amplified by a multiplier process which is only partially offset by the subsequent behavior of interest rates.

The argument of the previous paragraph says nothing about the quantitative significance of the various effects discussed, and it is here that substantive disagreements have arisen.[6] Nevertheless, the qualitative issues raised do have important implications for the interpretation of empirical evidence on the transmission mechanism, particularly that evidence which comes from certain large-scale econometric models. In principle such models are capable of opening up to inspection the interior of the "black box" that connects monetary policy to the behavior of money income. In practice, these models, with certain notable exceptions (the Canadian RDX2 model, for example, and to a lesser degree the U.S. FMP model) have frequently omitted monetary

Andersen and Jordan (1968) certainly show that there is a positive
and statistically significant relationship between the time paths of
the quantity of money and money income, both over long runs of data
and in the post "accord" period as well. The relationship between
money and income also dominates that between autonomous expenditure
and income. Moreover, as far as more recent data are concerned, the
statistical analysis of Sims (1972) strongly suggests that causation
runs predominantly from money to money income rather than vice versa.[9]
For earlier periods Friedman and Schwartz (1963) (1970) using the
approach of the historian rather than the econometrician conclude that
causation has run in both directions, with that running from money to
income predominating.

Reduced form studies have been carried out for Britain, by Barrett
and Walters (1966) using data for the period 1878-1963, and by Artis and
Nobay (1969) as well as the Bank of England (1970) for post-Second
World War data. Here too there can be no doubt that correlations be-
tween money and money income exist, but it is a fair generalization
that these are not nearly so strong and well determined as their counter-
parts for the United States. It is also notable that when Williams, Goodhart,
and Gowland (1976) applied Sims' techniques to British data for the period
1958-1971, no clear-cut results on the direction of causation between
money and money income emerged. If anything, this study sup-
ports the "reverse causation" hypothesis. As to earlier periods,
Howson's (1975) work on inter-war Britain is, like that of Friedman
and Schwartz, based on historical rather than econometric methods.

Although she attributed an important causative role to monetary variables at certain times, notably during the upswing that followed the abandonment of gold in 1931, she found it hard to attribute much influence to money in other episodes, for example, in determining the economy's cyclical behavior in the mid- and late 1920s. Problems like those encountered with British evidence occur in the Canadian case as well. Macesitch's (1966) (1969) attempts at replication of the Friedman and Meiselman study for that economy led to a debate which left the significance of the money-income relationship, and the direction of causation, for that economy, an open question.[10] Furthermore, Barth and Bennett's (1974) replication of Sims' test for Canada for the years 1957-1972 showed, at best (and then only provided that money was narrowly defined), that the interaction between money and money income involved causation running in both directions, and hence did nothing to solve the problems left open by the earlier work.

It is certainly easier to find a clear-cut correlation between money and money income for the United States than for Britain or Canada, but the details of an IS-LM type of transmission mechanism are just as hard to pin down for that country as for others. For the United States, the whole question of the importance of monetary factors in influencing business investment in fixed plant and equipment is currently an open one. Jorgenson's theoretical work (e.g., 1967) on the neoclassical theory of investment clarified the role played by the rate of interest in determining the opportunity cost of the services of capital equipment, and the empirical work which he and his associates (e.g., Jorgenson and Stevenson (1967), Jorgenson, Hunter and Nadiri (1970)) carried out seems to show that investment responds with a

time lag, to interest rate variations. However, that work has been criticized
by Brechling (1974) (1975) on a number of grounds.

The time lags in Jorgenson's empirical work were introduced and
specified arbitrarily. Brechling shows that the neoclassical theory of in-
vestment, supplemented by an adjustment cost hypothesis, itself has definite
implications, for the time pattern of investment's response to interest rates,
that ought to be incorporated specifically into the empirical formulation of
time lags. He also shows that the neoclassical theory of investment, either
as specified by Jorgenson, or with the addition of lags arising from adjust-
ment costs, is not robust in the face of empirical evidence. The particular
structural equation derived from that theory, that Jorgenson and his associates
chose to fit to data, seems to perform well enough, but that equation treats
output as an exogenous variable. The reduced form expression implied by the
same theory which has prices, wages and the cost of capital (in which an
interest rate variable is incorporated) as exogenous variables, but not output,
fits badly with wrongly signed parameters being the rule rather than the
exception. Brechling also shows that the equation that Jorgenson and his
associates fit is not an appropriate reduced form for a cost-minimization,
as opposed to profit-maximization, formulation of the neoclassical theory
and that the appropriate reduced form fits the data badly. Thus, though
interest rates might well systematically influence business investment by way
of neoclassical mechanisms, Brechling's work shows that this proposition
remains to be demonstrated as far as the United States' economy is concerned.[11]
It also, incidentally, cast doubts upon the account of the transmission mech-
anism implied by the FMP econometric model, since that model's treatment of
investment draws heavily on Jorgenson's work.

One must be careful not to infer from the foregoing analysis that
there is no evidence that business investment is affected by

monetary factors. As Lund (1971) and Fisher and Sheppard (1974) note, there is abundant evidence, from studies based on one form or another of the accelerator hypothesis, that output or sales variables seem to be important determinants of investment. Jorgenson's own empirical work, of course, leads to similar results. If monetary factors affect consumer expenditures, then sales or output variations, to the extent that these are the result of monetary changes, provide an important indirect channel whereby those same changes influence investment.[12] This point is worth stressing, because, for the United States at least, there is a good deal of evidence to show consumer expenditure is sensitive to monetary influences. Thus Hamburger (1967) has found that interest rates played an important role in determining the demand for new durable goods over the period 1953-1964. The demand for newly constructed housing is also well known to be sensitive to monetary factors, with credit availability effects whose roots lie in imperfections in the mortgage market playing a significant role, at least according to the FMP model. That same model takes a "life cycle" approach to formulating the consumption function, and the effects of interest rate variations on the value of stocks owned by households exert an influence on their levels of expenditure that constitutes an important component of the transmission mechanism which the model generates.

For Britain and Canada the evidence on all these issues is at least as mixed as it is for the United States. For both countries there do exist studies that find a significant role for interest rates

in determining investment--Hines and Catephores (1970) or the investment
equations of the London Business School (LBS) model for Britain, and the
Investment equations of both the RDX2 and CANDIDE 1.2 models of Canada,
to give some examples. With the exception of Hines and Catephores, all
this work draws heavily and explicitly on that of Jorgenson, but none
of it has been subjected to the same thorough scrutiny which Brechling
brought to bear on studies of United States data. Accelerator type
effects do seem to be important for investment in both countries, and,
for Britain, Trivedi (1970) has found a marginally significant role for
interest rates to play in determining inventory investment, a result
which seems to have eluded those working with U.S. and Canadian data.

The influence of monetary variables on consumption is less well
established for Britain and Canada than for the U.S. In particular,
the type of wealth effects that figure so prominently in the FMP model
seem to be barely present in British data (cf. Deaton (1972)). The in-
fluence of interest rates on relative prices give them an important
role to play in influencing the demand for consumer durables in the
Canadian RDX2 model while they are also allowed to influence overall
savings behavior. In this model, also, credit availability influences
the housing market though in CANDIDE, the monetary influences are trans-
mitted to this market by interest rates. There is little debate about
the importance of availability effects on that market as far as Britain
is concerned. Even when the "Radcliffe view" about the relative un-
importance of monetary policy was at the height of its popularity, the
availability of mortgage funds was regarded as a key factor in the new
housing market, and events of recent years have done nothing to alter

anyone's views on this issue.[13] Credit availability effects also seem
to be important in influencing the demand for consumer durables in
Britain (cf. Hilton and Crossfield (1970) and Garganas (1975)).

Now the evidence sketched out here would, taken at face value,
suggest that "money matters" to a greater extent in the United States
economy than in Britain, and perhaps than in Canada also. Crude cor-
relations between money and money incomes are better determined in
United States data; there seems less ambiguity about the direction of
causation between the variables in those same data; and the details
of an IS-LM type of transmission mechanism are at least as easy to
discern in the case of the United States. However, an alternative,
and simpler, interpretation of the evidence is that the IS-LM frame-
work, although reasonably well adapted to the study of the United States,
particularly the United States of the 1950s and 1960s from which so
many of the results we have cited above are derived, is, in general,
an inadequate model for investigating the links between money and money
income.

Three well-known shortcomings of the IS-LM approach to macro-
economic questions are particularly relevant to this point of view.
First, the model does not deal satisfactorily with the fact that
variations in money income are made up of fluctuations in real income
and prices; secondly, it ignores potential linkages between the govern-
ment's budget and the behavior of the money supply; and thirdly, it
is a model of a closed economy. It seemed until recently that these
problems merely required that the model be extended, that equations be
added to it. Indeed, the large scale econometric models mentioned

above all do extend the framework in one way or another to cope
with these factors. It was not apparent that such extensions would
also require us to modify our views about the qualitative nature of
the linkages between money and aggregate demand that we have already
discussed, and such a possibility does not seem to have been enter-
tained when econometric models have been extended. However recent
theoretical work has indeed forced us to do just that and hence casts
considerable doubt upon the relevance of much of the evidence cited
so far has for the questions with which this paper is dealing.

III. MONEY INCOME, REAL INCOME, AND PRICES

As I have set it out, the IS-LM model holds the price level
constant and determines the level of real income. A common practice
(though not one adopted by the builders of big models) in adapting it
to the analysis of the determination of money income has been to replace
real variables with nominal variables, to postulate that the way in
which, and the extent to which, variations in the quantity of money af-
fect money income is independent of the breakdown of changes in money
income between real income and the price level. Such a procedure
does of course underlie Friedman and Meiselman type studies, and it
was defended by Friedman (1971) on grounds of theoretical convenience;
it has also been implemented in empirical work using small scale IS-LM
models by Tanner (1969) and Moroney and Mason (1971).[14]

Now if we consider the vertical segment of the "reverse L"
aggregate supply curve, if we set Y constant in equations (1) and (2),
and treat P as an endogenous variable, we may derive the following ex-
pression:

$$P = \frac{1}{Y[m + \frac{\ell}{a}(1-k(1-t))] - \frac{\ell}{a}(A+G)} M \qquad (4)$$

A simple comparison of this expression with equation (3) makes it ob-
vious that, even in terms of the IS-LM model, the quantitative nature
of the relationship between money and money income will depend upon
whether real income or the price level is varying. However, if either
ℓ is equal to zero or a to infinity, if either the LM curve is vertical
or the IS curve horizontal, equations (3) and (4) do reduce to the same
expression, namely:

$$PY = \frac{1}{m} M \qquad (5)$$

The money multiplier's size in equation (5) is independent of
the breakdown of money income between real income and prices, but that
characteristic rests on the very special assumption, introduced into
the model purely for the sake of simplicity, that the relationship be-
tween the demand for money and real income is linear. In the special
case of the model underlying equation (5) this assumption implies that
the real income elasticity of demand for money is unity, and hence equal
to the price level elasticity of demand. If the demand for money is
not unit elastic with respect to real income, then even if the potential
effects of interest rate variations on velocity are assumed away by
making the LM curve vertical or the IS curve horizontal, the size of the

money multiplier will vary with the division of money income fluctu-
ations between real income and prices.

I have mentioned earlier that the evidence to the effect that
the LM curve is not vertical is overwhelming. The evidence cited in
the previous section of this paper on the role of interest rates in
determining various components of expenditure makes it hard to believe
that a horizontal IS curve is an empirically relevant construction either.
Moreover, whatever might have been its value in earlier periods, it is clear
that the short-run real income elasticity of demand for money, particularly
if money is defined narrowly, has been significantly below unity in the
post-war United States. It has also been below unity in virtually
every other developed economy as well, over the same period. The
theoretically predicted value of unity for the price level elasticity
of demand for money, on the other hand, is supported by a good deal
of evidence.[15]

Thus, although the practice of treating the determination of
variations in money income as a problem prior to, and separate from,
that of breaking such variations down between real income and prices
would, as Friedman (1971) argued, greatly simplify macroeconomics, and
though it is easy enough to find premises in terms of which such a
practice could theoretically be justified, those premises are factually
wrong. How much money income will change in response to a given change
in the quantity of money depends upon how much of that change comes

in real income and how much in the price level. The mechanisms which determine the interaction of prices and real output must be treated as an integral part of the transmission mechanism that links the quantity of money to money income.[16]

In recent years, the "expectations augmented Phillips curve" has become the centrepiece of models that attempt to come to grips with price and output interaction. Two alternative accounts of the behavior underlying this relationship are to be found in the literature and though the distinction between them is apparently irrelevant for many of the questions upon which the relationship may be brought to bear, it is critical as far as the subject matter of this essay is concerned: the very concept of a "transmission mechanism" is hard to square with what may be termed the "Fisherian" interpretation of the curve.[17]

Consider an economy made up of perfectly competitive firms, with the output of each depending upon the relative price ruling for that output. Thus, where Y_{it} is the output of the ith firm in time t, P_{it} is the price of that output, and P_{it}^e the general price level as perceived by firms in that industry, we have,

$$Y_{it} = f(\frac{P_i}{P_i^e})t \ , \quad f' > 0 \tag{6}$$

Summing over all firms and using conventional symbols for aggregate output and the general price level, we get

$$Y = F(\frac{P}{P^e}) \ , \quad F' > 0 \tag{7}$$

Using lower case letters for logarithms and assuming a log linear form for F, equation (7) may be written

$$y_t = h(p_t - p_t^e) \, , \quad h > 0 \tag{8}$$

If we define the inflation rate as

$$\Delta p_t \equiv p_t - p_{t-1} \tag{9}$$

the expected inflation rate as

$$\Delta p_t^e \equiv p_t^e - p_{t-1} \tag{10}$$

and measure units of output so that y takes the value zero in equation (8) when $p = p^e$, we may rewrite equation (8) as an expectations augmented Phillips curve

$$\Delta p_t = \frac{1}{h} y_t + \Delta p_t^e \, . \tag{11}$$

According to the foregoing analysis, therefore, the expectations augmented Phillips curve (11) is simply another way of writing an aggregate supply curve (8), which can be used instead of the textbook "reverse L" relationship; and can be brought together with an aggregate demand curve derived from an IS-LM framework in order to determine simultaneously, for given expectations about prices, the level of real income and prices.

The difficulty here is that although we can think of a change in the quantity of money operating through the type of "transmission mechanism" discussed in the preceding section of this paper to change the quantity of goods and services demanded at any given price level, and hence to shift the aggregate demand curve, there is no analogous mechanism to tell us about what underlies the accompanying shift along

the aggregate supply curve. Output expands in response to an increase in the price level, but that increase in the price level simply happens, and is of just the right size to generate the output change that will clear the market. A Walrasian auctioneer must be brought in to bridge this vital gap in the sequence of events that leads from a change in the quantity of money to a determinate change in money income. To postulate his existence in response to a request for an empirically based account of such a sequence of events is hardly satisfactory.[18]

In certain markets--of the type that Sir John Hicks (1974) has called "flex-price"--the activities of specialist traders make it possible to treat all who are engaged in consumption and production as "price takers", but it is clear that, in Hicks' "fix-price" markets, which lack such specialist dealers, price and output decisions are taken by the same agents. It is equally clear that, in advanced economies, the latter type of market predominates. Thus, although it is certainly an advantage of the Fisherian interpretation of the expectations augmented Phillips curve that it is clearly grounded in orthodox microeconomics, and although it cannot be claimed that the alternative "Phelpsian" interpretation has such well established micro foundations, the latter does have the great merit of enabling us to do without the Welrasian auctioneer: it treats prices as being set by firms rather than being taken by them "from markets".[19]

Think of each firm in the economy as forming an expectation of what price it must charge in time t in order to maintain its real level of sales constant. Suppose that each firm sets its actual price above or

below that level depending upon whether it wishes to contract or in-crease its level of sales. For the economy as a whole, there will exist some level of output and sales at which the number of firms (suitably weighted by their shares in output) which want to expand sales just equals the number that wish to contract. At that output level, the value for the general price index that results from their individual price setting behavior will be equal to an index of the prices which they expected would keep their sales level constant. If output and sales for the economy as a whole exceed this "natural" level, there will be a preponderance of firms wishing to contract, and if they fall short of it a preponderance of firms will wish to. expand. The actual price level will then lie respectively above or below the "expected price level" in these instances.

Putting the end product of the above argument into algebraic terms, picking a log linear form, with units chosen so that the log of the output level at which the actual and expected price level are equal is zero, and using the same symbol as before for the "expected price level", even though it is conceptually a somewhat different variable, enables us to write

$$p_t - p_t^e = g\, y_t \qquad\qquad (8a)$$

which is obviously the inverse form of equation (8) from which we may derive

$$\Delta p_t = g\, y_t + \Delta p_t^e \; . \qquad\qquad (11a)$$

However, the choice of which way round to write this equation is, in the present context, neither arbitrary nor irrelevant. It must already be apparent to the reader that this Phelpsian account of how we arrive at the equation in question reverses the direction of proximate causation between output and prices at the level of the firm's behavior, and in doing so enables us to discuss the transmission mechanism between money and money income without having recourse to the "auctioneer". As before, we can think of an increase in the money supply leading to a higher level of demand for goods and services at any price level. As that higher level of demand, perhaps amplified by a multiplier process for which there seems to be no room in Fisherian analysis, materializes in the form of a higher level of real sales and real output, so will the number of firms wishing to contract their operations, or prevent them from expanding, increase. Thus the price level will rise relative to its expected level as these firms revise upwards the prices they set for their individual products.

We can describe the above process whereby price changes might be brought about in an alternative way which brings out more clearly the desirability of treating it as an integral part of the transmission mechanism between money and money income. I have already argued that a higher than equilibrium quantity of money in the economy leads, in principle, to a generalized process of substitution into other assets, and into current consumption. Such behavior on the part of households must lead to an increase in firms' sales, a tendency for their holdings

of money (and perhaps of such liquid assets as trade credit) to increase, and, if output does not fully expand to meet sales, to a diminution of their inventories. The act of increasing prices is an integral part of firms' response to the asset disequilibrium just described if the Phelpsian account of the Phillips curve is accepted. However, it would be wrong to claim that, in the present state of knowledge, the factors determining the extent to which such a disequilibrium would be met by price changes on the one hand, and output and inventory changes on the other, are understood.[20] Barro's (1972) work on the pricing behavior of a monopolist who faces a stochastic demand function, and lump-sum costs of price adjustment, provides what might prove to be a useful starting point for anyone seeking to analyze this problem.

The relationship analyzed above has been termed a "Phillips curve" but the discussion has dealt with output levels and prices, not with employment and money wages. Nevertheless, assumptions about the behavior of the latter variables have underlain the discussion. There exists a Fisherian interpretation of the interaction of money wages and unemployment exactly analogous to that of price and output interaction; an account in which the supply of labour and hence employment is made a positive function of the difference between the actual and expected level of money wages.[21] The expected money wage level in turn depends on expectations about the price level and about labour productivity. This Fisherian approach then interprets all unemployment as being of the voluntary search variety. An analogue to the Phelpsian interpretation of price output interaction (set out in Phelps (1968)) has firms forming expectations about the level of money wages that will maintain employment constant, and setting wages above, or below, that level depending upon whether they desire to expand or contract

their labour force. There then emerges a "natural" level of search
unemployment at which there is equality between the expected and
actual wage on both sides of the market. When firms wish, on average,
to reduce their labour forces, there emerges downward pressure on money
wages relative to expectations and unemployment goes above its "natural"
level, and vice versa. If a multiplier process is involved in ampli-
fying output fluctuations, such deviations of unemployment from its
natural level may be interpreted as involving "involuntary" unemployment,
generated by a failure of wages to fall fast enough to keep the labour
market cleared, unemployment of a type analyzed by Patinkin (1965) and
Barro and Grossman (1975).

However we interpret its underlying microeconomics, for the
expectations augmented Phillips curve to provide a valid account of the
interaction of prices and output, it is clearly necessary that, as out-
put and employment fluctuate about their "natural" levels, money wages
as well as prices fluctuate relative to their expected levels. If money
wages do not so fluctuate, then we would be left with an exogenously
given money wage rate as the principal determinant of prices, with only
the mark-up between wages and prices potentially susceptible to vari-
ation in response to market forces.[22] The evidence on the interaction
of prices, wages, output and employment has been surveyed recently (see Laidler
and Parkin (1975) Section 3) and shows that the price level does vary
(relative to expectations) with the level of real output, while the
level of money wages varies (again relative to expectations) with un-
employment. Also (pace Godley and Nordhaus (1972)) the mark-up of
prices over money wages does vary with market pressures. All this is
true, not only of the United States, but of Britain, Canada, and many

other countries. Moreover, it seems to be the case that unemployment and output changes precede the price and wage changes associated with them, so that to the extent that one may make inferences about the direction of causation from data on timing, the evidence in question would seem to support the Phelpsian rather than the Fisherian interpretation of the expectations augmented Phillips curve.[23] Hence it is compatible with a chain of causation such as I described earlier, that does not need to rely on an "auctioneer". Moreover, a pattern of wage-price-employment-output interactions such as I have just described is a feature of both the FMP model and of RDX2. To a degree at least theory and econometric modelling have complemented one another in developing this aspect of the analysis of the transmission mechanism.

I have suggested that the multiplier process and the Patinkin-Barro-Grossman treatment of involuntary unemployment might be integrated into an account of the transmission mechanism such as I have just sketched, but such integration is yet to be accomplished. Moreover, Phelps' labour market analysis, in which firms simply set money wage rates, is hard to swallow as an account of the processes whereby unemployment affects wage bargaining in labour markets as they exist rather than in some competitive ideal type. There can be no denying that, because of these gaps in our knowledge, there is still an element of the "closed black box" about any account which can currently be given of this stage in the transmission mechanism between money and money income. It is to be hoped that work now in progress on what Gordon (1976) has called the "new-new microeconomics" dealing as it does with the question of the optimal length of wage and employment contracts, and the reasons for wage rigidity within the contract period, will soon begin to fill these gaps in our knowledge.

IV. THE ROLE OF INFLATION EXPECTATIONS

IS-LM analysis implicitly holds <u>price level</u> expectations constant, but recent work, developing as it has against a background of severe inflation, takes it as normal that future prices are expected to differ from current prices. The zero expected rate of inflation of IS-LM analysis becoms one, very special, case in a more general range of possibilities. Even this substitution of a given expected rate of inflation for a given expected price level somewhat complicates the analysis of the relationship between money and money income.

Equation (11a) tells us that, ignoring real growth, if output is held at its "natural" level, prices and hence money income will increase at the same rate as the price level is expected to increase. The existence of a stable aggregate demand for money function implies that this can happen only if the money supply also expands at the expected rate of inflation in order to validate the price increase in question. If inflation expectations remain constant over time, then so will the actual inflation rate so long as the percentage rate of change of the money supply also remains constant at the appropriate value. Here we have a state of affairs in which money income and the money supply grow at the same rate but in which there is no sense in which one can be said to be "causing" the behavior of the other.[24]

The factor which really complicates the analysis that follows, however, is not just the existence of inflation expectations nor, as is well known, that they influence nominal interest rates as well as price setting behavior; it is that they themselves change endogenously over time.

I will, for the moment, adopt a postulate, whose first order adaptive
expectations special case is commonly found in the literature (but
which is by no means uncontroversial because of that), that agents
form expectations of inflation by observing the time path of the
actual inflation rate, and extrapolating from it in such a way as to
ensure that if a constant inflation rate persists over time, the
expected inflation rate will eventually come into equality with it.

The first, and quite basic, complication that the presence of
endogenous inflationary expectations introduces into the analysis of
monetary policy is that it makes it inappropriate to follow IS-LM
analysis in treating an increase in the money supply as the typical
expansionary policy and a decrease as the typical contractionary one.
Once we permit inflationary expectations to enter as proximate deter-
minants of the behavior of prices, so that it is possible for any on-
going rate of inflation to be validated by the appropriate monetary
expansion rate, it is more helpful to think of a rate of monetary
expansion in excess of the expected inflation rate as expansionary,
and a rate of expansion below the expected inflation rate as contrac-
tionary. Thus in dealing with the "transmission mechanism" we should,
as Friedman argued as long ago as 1958 (though not on the grounds ad-
vanced here), be concerned with a series of events set in motion by a
change in the rate of monetary expansion rather than in the level of
money supply.[25] Let us trace out the consequences of a particular ex-
pansionary policy, namely an increase in the monetary expansion rate
occurring when the economy is initially in a full equilibrium situation.
To do so, we must extend the transmission mechanism sketched out earlier

to allow for the influence of endogenous inflation expectations
on both price setting behavior and the time path of interest
rates.

An increase in the rate of expansion of the money supply to
a pace faster than that necessary to validate an ongoing anticipated
inflation will first lead to a buildup of real money balances, whose
implicit own rate of return will therefore begin to fall relative to
that on other assets. As a consequence, a process of substitution into
all other assets and into current consumption will be set in motion,
driving down interest rates, both observable and unobservable,
leading to an increase in current production and setting in motion
a multiplier process. All this is familiar ground, but instead of
having described the whole transmission process, as it would have done
in the context of the IS-LM model, the last sentence has sketched only
the first step in a more complex pattern of events.

Along with the increase in output just postulated goes a tendency
for firms to increase their prices, and for money wages to rise, to
levels in excess of the values these variables were initially expected
to take. Given that there initially exists an expected rate of inflation,
this involves an acceleration of the actual inflation rate relative to
that expected rate. If the actual inflation rate influences the ex-
pected rate, the latter must also begin to rise. In its turn, an in-
crease in the expected rate of inflation has two interrelated effects
on variables involved in the transmission mechanism. It puts upward

pressure on the rates of interest that assets denominated in nominal

terms are observed to bear, and it increases the opportunity cost of

holding money, hence tending to accentuate the very portfolio dis-

equilibrium which plays a vital role in the first stage of the trans-

mission mechanism, and which accelerating inflation is beginning to

offset.[26]

Instead of attempting the impossible task of following sub-

sequent steps in this ongoing dynamic process with verbal argument,

let us first assume that it is stable. Since both the FMP and RDX2

models contain elements of the transmission process we are here de-

scribing, as do the small scale models of Laidler (1973) and Stein (1975),

and since all four models are dynamically stable, such an assumption

is defensible. Let us then jump ahead to describe the new equilibrium

to which the economy will move after a shock; we can derive some

information about the dynamic process whereby it is reached by con-

sidering its properties.

Because, as equation (11a) tells us, the expected and actual

inflation rates will differ so long as output is not at its "natural"

level, the new equilibrium, like the initial one, will see the economy

operating at such a level of real output. The expected rate of inflation

will be higher in this new equilibrium, and so the quantity of real

balances held by the public will be smaller. If the "natural" output

level is independent of the inflation rate, and of any past histroy

of disequilibrium in the economy (both of these being dubious assumptions

supported by no empirical evidence of which I am aware, and the former

being contradicted by a good deal of theoretical argument[27]), then we

would also expect to find real rates of interest returned to their

initial levels, with nominal rates having increased by the same amount as the inflation rate. If money is not "super neutral" in the long run, then we might find real rates either higher or lower. In either event, though, in such a new equilibrium, a higher and more rapidly rising volume of nominal expenditure would be associated with higher nominal interest rates. The quantity of real balances will be lower in the new equilibrium. Therefore, on average, during the transition towards it, the rate of inflation must exceed the rate of monetary expansion. Moreover, if nominal interest rates at first fall, but end up at a level higher than ruled initially, they must on average rise during the transition, and at some stage reach levels higher than their original values while nominal expenditure is still rising towards its new equilibrium level.

The above propositions about the economy's behavior are supported by empirical evidence. The influence of the expected rate of inflation on the quantity of real balances demanded is well established empirically, and not just for situations of hyperinflation or rapid inflation of the Latin American type. Its influence has also been shown to be present in data drawn from France (Melitz (1976)) and the United States (Shapiro (1973), Goldfeld (1973)), in the post-war period. Moreover, the influence of inflation on nominal interest rates is also clearly reflected in empirical evidence, and the inverse relationship between such rates and the demand for money must be one of the best established results in applied macroeconomics.[28] Evidence concerning the influence of inflation on nominal interest rates goes back to Irving Fisher (1896), but more to the point here, the work of Gibson (1970) has more recently established, at least for United

States data, the tendency of nominal interest rates to fall, and then quickly to rise above their original level in the wake of increases in the rate of monetary expansion (and vice versa for decreases).[29]

The argument of the last few pages has been carried on on the assumption that the principal determinant of the expected inflation rate is the behavior of the actual rate. The "rational expectations" approach to modelling the formation of inflation expectations challenges this assumption, and does so in such a way as to make questions concerning the transmission of the effects of monetary policy even more awkward to get to grips with than the above analysis would suggest.[30] This approach argues that economic agents act "as if" they form their expectations about the inflation rate by using the forecast that would be yielded by a correct model of the economy in which they are operating, and "as if" they expected every other agent in the economy to form his or her expectations in the same way.

A thorough-going application of this approach raises a number of difficulties. It ignores the fact that the gathering and processing of information is costly, so that many agents might not find it worthwhile to compute the (statistically speaking) optimal forecast of the inflation rate. It begs questions about how agents might be induced to agree upon just what is "the correct model" to use for forecasting purposes.[31] And it ignores the fact, stressed by Poole (1976), that, if they are bound by long-term contracts, agents will be unable to act upon new information however it might affect their view of the future. Moreover, if despite these objections, all agents did act completely rationally, any change in the monetary expansion rate, whose effects on the equilibrium demand for real balances were not offset by an accompanying step change in the level of the money supply would lead to

an instantaneously explosive inflation or deflation.[32] However, arguments such as these dispose only of a particularly extreme form of the rational expectations notion, not of the idea in general.

A looser version of the same hypothesis would recognize that agents' knowledge of the way in which the economy works is imperfect, that data on the behavior of particular variables are expensive to generate and process, and that changed expectations do not immediately lead to changes in activities. It would nevertheless insist that, for some agents at least, it is possible to use extraneous information on the behavior of such variables as the money supply, and others with which we shall deal in more detail below, in order to generate a more accurate forecast of the behavior of the inflation rate than could be had simply by extrapolating from past data on that variable, and to do so at a cost which will make the exercise worthwhile.[33]

If some agents were to use data on the time path of the money supply in forming expectations of inflation, their behavior would "short circuit" the transmission mechanism that I have described above. The effect would be to make the expected rate of inflation that under- lies price setting activities, and the determination of nominal inter- est rates, depend _directly_ upon the behavior of the money supply. Thus if specialist dealers in security markets were to note that the rate of monetary expansion had increased, and to change the prices of secu- rities to reflect changes in expectations of inflation, they could do so before any discripancy between _ex ante_ supply and demand in such markets appeared. More important, if the rate of monetary expansion increased, and this very fact led some firms to expect that there would be an increase in the inflation rate, they would begin to

increase the prices of their output at a more rapid rate, without any intervening chain of asset disequilibrium or output change being necessary to prompt such behavior. If all agents acted in this way, and expected all other agents to do the same, we would have instantaneous and explosive inflation, as has already been noted. Even if only some did so, however, their activities would involve yet another channel whereby monetary changes affected money income and expenditure, one which operated directly through expectations and their influence on price setting behavior.

Now, the arguments presented in this section of the paper have important, and, to a degree, destructive, implications for much of the evidence on the transmission mechanisms of monetary policy sketched out in Section II. If the division of changes in money income between the price level and output must be regarded as an integral part of that transmission mechanism rather than as a matter that can be analyzed separately from it, then we must pay particular attention to the way in which endogenous, and variable, inflationary expectations impinge upon behavior when we study that transmission mechanism. This is of crucial importance in assessing how much attention we should pay to evidence on the influence of market interest rates on various categories of expenditure. As far as the demand for durable goods is concerned--both consumer and producer durables-- it is real rather than nominal rates of interest that matter, or nominal rates taken in conjunction with expected inflation rates, and yet, all too often it is nominal interest rates alone that have been

used in empirical work.[34] Of course, if the expected inflation rate
is more or less constant, variations in nominal interest rates will
reflect variations in real rates, and little if any harm is done by
using the former. It is, perhaps, not without significance that
work utilizing United States data drawn from the period starting at
the end of the Korean War and terminating in the late 1960s--such as,
for example, Hamburger's study of the demand for consumer durables--
has produced evidence showing an influence of nominal interest rates
on expenditure, for this was a period of unprecedented price stability.
Moreover, the studies of Tanner (1969) and Moroney and Mason (1971), based
on an IS-LM framework cast in nominal terms, seemed to produce satis-
factory enough results, and also used data for virtually the same period.
This too is not without significance, because implicit in the foregoing
discussion is the conclusion that the IS-LM model is viable for times
and places where the expected rate of inflation is approximately zero,
and fluctuates little.

Whenever or wherever there have been variations in the inflation
rate, which there is any reason to suppose might also have been reflected
in variations in the expected inflation rate, that same discussion
makes a strong a priori case for regarding any correlation, or lack
thereof, between nominal interest rates and expenditures of any type
as irrelevant to deciding upon the existence, or otherwise, of a well-
determined linkage between monetary policy and nominal income. We
have seen that in such circumstances, falling and then rising nominal
interest rates can co-exist with rising real expenditure during a

transition to a higher inflation rate, and that once equilibrium is reached, higher nominal rates might be associated with the initial level of real but a higher level of nominal expenditure. Moreover, the "rational expectations" hypothesis makes it possible to picture circumstances in which nominal rates of interest do not fall even initially in response to an expansionary monetary policy, although the empirical work of Gibson, cited above, raises doubts about the practical significance of this theoretical possibility. In short, once we take account of the manner in which endogenous inflation expectations impinge upon the transmission mechanism of monetary policy, it becomes clear that, quantitatively speaking, we know even less than we thought we did about what is in the "black box" which contains that mechanism. The evidence upon which we have to rely has mainly been generated in terms of a suspect theoretical structure.

All this means that the crude correlations between money and money income which we discussed earlier become relatively more important than one might initially have supposed, or than one might think desirable, as pieces of evidence about the matters under discussion in this paper. That such correlations vary in strength between time periods and across countries may no doubt be explained in part by the considerations that earlier led us to the conclusion that the division of money income fluctuations between output and price level changes is of vital importance. However, such an explanation still leaves us with questions about the direction of

causation between the variables to be discussed further. Results on this matter are, as we have seen, much more clear-cut for the United States than for other economies. In the following section of this paper I shall consider how the potentially endogenous nature of the money supply impinges upon the transmission mechanism and hence upon the way in which we might interpret these results.

V. THE ENDOGENEITY OF THE MONEY SUPPLY AND EXPECTATIONS

The standard IS-LM model treats the money supply as independent of fiscal policy and it deals with a closed economy. These properties do not immediately imply that within that model the money supply must be treated as an exogenous variable, but they do limit the cases in which it can become endogenous to those where the monetary authorities set a target for the nominal interest rate and let the money supply adjust to any level necessary to achieve that target. It is certainly true that interest rate levels have frequently been pegged by central banks, not least as I have already noted, during the 1941-51 period in the United States, but the adoption of such a policy regime is in fact far from being the only possible source of endogeneity in the money supply.[35] The way in which the government decides to meet its own budget constraint, and the exchange rate regime it adopts, both have potentially important implications for the way in which the money supply will interact with other economic variables, and hence for the way in which we should interpret evidence about that interaction.

Let us consider the matter of the government's budget constraint
first of all. Government expenditure not financed by taxes or by borrowing
from the public must be financed by borrowing from the banking system. This
latter method of finance necessarily involves money creation and, like bond
financing if bonds are imperfect substitutes for equity, will alter the
structure of portfolios in the private sector. As Brunner and Meltzer (e.g.,
(1976)) in particular have stressed, these facts imply that policy induced IS
curve shifts must also lead to LM curve shifts except in the special case in
which changes in government expenditure are matched by equal changes in
taxes, even if we assume that government interest bearing debt is not to any
degree net wealth. Moreover, because anything but complete tax financing of
government expenditure implies the creation of money and/or government debt,
these shifts will persist for as long as any deficit arising from a
fiscal policy change also persists, unless money and debt are created in just
the right proportions to keep the LM curve stationary.

This is not the place to go into the implications of these con-
siderations for macroeconomics in general. The "crowding out" debate is not
central to the issues that I am dealing with here.[36] Nevertheless there
are noteworthy implications for the way in which we discuss the transmission
mechanism and evidence about it. First, if the monetary authorities of a
country are expected to accommodate that country's treasury--as until recently
they have been to a greater extent in Britain and Canada than in the United
States--then expansionary fiscal policy will be accompanied by expansionary
monetary policy. Hence, it is bound to be difficult for "reduced

form" studies that rely on correlations between money and autonomous expenditure on the one hand, and money income on the other, to distinguish between the influence of the two policy tools.[37] This is not to mention the problems that arise from government expenditure, as well as taxes, being variables that themselves depend in part upon real income and prices. The endogeneity of the deficit combined with the existence of the government budget constraint implies the possibility of causation running from money income to money as well vice versa. This would cause no problem if increases in money income had a negative effect on the rate of money creation, since then, the two way causation would be easy to disentangle, but there can be no a priori presumption that this will be the case.

It is natural to think of an increase in money income leading to a fall in the budget deficit and hence in the rate of monetary expansion, because one normally thinks of an increase in income involving an increase in tax receipts and a fall in government expenditures. That is how "built in stabilizers" are expected to work. However, here it is crucial to consider the division of changes in money income between real output and the price level. Many items of government expenditure are effectively fixed in real terms: the nominal cost of a road building program, for example, automatically goes up with the general price level. Moreover, government employees' salaries, and many transfer payments, not least those related to the level of real economic activity, for example, unemployment benefits, have increasingly come to be indexed in recent years, either formally or informally; while it is worth noting that in Canada, at least, income taxes have been formally, albeit partially, indexed.

The point of all this is that, in situations where the major source of an increase in money income is rising prices rather than rising real output, it is quite conceivable that the government's nominal deficit will increase rather than decrease. This is especially likely to be the case if we have a state of affairs in which rising money income is the net result of rising prices and falling output, as it has been in a number of countries in recent years. To the extent that the nominal deficit feeds into monetary expansion, rising money income can then be regarded as a cause of that monetary expansion. This is not to say that the expansion in question will not itself cause further increases in money income--in what could prove to be an explosive inflationary spiral--but it is to say that the interaction between money and money income over time can easily involve positive effects running in both directions. If it does, then it will be difficult indeed to disentangle the complex causative patterns involved from the results generated by reduced form equations of the type used in the studies mentioned earlier, or indeed from studies that employ Sims' methods.

Factors such as those just described might account for some element of the ambiguity of the evidence on the predominant direction of causation between money and income for countries such as Britain and Canada, because it is certainly the case that the conduct of monetary and fiscal policy has traditionally been much more interdependent in those countries than in the United States. It would require empirical work of a type not yet carried out, as far as I am aware, to establish the truth or falsity of such a conjecture, but I would doubt that the factors discussed here were of great

importance until inflation became chronic in the 1970's. A much more important source of "reverse causation" between money and money income is implicit in the openness of economies such as Britain and Canada. I shall turn to that issue in a moment, but before I do so one final, but crucial, implication of the existence of a government budget constraint for the analysis of the transmission mechanism must be dealt with.

In my earlier discussion of rational expectations, I considered the consequences of agents using direct observation of the rate of monetary expansion to form expectations about the behavior of the price level. If the money supply itself is an endogenous variable whose time path depends upon the size of the government's deficit, and the manner in which it is financed, it is a short step to suggest that agents might use information about the deficit, among other variables, to form expectations about the time path of the money supply in order to generate, in turn, expectations of inflation. It then becomes possible to conceive of the rate of monetary expansion being divided into two components, one expected and the other un- expected. Expected variations in the monetary expansion rate should lead directly, via a rational expectations mechanism, to variations in the inflation rate, but unexpected variations should have their effects transmitted through a mechanism involving portfolio dis- equilibrium leading on to output and eventually to inflation rate fluctuations.

The empirical work of Barro (1975) for the United States,
and of Wogin (1976) and Saidi and Barro (1976) for Canada put
this proposition to the test. They all attempt to divide the mone-
tary expansion rate up between a forecast component and residuals
from that forecast, and then show that unemployment and output
fluctuations correlate only with the residuals so derived. They do
not go on to show that forecast changes in the monetary expansion
rate directly lead into changes in the inflation rate, and so their
evidence stops short of providing a complete set of tests of the
above propositions. Feige and Pearce (1976a) apply optimal time series
forecasting techniques to U.S. data on inflation for the period
1953-1971, and then show that information on the behavior of the money
supply does not permit any improvement to be made in inflation fore-
casts derived by these methods. However, the feedback rules used by
the monetary authorities to decide upon their policy actions may be
implicit in the lag structure which Feige and Pearce's forecasting
technique applies to the past behavior of the inflation rate. Thus
their results are not in conflict with those of Barro, but do show that
that his is not a strong test of the rational expectations hypothesis.
Sargent (1975) has stressed the need to test the rational expectations
hypothesis against data sets within which different policy regimes have
been in force in order to overcome the problems posed by considerations
such as these.[38]

Be all that as it may, if some agents do use data on the
factors underlying the behavior of the money supply to form expect-
ations of inflation, then the precise nature of the linkages between
monetary policy and variations in money income that exist at a
particular moment will depend upon how accurately they can forecast
the monetary expansion rate. Moreover, a different forecasting
model will be appropriate for making such predictions depending
upon the behavior patterns of the authorities towards the financing
of budget deficits, while the accuracy that such predictions can
attain is also likely to depend upon the same factor. These con-
siderations lead directly to the following crucial implication:
the structure of the economy through which monetary policy operates
to affect money income will itself depend upon the way in which that
policy is carried out, and how it interacts with fiscal policy.

The proposition, that the nature of policy, and the nature of
the transmission mechanism are interdependent, if it is correct, means
that our habitual manner of thinking of the economy as having a given
structure, knowledge of which will enable us to improve the conduct
of policy is fundamentally erroneous. The evidence cited above,
though not definitive, is nevertheless strong enough to require
us to take this proposition seriously. However, it is not the only
evidence that we have on these matters. Analysis of the behavior of
open economies under alternative exchange rate regimes leads to a
similar line of reasoning about expectations, and here the theoretical
results in question are supported by more, and stronger, empirical
evidence.

How the openness of an economy impinges upon the conduct of
monetary policy and its transmission mechanism depends upon
the exchange rate regime in force. Consider first a fixed rate. Its
maintenance must involve a commitment by a country's monetary author-
ities to buy and sell their own currency at a fixed price in terms of
others. Thus, unless sterilization is feasible, they must surrender
control over the quantity of money, exactly as they would were they
to peg the price of bonds instead of the price of foreign exchange.
The traditional view of the operation of a fixed exchange rate has
always recognized the balance of payments as a source of monetary
expansion or contraction unless reserve flows are sterilized; but the
period of time over which sterilization operations can be expected
to be successful is widely agreed to have diminished markedly with
the growth of international capital mobility in the 1960s.[39] Hence,
we here neglect sterilization operations as being a short-term com-
plication that does not alter the essence of the analysis.

The traditional view of the balance of payments mechanism
would lead us to expect that, if the inflation rate in the world
economy were to accelerate, and if the domestic authorities did not
simultaneously undertake an expansionary policy, the home country's
balance of payments would become increasingly favorable. Its rate
of monetary expansion would increase as a result, and ultimately
a readjustment of its domestic price level and inflation rate to
values compatible with balance of payments equilibrium would take

place. In this traditional view, the purely domestic aspects of the
chain of causation would be no different from those through which a
change in the monetary expansion rate would operate in a closed economy,
although it is worth noting that the same characteristics of inter-
national capital markets that render sterilization operations less
viable also put severe limits on the extent to which domestic interest
rates can deviate from those ruling in the world economy.

Application of the rational expectations notion undermines the
traditional view of the transmission mechanism in an open economy.
If an increase in the world inflation rate is going to lead to an
increase in the monetary expansion rate via the consequences of a
balance of payments surplus, then rational agents would expect this
to affect the time path of domestic prices. Hence domestic inflation
expectation might well be directly influenced by the time path of
world prices. Domestic interest rates, even on assets not directly
tradeable on world markets, would then rise when the world inflation
rate increased. The effect of inflation expectations on price setting
behavior would also result in there being a direct causative link
between the behavior of world and domestic prices. If rational ex-
pectations work in this way, then monetary expansion, coming through
the balance of payments, must be regarded as accommodating rather than
causing any change in the time path of domestic money income resulting
from changes in the world inflation rate. Moreover, it is quite con-
ceivable that money income changes, brought about by changes in the world
inflation rate, might lead rather than lag behind accompanying variations
in the quantity of money.[40]

The process I have just sketched out could give all the
appearances of "reverse causation" between money and money income
in data generated by an open economy operating a fixed exchange rate.

The key element in it is the role played by the world price level,
by way of its effect on inflation expectations, in determining
domestic price setting behavior. Cross and Laidler (1976) in a
study of 19 countries for the years 1952-1970 found that the behavior
of the world price level did seem to influence inflation expectations
in all of them (such influences being at a minimum in the case of the
United States). Parkin, Sumner and Ward (1976), in a study of wage
price behavior in the United Kingdom, generated a similar finding
for that country as did Spinelli (1976) in a study of Italy for the
period 1954-1973.

Exchange rate changes under a fixed rate regime also have, for
given behavior of the domestic credit expansion rate, predictable
consequences for the balance of payments and hence the money supply.
It is therefore noteworthy that Laidler (1972) found that, over the
period 1919-1970, the qualitative nature of price and output inter-
action for Britain could be predicted with an expectations augmented
Phillips curve that utilized error learning, except for the years fol-
lowing exchange rate changes. Moreover, Carlson and Parkin (1975) derived
an estimate of the expected inflation rate for Britain directly from
survey data, and found that it increased markedly and otherwise un-
explicably after the November 1967 devaluation. These results, dealing
as they do with the behavior of expectations in the wake of abrupt policy
changes, provide evidence in favor of the "loose" version of the rational
expectations hypothesis. Taken in conjunction with the more general
arguments advanced earlier about the generation of inflation expectations
in a fixed exchange rate open economy, they also go a long way towards

explaining why British data in particular produce such ambiguous re-
sults about the direction of causation between money and money income.[41]

Now it is worth noting that the expectations mechanism sketched
above is not the only potential route whereby changes in world prices,
or in the exchange rate, can impinge directly upon domestic prices
without the intervention of changes in the money stock. The "mark-up"
pricing hypothesis has long been an important component of models of
the inflationary process, and still plays a crucial role in determining
prices in large macro models. In open economies, the role of import
prices as a component of production costs has attracted much attention
as a means whereby inflationary impulses could be directly imported
from abroad. For example, Dicks-Mireaux (1961) and Lipsey and Parkin
(1969) both found that such a variable could be given an important
role in an aggregate price determination equation for Britain, while
import prices contribute significantly to the proximate determination
of the price level in both the LBS model of Britain, and the RDX2 model
of Canada. I am aware of only one study (Laidler (1976)) that has
attempted to discriminate between what we might term the expectations
and import cost push mechanisms as the principal means by which world
price level fluctuations are transmitted into open economies under
fixed exchange rates. The results of that work favored the expectations
mechanism, but, given that there has been only one study of this issue,
any conclusion based on its outcome should be regarded as extremely
tentative.

In any event, either of the above mechanisms could lead to an
appearance of "reverse causation" between money and money income in an
open economy, but it is worth stressing that this phenomenon would exist only
at the level of the individual economy. The foregoing analysis helps us
to interpret evidence generated for individual open economies but,
because it treats the behavior of the price level in the rest of the
world as exogenous, it cannot be looked upon as providing a complete
account of the relationship between the behavior of money and money
income. A full treatment of the problems with which this paper is
trying to deal, for a fixed exchange rate open economy, would have to
include an account of what it is that determines the behavior of money
income at the level of the "closed" world economy. It would treat
the mechanisms described above as elements in the process whereby
variations in economy-wide money income impinge upon various regions
of the economy.[42]

The contrast between a fixed and flexible exchange rate regime
is not necessarily a sharp one, particularly as far as the matters
being discussed in this paper are concerned. The adoption of a flexible
exchange rate does give the monetary authorities, in principle, the
ability to do what they will with the domestic money supply. This
does not mean, though, that the transmission mechanism for monetary
policy will be just as it would be in a closed economy. For example,
in the LBS model (as in RDX2) import costs play an important role in
determining prices. Under flexible rates, the LBS model has expansionary
monetary policy driving down the exchange rate. The subsequent rise in

the domestic price of imports plays a key role in driving up domestic prices. (See Ball and Burns (1976).) Such a chain of causation obviously could not be incorporated in a model of a closed economy.

If we look to an expectations mechanism, rather than to an import cost mechanism to link domestic prices to those in the rest of the world under fixed exchange rates, then the adoption of perfect exchange rate flexibility could break this link completely. However, it would do so only if all agents ignored the behavior of world prices, and of the exchange rate, in forming their expectations, if all agents concentrated solely on the behavior of domestic variables. Though its truth or falsity is obviously an empirical question, one cannot rule out this possibility a priori. Rational agents might plausibly look only to domestic variables in forming expectations under a regime in which the monetary authorities were willing to ignore completely the behavior of the exchange rate in designing their policies, but such a policy stance is an extreme one. Even when they abandon a fixed rate, monetary authorities typically entertain the notion that there is a desirable value, or range of values, for the exchange rate.

If they do treat the exchange rate as a policy target, they must also stand ready to make the behavior of the domestic money supply compatible with the maintenance of whatever range of values they decide to aim for. Such a policy regime would differ from one of rigidly fixed rates, but the difference would be one of degree rather than kind. The domestic money supply would still be open to influence from the rest of the world in a systematic way, so that events in the outside world might very plausibly be used to form expectations about

the time path of domestic prices. Thus, even with some degree of exchange rate flexibility, the traditional channels whereby monetary changes influence money income may be bypassed just as, it has been argued, they are bypassed under fixed rates. Arguments such as these might well explain why difficulties of interpreting money-money income correlations similar to those encountered with British data also arise in studies of Canada, despite that economy having operated nominally flexible exchange rates for a good part of the post-war period. This conjecture receives support from the work of Caves and Feige (1976) who, using a Sims-type test show that, for Canada, causation has run primarily from the exchange rate to money, rather than vice versa. Nevertheless, a flexible exchange rate does give domestic monetary policy a greater chance, if the authorities wish to use it, of influencing money income, and Howson's (1976) conclusions about post-1931 Britain suggest that, in that episode at least, the chance was exploited.

If the argument of the last two paragraphs is correct, then the degree to which the behavior of foreign prices will impinge directly upon domestic expectations is likely to vary with the amount of confidence that the agents forming these expectations have in their judgement of the aims of the monetary authorities vis-à-vis the exchange rate. If the conduct of policy affects that degree of confidence, or if the authorities' aims are seen to vary, then, if there is anything to the application of rational expectations ideas in the current context, the manner in which expectations are formed will also vary. Once again, then, we have a line of reasoning which suggests that the structure of the economy, through which policy operates, will actually vary with the goals of policy and with the means adopted to achieve them, rather than being independent of them. We also seem to have empirical evidence to back up this line of reasoning.

VI. SUMMARY AND CONCLUSIONS

This essay has covered a great deal of ground but its princi-
pal theme is easily summarized. The IS-LM model provided a common
theoretical framework in terms of which a spectrum of viewpoints about
the nature of the "transmission mechanism" of the effects of monetary
policy could be reduced to questions about the empirical magnitudes of
the parameters of particular behavior relationships. The model treated
the money supply as an exogenous variable, independent of fiscal policy,
dealt with a closed economy, and offered no satisfactory way to analyze
the division of changes in money income between real income and prices.
Each of these shortcomings seemed open to a remedy that involved ex-
tending the structure without at the same time altering its basic
properties, but in the event the attempt to solve these problems has
led economists to a basic reassessment of the nature of macroeconomic
analysis.

At the heart of this reassessment lie the results of the search
for the "missing equation" that divides up changes in money income
between real income and prices. To begin with, it has become apparent
that the processes underlying this division must be treated as forming
part of the transmission mechanism that links money and money income,
rather than as involving a subsequent and analytically separable series
of events. The expectations augmented Phillips curve, which is the
most popular candidate to fill the role of "missing equation", rests
on theoretical foundations which are as yet not fully developed. There

seems to be a good deal of empirical evidence in its favor, but what
kind of micro postulates about the interaction between excess demand
and price formation it rests upon, particularly in the labor market,
is still an open and controversial question. It is hardly surprising
that much work on the transmission mechanism has in recent years
centered on labour market behavior.

Even so it is not doubts about the way in which the forces of
supply and demand operate in the labour market that have undermined
our conventional way of thinking about macroeconomic problems. Rather
it is the role that price expectations play in determining all kinds
of behavior, including labour market behavior, that forces us to re-
think so much of our analysis. If such expectations were related to
the behavior of particular economic variables in a stable and dis-
coverable way, then even if such relationships differed between agents,
the way in which they were determined could be treated as part of the
structure of the economy. We could argue that, to the extent
that we had not yet discovered such relationships, there existed a
gap in our understanding of the structure of the economy, of the trans-
mission mechanism through which policy, including monetary policy,
operates to influence prices and output. That would be a problem, but
not a fundamental one.

However the issue raised for macroeconomics by the emphasis we
now lay upon expectations is more basic. If economic agents are
capable of recognizing that economic policy, and the institutional

framework against whose background it is carried out, influence the environment in which they themselves operate, then it is plausible to postulate that information about the conduct of economic policy, and about that institutional background, will be used by at least some of them in forming their expectations. Hence, the way in which fiscal policy, or the exchange rate regime adopted by an open economy, interacts with monetary policy will influence not just the values of those expectations but the very manner in which they are formed.

This implies that there may be no such thing as a unique transmission mechanism for monetary or any other kind of policy, knowledge of which will enable us first to discover how, in particular historical episodes, alternative policies to those actually implemented might have worked, and second to choose in any current situation, the best policy from a menu of alternatives. Rather, there is potentially a different transmission mechanism for every policy regime. The interior of the famous "black box" may have no unique structure to its contents. Whether it will prove possible to generate empirically useful hypotheses about the way in which the nature of the transmission mechanism varies with that of the policy regime, so that it becomes possible to allow for the endogeneity of the transmission mechanism in building macro theories and designing macro policies must remain to be seen. This question, though, must surely be the crucial one for future work in macroeconomics.

FOOTNOTES

[1] See Fisher and Sheppard (1974), Fisher and Sparks (1975), Goodhart (1975), Ch. 9. Note that Laidler (1971) provides an earlier survey.

[2] This proposition was unquestioningly accepted in Laidler (1971).

[3] It is easy to recast this argument concerning their importance for the money and automonous expenditure multipliers in terms of elasticities instead of slope parameters. Simply multiply $m\frac{a}{\ell}$ by $1 \equiv \frac{Yr}{Yr}$. I owe this point to Michael Parkin.

[4] See Laidler (forthcoming).

[5] This account of the transmission mechanism is widely accepted. It appears essentially as presented here in the work of Tobin (see 1969), Friedman (see Friedman and Meiselman, 1963), and Brunner and Meltzer (see Brunner and Meltzer, e.g. (1976)). Note that Brunner and Meltzer in particular stress the behavior of the price of currently existing physical assets relative to the supply price of new assets as a basic element in the transmission mechanism. They also stress that, once assets other than money and physical capital are admitted explicitly into the analysis it becomes necessary to consider the elasticities of demand and supply for such assets with respect to the rate of interest as well as the interest elasticities of demand for money and investment goods. Whether this makes a quantitative difference or a qualitative difference to the outcome of any analysis depends, as Dornbusch (1976) has shown, on whether the sharpest break in the chain of substitution between money and physical capital occurs at the liquid end or the less liquid end of the spectrum of assets.

[6]The extreme Keynesian view that only the interest sensitivity
of investment is relevant to the transmission mechanism has not been found
commonly in recent North American literature. However, some British
Keynesians still seem to regard this as the critical step in the mechanism.

[7]The foregoing paragraph draws heavily upon Fisher and Sheppard (1974).
Among the models that rely heavily--perhaps too heavily--on interest rates'
influence on investment to link the monetary and real sectors are the 1972
version of the London Business School model of the United Kingdom and the
Economic Council of Canada CANDIDE 1.2 model. See Ball et al. (1975) and
Economic Council of Canada (1975) respectively. For an account of the links
between money and economic activity in the FMP model, see Modigliani (1975)
and for RDX2, see Helliwell et al. (1971).

[8]In Laidler (1971), I criticized reduced form studies. This criticism
however was not directed at the use of reduced forms per se, but rather at the
difficulties that arise in interpreting them if they are not related to an
explicitly formulated model. Neither Friedman and Meiselman (1963) nor
Andersen and Jordan (1968) derived their equations from an explicitly formulated
model.

[9]Sims' test, building on the work of Granger (1969), essentially relies
upon the timing of variations in the data. If, after the relevant series
have been prefiltered to remove serial correlation from regression residuals,
variations in income are more closely correlated with preceding variations
in the quantity of money, than variations in the quantity of money are with
preceding variations in money income; if variations in money income
are less closely correlated with succeeding variations in the quantity of

money, than variations in the quantity of money are with succeeding variations in money income; then it is argued that the predominant direction of causation runs from money to money income. Note that Fisher and Sparks have argued (1975) that it is only possible to use data on timing to establish directions of causation in the context of a specific theoretical framework. Note also that Feige and Pearce (1976b) argue that Sims results are extremely senstive to variations in the prefiltering procedures used.

[10]For an account of the debate as far as Canadian data are concerned see Fisher and Sparks (1975).

[11]Brechling suggests that the supply side as well as the demand side of the capital goods market needs to be explicitly analyzed and brought into the picture before satisfactory tests concerning the interest sensitivity of investment demand can be carried out. In this his work echoes the stress that Brunner and Meltzer lay on the role played by the supply price of newly-produced capital assets in the transmission mechanism.

[12]Note that this is not a new argument. It was explicity set out as long ago as (1939) by A. J. Brown.

[13]The mechanism involved here involves the borrowing and lending rates of institutions involved in the mortgage market being sticky. Then a rise in market interest rates elsewhere attracts funds from these institutions, leading to a shortage of mortgages, at going interest rates, and hence to credit rationing in the housing market. The mechanism is described in the Radcliffe Report (1959), paragraphs 292-295.

[14]Tanner and Moroney and Mason both use dynamic versions of the IS-LM model as originally developed by Tucker (1966). The theoretical model in question was explicitly of the fixed price level kind.

[15]For evidence on these matters see Laidler, forthcoming, Ch. 7.

[16]Acceptance of the foregoing arguments make the evidence generated by reduced form studies of the Friedman-Meiselman type hard to interpret, as I argued in Laidler (1971). Note that there is an even more fundamental reason, that arises from analysis that involves the rational expectations hypothesis, why we must regard price and output interaction as part of the transmission mechanism. This is taken up below. (See, pp. 30-33).

[17]The mechanism in question is sketched out in Fisher (1926) and cited with approval by Friedman (1975). In the modern literature the Fisherian approach to the transmission mechanism underpins the work of Lucas (1972) (1975), and Sargent and Wallace (1975).

[18]Of course the absence of a Walrasian auctioneer makes a fundamental difference to our whole view of how the macro-economy works. This is precisely the theme of the work of Clower (1965) and Leijonhufvud (1968). The Fisherian approach to the expectations augmented Phillips curve, particularly when it is combined with a rational expectations hypothesis, essentially leads to a macroeconomics based on Walrasian general equilibrium analysis, and which thus seems quite incompatible with the Clower-Leijonhufvud extension of Keynesian economics.

[19]The paper in the Phelps (1970) volume which explicitly analyzes the price setting behavior of firms is of course that of Phelps and Winter.

[20]Jonson, et al., (1976) have explicitly utilized such a view of the transmission process in a small scale econometric model of the Australian economy with some success. As the reader will recognize, and as Jonson et al.

acknowledge, the underlying mechanics of this process are very similar to those first set out by Archibald and Lipsey (1959) in their commentary on Patinkin (1956). Note that Howitt (1974) embeds this mechanism in a model in which price setting is endogenous, and shows that it still leads to stable equilibrium in a monetary economy. Hicks (1974) makes much of the role of inventories in permitting output dynamics to get underway and persist over time, but his analysis differs crucially from that outlined here in not permitting wages and prices to vary systematically (relative to expectations) with the level of real activity.

[21]Lucas and Rapping (1969), Alchian (1970) and Mortensen (1970) are among those who have analyzed a labour market Phillips curve as a supply curve.

[22]Thus, Hicks (1974), Ch. 3, argues that the behavior of money wages is dominated by institutional factors and hence is not susceptible to influence, to a policy relevant extent, by variations in the level of aggregate demand in the economy. This view was, until recently, widely held among British Keynesian economists, far more widely held than Ball and Burns (1976), who themselves did not hold this view, seem to think.

[23]Friedman when discussing actual inflationary processes (e.g., (1974), pp. 87-9) has it that monetary policy affects output first, and prices subsequently, the whole chain of causation taking about two years to work out.

I find it hard to reconcile Friedman's perception of the facts--with which I agree--with his espousal of the Fisherian approach to the analysis of the interaction of prices and output. It is worth noting that, in (1968) his 1967 AEA Presidential Address he seemed to adopt a Phelpsian interpretation of these matters, and only subsequently (1971) adopted the Fisherian view.

[24] Price setting is by no means the only aspect of economic agents' behavior influenced by expected inflation. If the nominal rate of return on money is fixed at zero by cartel arrangements, as it is thought to be in many economies, then the opportunity cost of holding money increases with the expected inflation rate; less real balances are held, the higher the expected inflation rate. Moreover, the rate of return on all nominal assets must be adjusted upwards by the expected rate of inflation if their holders are to get the same real rate of return as they would in a constant price level situation. This consideration makes it essential, as we shall see below, to distinguish between real and nominal rates of return when discussing the role of interest rates in the transmission mechanism. However, as the work of Klein (1974) suggests, cartel arrangements probably do not work very well so that the own rate of return on money (including the value of various services which banks provide for their customers) does, to a considerable extent, move along with market rates of interest.

[25] The considerations just outlined make it difficult, at least for this writer, to regard as very helpful to our understanding of the world we live in the results of simulation exercises with large models which trace out the effects of a step change in the money supply. See Modigliani (1975)

for an example of such an experiment. This is not to say that when teaching macroeconomics there is no paedagogic value to analyzing the consequences of a step change in the money supply, as a preliminary step to dealing with the consequences of the more empirically relevant case of a change in the monetary expansion rate.

[26]Of course if velocity is sufficiently sensitive to the rate of inflation, the system can become unstable. This is precisely the problem examined in Cagan's (1956) classic article on the dynamics of hyperinflation.

[27]On the first assumption, see Phelps (1972), Ch. 3. The relevant literature on the second concerns the long-run "superneutrality" of money and is briefly surveyed in Laidler and Parkin (1975), Section 2.

[28]See Laidler, forthcoming, Chapter 7.

[29]Gibson attributes the subsequent rise in interest rates to induced increases in income, rather than to increases in the expected inflation rate, but he bases his conclusion on what is now widely regarded as an implausibly long estimate of the delay with which interest rates respond to changes in the expected inflation rate: thus the above paragraph reinterprets his evidence.

[30]The basic work on rational expectations is of course that of Muth (1961). Recent applications of this idea to the problem under discussion here include Lucas (1972) (1975), McCallum (1975), Sargent and Wallace (1975) and Walters (1971).

[31] For example, it was widely agreed in the United Kingdom in the first half of the 1970's that "money did not matter" as far as the generation of inflation was concerned. The ex post evidence however, would seem to give the lie to this point of view. It is now an interesting question as to what would have constituted "rational expectations" in Britain during that period.

[32] As soon as the rate of monetary expansion changes, agents must recognize, not only that the long-run equilibrium rate of inflation has increased, but also that, in the absence of a step fall in the money supply, the economy must move to the higher price level associated with an increased velocity of circulation. The latter change, if it is foreseen, involves a step jump in the price level and hence an infinite rate of inflation for an instant. As a result of this, completely rational agents would "flee from money" and generate an explosion in the price level. This problem was recognized by Sargent and Wallace (1973) who got around it essentially by introducing a small time delay in the formation of rational expectations which permitted the step jump of the price level to take place without being anticipated. This type of problem also turns up in the analysis of the inflation tax in a perfect foresight monetary-growth model. See, for example, Auernheimer (1974) and Marty (1976).

[33] Note that Poole (1976) argues that a relatively extreme form of the rational expectations hypothesis is more likely to be relevant in the "flex-price"--he uses the term "auction"--market for securities, than in "fix-price"--non-auction--markets for goods and labour. Poole nevertheless reaches substantially the same conclusions as do I about the relevance of a looser form of the hypothesis.

[34]On this matter see particularly Fisher and Sheppard (1974). Note that investment models that use Jorgenson's "cost of capital" concept, provided they take proper account of the expected rate of change of the nominal price of capital goods may appropriately include a nominal interest rate variable. Hence, the investment equations of the large scale models that rely a Jorgenson's approach-- such as the FMP, RDX-2, LBS and CANDIDE models, are potentially immune to this criticism.

[35]It is worth noting that this essentially "Wicksellian" type of monetary policy is incompatible with the existence of rational expectations. So long as there is a gap between the natural and money rates of interest, there is a potential for inflation to go on without limit. Hence, with rational expectations, the price level would instantaneously explode. Note that Wicksell himself recognized this problem. See Wicksell (1898), p. 97. I am indebted to Malcolm Gray for discussion of this matter.

[36]An excellent brief survey of the crowding out debate is to be found in Carlson (1975).

[37]This is a point of which Kaldor (1970) made much. However, the experience in Britain over the years since 1973 has involved large budget deficits combined with relative monetary stringency and does provide a potentially crucial experiment on this question.

[38]The evidence drawn from open economies, to which I refer below, is particularly important precisely because the adoption of different exchange rate regimes, or the act of changing the level of a fixed exchange rate, provide just such a break in the rules under which monetary policy operates.

[39]For a discussion of these issues see Bell (1974).

[40]The properties of the model in which this occurs have been investigated in Laidler (1975), Ch. 9.

[41]The argument of this paragraph is not intended to imply that either this author or his colleagues knew that they were providing evidence on the rational expectations hypothesis in the work cited. We were aware that an open economy made a difference to the manner in which expectations were formed, and that the nature of the exchange rate regime would also make a difference. However we did not at the time recognize that this could be regarded as a special case of the more general phenomenon that is now known as rational expectations.

[42]See Parkin (1977, forthcoming) for a succinct account of this approach and the problems it raises.

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