

WHAT WAS THE MATTER WITH IS-LM?

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1. At a conference on "Recent Developments in Macroeconomics," elementary IS-LM might be a somewhat unexpected topic. IS-LM, after all, has been around for a while. It ruled research for 30 years or more and, in the teaching of macroeconomics, a better mousetrap is still to be invented. For the last fifteen years or so, however, it has been out of favor even with many economists who do not quite know what to put in its place. And in the last decade, theoretical research in macroeconomics has moved away from this frame of reference.

Why are we bent on abandoning IS-LM ? It would seem that this is a question to which we ought to have a clear answer. An answer is needed for the appraisal of "Recent Developments". Do fix-price temporary general equilibrium models solve (or successfully avoid) the problems we had with IS-LM ? Do rational expectations models ?

Well -- what were those problems ?

2. Different people are apt to have different answers to that question. Every teacher of macroeconomics has his own list of "troubles" with IS-LM. But almost all of those one hears frequently mentioned are surely remediable deficiencies. Taking inventory of the most popular complaints does not seem a promising tack, therefore.

My title does not ask what's wrong with IS-LM. We are not looking for some simple error or omission. Omissions would have been remedied long ago. Fatal error is inconsistent with the long dominance of the framework. Yet IS-LM, somehow, does not do what a good model is supposed to do, i.e., be dependable in producing the right answers to questions in the hands of

(*) The argument of this paper is a subsidiary theme of my "The Wicksell Connection : Variations on a Theme", which will appear in A. Leijonhufvud, Information and Coordination : Essays in Macroeconomics, Oxford University Press (in press).

students (for example) who may not understand all that much economics yet but do know their algebra. It is a good vehicle for demonstrating certain relationships, which is why we continue to use it. But some questions are more easily understood or analyzed without it than with it. In the end, it is probably not a short-cut to understanding macroeconomics, for knowing when to use it and when not to rely on it seems to be more difficult than the subject matter itself. Even the best economists can go wrong with IS-LM on occasion.

In my opinion, IS-LM has served us ill in three long-lasting controversies.

(1) In the Keynes and the Classics controversy, IS-LM produced, in the end, widespread agreement on the wrong answer, namely, that Keynes was merely doing orthodox economics with rigid wages¹⁾.

(2) IS-LM was used to deny that the issues of the Loanable Funds versus Liquidity Preference controversy were of serious consequence to general macrotheory²⁾. This was a mistake.

(3) In the course of the Monetarist controversy, IS-LM has proved a less than helpful framework for producing agreement between the two sides on what the empirically important issues are³⁾.

I will try not to bore the reader with a rehash of my views on (1). Some observations on (2) will be made. But this paper will deal mainly with (3), the Monetarist Controversy, as seen through IS-LM glasses darkly.

3. There are, somewhat simplistically speaking, two broad approaches to macroeconomics today. In one, which I have elsewhere called the

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- (1) Cf., e.g., Leijonhufvud, Keynes and the Classics, London 1969, Lecture 1. My own disaffection with IS-LM, obviously, starts here.
- (2) Loanable Funds vs. Liquidity Preference started out, of course, as part and parcel of the Keynes and the Classics debate. Following its wrongful dismissal from amongst the major issues of the latter, it has lived an independent and somewhat fitful existence as a sometime preoccupation of a small number of specialists in monetary general equilibrium theory. It is convenient to treat it as a separate set of issues here.
- (3) Thus Professor Tobin would maintain, for example, that the magnitude of the interest-elasticity of the LM reduced form is a critical issue between the two camps, while Professor Friedman maintains that it is not decisive in determining whether you are a "monetarist" or not.

"spanner-in-the-works" approach, coordination failures are explained as the consequence of rigidities in the economic system which prevent it from adjusting appropriately to parametric disturbances. For the individual agents of the system, the obstacle to appropriate adjustment may be coercion or past commitment to a (possibly implicit) contract or to a particular structure of physical capital. When this approach is being followed, it is usually not an important issue whether agents do or do not correctly perceive the potential gains from trade that they are in any case prevented from exploiting. Since this is so, the standard conceptual apparatus of static equilibrium theory--which assumes that agents have full information about their opportunities--may as well be utilized. Economists of this persuasion are consequently less likely to question the adequacy of standard neo-Walrasian theory as a microfoundation for macroeconomics and also less likely to see any reason why IS-LM should not serve perfectly well, at least for the proper care and feeding of undergraduates.

In the other approach, which we may cheerfully call the "mud-in-the-eye" approach, coordination failures are explained as the consequence of the failure of agents correctly and completely to perceive the opportunities present in the system. Thus, "stickiness" of certain prices, for example, are interpreted, not as due to constraints on price setters, but as due, instead, to their ignorance of changes in relevant market conditions. Economists who try to follow this approach find that they make lots of trouble for themselves for all the nuts and bolts and tricks of standard models are apt to be fashioned on the assumption that agents do know market conditions. So this group has problems with static price theory and is also likely to have problems with IS-LM.

Perhaps it would be better to talk of "emphases", rather than "approaches", for the two are obviously not mutually exclusive. In pursuing, for instance, the incomplete information approach as far as it will go, one need not be committed to the belief that the world is free of institutional or other rigidities of significant consequence.

Here, however, the question of the title will be discussed altogether from the incomplete information perspective.

4. It is sometimes complained that IS-LM is "too static". As we will see later, however, one might with at least equal justice voice the complaint that "it is not as static as it seems". IS-LM, as it is most frequently utilized, is neither static nor dynamic. It is a "short-run period model" --the accepted term for a static model with which one tries to do dynamic analysis. We had better clarify its status in relation to the two concept pairs "static-dynamic" and "long run-short run".

The most widely accepted definition of dynamics in economics is the one due to Sir John Hicks : When the quantities that appear in our model must be dated, we are doing dynamics. For present purposes at least, I would like to amend the Hicksian definition to read : When we must date the decisions taken by various agents, we are doing dynamics. In statics, then, we need not date decisions-- because it does not matter in what sequence they are made.

The temporal order of decisions is of analytical significance if (and only if) transactors have to act on incomplete information. In models, where agents are assumed to have complete information, all choices are made at the same time. The multiperiod general equilibrium model is the best example. It is "dynamic" by Hicks definition, since an infinite number of future periods add as many dimensions to its commodity space. It is "static" by the present definition, since the opportunities and preferences defined over this space pose just one choice for each agent and since the simultaneous market reconciliation of the choices of all agents is provided for. Everything is decided simultaneously at the origin of time in this construction.

The well-known "cobweb" model illustrates the opposite case. Here, consumers and producers are assumed to take turns making decisions. On odd-numbered dates, consumers get to set a demand-price on the output that has been produced. On even-numbered dates, producers must choose their outputs for next period. The system oscillates because, at the point in time when producers have to commit themselves, they do not have, nor are they able to anticipate, the information most pertinent to the output decision, namely, the price that it will fetch. If we provide the producers with sufficient additional information--e.g., by putting a futures market into the model or by assuming rational expectations that will substitute for

such a market-- they will find the market equilibrium directly⁴⁾. The dynamic behavior of the system becomes of no interest. The exact sequence of events no longer matters. The static supply-and-demand cross tells us everything we want to know.

One further illustration will help to suggest approximately where one might draw the line between "complete" (or "full") and "incomplete" information. Arrow and Debreu generalized the metastatic neo-Walrasian model to deal with a probabilistically uncertain future. In their famous contingency market model, it is also true that all choices are made at the origin of time. I would like to subsume uncertain knowledge of this kind, therefore, under "complete" information. But can this be justified?

In the Arrow-Debreu model, agents plan for all possible futures. No matter what the future brings, they have anticipated it perfectly and have concluded the contracts that are optimal to this contingency. All they learn, therefore, as the future moves into the present, is what particular Markovian railroad track the world is fated to run out. In a more fundamental sense, they have nothing to learn. They do not learn, for example, what it is like to grow old, that is, they do not "discover" anything about themselves (and their preferences) that they had not already anticipated. In particular, they do not learn anything about the economic system that they did not already know. Their understanding does not change⁵⁾.

Processes of this type are equilibria in the sense suggested by Hahn, in that further experience with market interaction will not teach agents anything that significantly alters their beliefs.⁶⁾ We may note also that the rational expectations approach, which assumes that agents fully understand the world that they inhabit, has produced a class of equilibrium models of the business cycle. Lucas explicitly interprets business cycles as the period-by-period revelation of a particular Arrow-Debreu contingent-claim

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- (4) Students used to be told that the cobweb model oscillates "because production takes time". But the time-consuming nature of physical processes is significant only in so far as it is associated with an information-lag.
- (5) It is a world in which economic theory need not be taught and where the only economic research needed would be of the simplest fact-finding variety. What a threatening picture to paint on the wall!
- (6) This is loosely paraphrased. For the original statement, cf., Frank H. Hahn, On the Notion of Equilibrium in Economics, Cambridge University Press, Cambridge 1973.

time-path⁷⁾. And preceding both Hahn and Lucas, we have Hicks : "Equilibrium over time requires ... (that) there can be no revision of expectations at the junction between one 'short' period and its successor"⁸⁾.

The older theories of business cycles were generally not equilibrium theories by these criteria. It is for the representation of these "dynamic" or "disequilibrium" theories that IS-LM has been so much utilized. In trying to understand these theories from the incomplete information standpoint, it may then be a good idea to examine the sequence of interactions that lead up to IS-LM solution states.

5. In the "long run" of price theory, all adjustments have taken place. In the "short run", some adjustments "have not had time" to be completed. Originally, in Marshall, the distinctive characteristic of the short run was that stocks need not be stationary but that net investment or disinvestment may be going on. Except for the adjustment of stocks, all activities were "equilibrated" in the Marshallian short run. More recently, new short run notions have begun to proliferate in the literature to fit all sorts of incomplete adjustment cases.

For macroeconomics, Marshall's long run does not seem to be the most useful full adjustment benchmark. Since, most of the time we are dealing with growing economies, the stationarity condition is inappropriate. An economy travelling on an equilibrium growth-path is "fully adjusted" as far as the coordination of economic activities is concerned. If we are to be able to define what "goes wrong" with the adjustment of the system we need a clear conception of what "full adjustment" would entail. So what should this benchmark be like ?

The suggestion here, of course, is that it should be complete or full information. This term should not evoke notions of perfect foresight or costless information. It should convey, rather, the sense of a situation

(7) Cf., Robert E. Lucas, Jr. "Methods and Problems in Business Cycle Theory", Paper presented at the American Enterprise Institute Conference on Rational Expectations, February 1980.

(8) J.R. Hicks, Capital and Growth, Oxford University Press, Oxford 1965, pp. 92-93. Also cited by Hicks in "The IS-LM Question", in this volume.

in which agents are not going to learn anything new or surprising from continued market interaction⁹⁾. In a full information state, agents have learned all that can be (profitably) learned about their environment and about each others' behavior. In economies that are not hampered by rigidities adjustments will then be complete ; people are not going to change their behavior. Full information states are equilibria in this sense. By the same token, incomplete information states are, of course, "disequilibria" in the sense that when people proceed to interact in markets on the basis of the information they possess, some of them will discover that they are acting on incorrect (and unprofitable) premises.

It would be a mistake, I feel, to press the badly used and badly worn Marshallian "long run"/"short run" terms into the further service of covering also the "full information state"/"incomplete information state" concepts¹⁰⁾. Marshall had in mind the actual creation and installation, or depreciation and wearing out, of physical capital as the adjustments needed to bring about a stationary state. These are processes that necessarily take long time--"real", calendar time. We are not concerned with stationarity, but with the coordination of activities. The degree to which coordination is achieved depends upon the state of knowledge and convergence to full coordination on the speed of learning. Learning can be sometimes fast and sometimes slow.

To illustrate the point, consider the complaint voiced with some frequency by Keynesians in the course of the Monetarist controversy : "The trouble with Friedman is that he takes propositions that we all agree are true in the long run and uses them as if they were true in the short run". What does it mean ? What we all agree to be true in the long run is that money is neutral. In the long run, therefore, nominal income is proportional to the money stock. Friedman has a monetarist theory of nominal income in the short run. Keynesians object to it because they do not think money stock policy is as effective and reliable as this would imply¹¹⁾.

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- (9) Disappointments or surprises of a sort may still occur. But they should then be in the nature of lottery outcomes (or harvest results) where it is too late for the winner or loser to do anything about it. Also, the outcome should not change the agent's willingness to play the game or the strategies he uses in doing so.
- (10) Most of all, of course, we want to avoid calling the mathematical solution to an incomplete information model a "short-run equilibrium".
- (11) This is not the only objection to Friedman's theory that is suggested when this loosely worded complaint is aired. But it will do for our illustrative purpose here.

Friedman might presumably say the same thing about Lucas (or Sargent, Wallace, and Barro) : "The trouble with Lucas is that he takes propositions that I agree are true in the long run ..." etc. What would this mean ? In Friedman's theory, the long-run Phillips curve is vertical, so that monetary policy has only price level effects in the long run. In Lucas' theory, anticipated monetary policy is neutral right away. Friedman would object because he does not believe anticipated monetary policy to be without consequence for real variables in the short run.

When Sam played it again (fans of Casablanca will remember) his words were

... the fundamental things apply

As Time Goes By

The trouble here is that the Fundamental Things might apply without much time at all going by^{12/}. It depends upon how much people understand and what information they receive. In the two cases just mentioned, Friedman's transactors are assumed to know more than Keynesians think is reasonable, and to know less than Lucas thinks it reasonable to assume for his transactors.

This last statement could stand some more explanation. But we are not interested in the transmission of monetary impulses for its own sake here, but only in order to find out what is the matter with IS-LM. There are a number of things to be done before we can return to the transmission question and look at it from the IS-LM angle.

6. Full information macroeconomics (FIM) would be a useful branch of the subject. We may not be terribly fascinated with a kind of macroeconomics in which little, if anything, ever goes wrong. But FIM would be useful as a benchmark construction. Its main purpose would be to define the adjustments that must take place if the system is to adapt fully following some disturbance, such as a shift of the investment function or a change in the money supply. Knowing this is helpful in trying to define exactly what is the trouble assumed to occur in various macrotheories in which much, if not everything, always goes wrong.

Use of FIM constructions, on the other hand, does not commit us to the belief that the system will always or normally adapt smoothly and rapidly no matter what the disturbance; nor does it force us to preclude the very

(12) Love at first sight is one example--a case of irrational expectations. In the drearier area of rational expectations, the example would be Money at first sight.

rapid convergence of the economy on full information equilibrium in certain cases. We do not want invariably to associate the notion of a FIM state with either the short run or the long.

For present purposes, we want an FIM model that will match the structure of a simple IS-LM model. For present purposes, also, it is not necessary (fortunately) to derive and justify the properties of the FIM model in any detail. It will be all right to "suppose" a system with certain FIM properties, and then look at it through its IS-LM version. Our FIM model should, of course, have a reasonable family resemblance to Hicks' Classical model. So, we suppose the following :

$$\begin{aligned} (1) \quad & X = f(N, K) \\ (2) \quad & N^d = f_N^{-1}(w/p) \\ (3) \quad & N^S = g(w/p) \\ (4) \quad & N^d = N^S \end{aligned}$$

The notation is too familiar to need explanation. The first four equations state that labor supply and derived demand for labor in a competitive, one-commodity system determine output, employment, and the real wage rate in FI states.

$$\begin{aligned} (5) \quad & I = I(r) \\ (6) \quad & S = \underline{X} - C(\underline{X}, r) \\ (7) \quad & S = I \end{aligned}$$

Saving and investment determine the rate of capital accumulation and the real interest rate.

$$\begin{aligned} (8) \quad & M^d = \underline{kpX} \\ (9) \quad & M^S = \underline{M} \\ (10) \quad & M^S = M^d \end{aligned}$$

Money supply and money demand determine the price level. For certain purposes, we will substitute a more common liquidity preference function, (8') $M^d = p \times L(X, r)$, for the constant velocity function (8). For the time being, however, we are supposing that, in comparisons between FIM states, velocity will be found unrelated to the real rate of interest.

In this paper, we will discuss only two macroeconomic questions : What are the effects of a change in the money supply? and What are the effects of a decline in the marginal efficiency of capital (MEC) ? For

brevity, we will refer to the two parametric shifts as the "monetary shock" and the "real shock".

The comparative statics of the above FIM model are so simple as to be obvious. The relevant results might be summarized as follows :

i) Monetary shocks have no real effects. Only the price level is affected. Note in particular that the real interest rate is not. Conceivably, it may be a long, long run before we get neutrality, but FIM comparative statics should skip by all intervening incomplete information states in silence.

ii) Real shocks have no monetary consequences. A decline in the MEC is interpreted here as a worsening of the terms on which a society can trade present goods for future goods--the terms being judged according to the best information available to that society. (For simplicity, think of a decline in the rate of embodied technological progress). The rational adaptation entails a lower rate of capital accumulation, a transfer of resources to consumption goods industries, and a lower real rate of interest. It does not entail unemployment of course, nor (in this FIM model) a decline in the price level.^{13/}

7. The macroeconomics we actually teach, of course, bears no clear relationship to full information macro. Instead of the static properties of some FIM model, the beginning student may be given one or the other of two crosses to bear. The first one uses a Keynesian saving-investment cross to determine (real) income. Call it "Model A". The second employs a given money stock and a "Cambridge k" money demand to determine (nominal) income.^{14/} Call it "Model T."

$$(A:1) pS = p[X - C(X)]$$

$$(A:2) pI = p\underline{I}$$

$$(A:3) pS = pI$$

$$(T:1) M^d = \underline{k}pX$$

$$(T:2) M^S = \underline{M}$$

$$(T:3) M^d = M^S$$

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If we replace (8) with (8'), however, a decline in MEC will produce not only a decline in the growth rate and a decrease in the real rate of interest, but also an increase in the amount of real balances demanded and hence a decline of the price level.

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There is some recklessness here in the use of "determine". But the beginning student should not be bothered by "missing equations" when first trying to fathom the familiar diagrams.

Why do we start students off this way ? Are these gadgets supposed to be easier to understand than a FIM model ? Whether the student is fed A or T as his first introduction to macro, he has had a switch pulled on him before he even got started. In our FIM model, contra Model A, saving and investment have nothing to do with the level of income, whether real or nominal ; and, contra Model T, money supply and demand determine the price level and not real income or the product of the two. Full information macro may have little direct bearing on problems of unemployment and short-run stabilization policy. But why does "relevant" macroeconomics start off by replacing FIM (5)-(7) with Model A, or else by replacing FIM (8)-(10) with Model T ?

As suggested in the previous section, it is not really a very good answer to say that FIM is long run and Model A (say) short run. That leaves the student on his own to try to figure out why saving and investment determine income in the short run but the rate of interest in the long run.^{15/}

Since A and T both differ from FIM, our answer should be that certain information failures (or rigidities) are taken for granted--so much, so, in fact, that they are built into elementary models as if they were inescapable features of the real world. The monetarist controversy started off, in effect, with a confrontation between Models A and T. To understand the theoretical issues in that controversy, it would seem desirable, then, as a first step, to explain how A and T, respectively, depart from a full information (all things flexible) model. This would tell us what the information problems (rigidities) are that are presumed to be ever-present--or ignored as implausible--by each side.

Model T is the simplest. In the rigidities (R)-version: To the extent that prices (wages) are sticky, a change in the money stock will affect real output, X , and not just prices, p . In the incomplete information (IIM)-version anticipated changes in money affect prices, but unanticipated ones affect real income as well.

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Beginning macro can be made even more challenging for him by suggesting that the reason for "switching" what saving and investment are made to determine lies, somehow, in the short-run stickiness of money wages.

For Model A, the R-version would state : To the extent that intertemporal prices (i.e., the interest rate) do not adjust to a change in perceived intertemporal production opportunities (i.e., MEC), changes in investment will lead to changes in aggregate money income. The corresponding IIM-argument would run: Whereas changes in the realizable rate of profit that are generally recognized will affect only the interest rate and the growth path, unrecognized such changes will affect money income. Except Model A is more extreme than that--it asserts that (R) the interest rate never responds or (IIM) the market never knows what is going on, so that the rational FIM-adjustment (which leaves income unchanged) can be excluded as a possibility from the model.^{16/} Model T is more reasonable in that, specified as a theory of nominal income, it leaves the extent to which the FIM response is approximated an open question.

Two long-established stylized facts lend plausibility to A and T, respectively, as candidates for the first thing the student should learn in macroeconomics. For Model A, we have the fact (SF:1) that investment and GNP are positively correlated over business cycles with investment showing a larger amplitude than other components of income. For Model T, of course, we have (SF:2) the positive correlation between the money stock and nominal income. The monetarist controversy started out as a statistical contest over the dependability of these stylizations. Although no economist alive will confess to belief in either Model A or Model T, the issues for Round I of the controversy are produced by putting the two on collision course: the relative stability of the consumption-income and the money-income relations; the appropriate empirical components to be included in "autonomous expenditures" or in the money supply respectively; the "autonomy" of investment and the "exogeneity" of the money stock; the effectiveness of fiscal and monetary policy actions and the predictability of their consequences.

Econometric contention over these issues did nothing to bring out the information failures implicit in the debate.

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Worse than that. Model A clearly allows us to eliminate the p's everywhere. Then it asserts, in addition, that shifts in investment must change real income, implying that the imperfection admitted as a possibility in Model T is inescapably present also in A.

8. From A or T, our student graduates to IS-LM. By linking A and T by the real rate of interest, r , we obtain the simplest version -- a model of nominal income :

$$\begin{array}{ll} \text{(AT:1)} \quad pS = p[X - C(X,r)] & \text{(AT:4)} \quad M^d = p \times L(X,r) \\ \text{(AT:2)} \quad pI = pI(r) & \text{(AT:5)} \quad M^S = \underline{M} \\ \text{(AT:3)} \quad pS = pI & \text{(AT:6)} \quad M^d = M^S \end{array}$$

On this loftier plane, new riddles appear. In the comparative statics of our FIM model, real and monetary phenomena were independent of one another. In IS-LM, as usually taught, real disturbances have monetary consequences and vice-versa-- unless extreme assumptions are made about the elasticities of IS and LM. Is it plausible that this two-way interdependence also stems from information failures of some sort ?

Round II of the monetarist debate necessarily had to lead on to consideration of these interdependencies as well. An A-theorist who relies on SF:1 to argue that changes in autonomous expenditures cause income movements must also explain away SF:2 as showing endogenous movements in the money stock.^{17/} A T-theorist similarly has to explain away SF:1. IS-LM gives us a handle of sorts on the interaction of real and monetary phenomena, so it became, rather naturally, the framework for debating these interaction issues.

The IS-LM model is used, in this type of context, as if one was doing comparative statics with a genuinely static model. Real disturbances (or fiscal policy actions) are represented as shifting IS, while LM stays put ; monetary disturbances (i.e., policy) as shifting LM, while IS stays put. The issues of Round I were gone over again in this framework and Crowding Out and Gibson's Paradox added.^{18/} IS-LM curve-shifting will

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For our simple AT model to serve this purpose, its fifth equation had better be changed into $M^S = M(\underline{B}, r)$, with B denoting the monetary base.

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Gibson's Paradox is the positive correlation of the interest rate and price-level over business cycles. Tooke's stylized fact would be a better name for it, since Tooke was the first to pose it as an empirical challenge to monetary theories of nominal income movements. In the IS-LM setting, movements of the LM locus with IS stable should give rise to negative correlation between the interest rate and nominal income. In this discussion of IS-LM we will leave this SF:3 aside.

suggest that the values of the elasticities of the two curves are crucial to the issues of the monetarist debate. Many of the participants accepted this suggestion. The discussion tended to presume, moreover, that these elasticities are stable properties of the system, that the results of time-series regressions give information on these steady-state elasticities, and that qualitative results from a priori static choice theory have a bearing on the issues in sufficing by themselves to exclude extreme values.

There are two extremist possibilities. The "fiscalist" extreme would postulate a vertical IS and/or a horizontal LM ; the monetarist extreme a horizontal IS and/or a vertical LM. Putting it this way tends to suggest that, surely, all moderate men of sound judgment will take a position somewhere in the middle. The trouble is that this moderate position (like the fiscalist extreme) implies that real impulses always must affect income and that monetary impulses always must change the economy's rate of growth. It implies that the rational FIM adjustments can never happen. And the monetarist extreme will imply that real impulses never change income and that monetary impulses never disturb the growth-path. In either case, "sometimes" is the (econometrically troublesome) possibility that is being excluded by construction. This steady-state version of IS-LM is a model that will not allow representation of an economy that adapts more or less well to shocks depending upon the state of information.

Note that if it were to be the case that these short-run interactions of real and monetary phenomena are due to incomplete information on the part of agents, then the steady-state elasticities view is seen to be misleading. What the response to a particular impulse will be then depends upon the state of information and not just on steady-state behavioral parameters. What counts is the extent to which the nature and extent of the shock is recognized or unrecognized, anticipated or unanticipated, perceived as permanent or as transitory. The same impulse need not produce the same response every time it is repeated.

In order to reexamine the interaction of real and monetary phenomena in the IS-LM model, start back with A and T, with the propositions that are fundamental to each. Money income, in Model A, will decline if and only if intended saving exceeds intended investment (so that we have an

excess supply of commodities). In Model T, money income will decline if and only if the prevailing state is one of excess demand for money. So far the two are consistent. But we have two contrasting hypotheses about causation. In A, a decline in investment produces the ES of commodities. In T, a reduction in the money supply produces the ED for money. If we scrutinize the A story through the suspicious eyes of a T-believer and then let an A-believer have his turn with the T story, we obtain two questions about "transmission".

(1) Why should real disturbances be expected to cause an excess demand for money and thus a change in the nominal income level (and, if money prices and/or wages are inflexible, a change in activity levels) ?^{19/}

(2) Why should monetary disturbances be expected to cause saving and investment intentions to diverge (and thus to change nominal income, etc ...) ?^{20/}

Let us begin with the second of these questions.

9. The effects of an increase in the money supply are usually demonstrated by shifting LM rightwards. With IS assumed to stay put ("in the short run"), money income rises and the interest rate declines. What kind of transmission mechanism does this suppose?

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Empirically, do real disturbances cause income movements? Always, sometimes, or never? The Keynesian answer is that they always do (although Cambridge Keynesians would insist, as we will see, that they do so without creating an ED for money in the process). Monetarists think "never" is the better conjecture.

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Empirically, do they? Always, sometimes, or never? In the various macrotheories stemming from Wickseil (which include the Austrian and Keynesian theories) it is presumed that monetary impulses do work this way. In modern monetarism it is presumed that they will always create an ED for commodities but not by disturbing the growth-path. The clearest contrast, on this score, is that between Hayek and Friedman.

In order to discuss the sequence of events, we supplement our simple IS-LM model with an Excess Demand Table.²¹ We count four goods: labor (L), commodities (X), securities (B), and money (M).

ED Table 1	L	X	B	M
FIGE ₁	0	0	0	0
M ^S increased				
Impact effects	0	0	ED	ES
r declines				
Inflationary pressure	0	ED	0	ES
p _X rises				
Nominal income "equil"	?	0	0	0

The IS-LM story of the once-over money injection should begin with the following course of events: (i) we assume the initial state to be a full information general equilibrium -- all excess demands are zero and the demands and supplies from which these ED's are computed are generated by FI individual conceptual experiments and aggregation over transactors. (ii) We assume a disturbance that creates excess reserves in the banking system. The banks expand, creating an ES of money and an ED for securities. The ED that implicitly corresponds to the explicitly specified ES of money is found to be 100% in the bond market, rather than distributed over all non-money markets, because the banking system is assumed to demand nothing but securities. Note, however, that we know that the ED-distribution at impact of the disturbance must be as specified in the Table also for another reason.

²¹ Also known as a one-armed bandit. For four "lemons" in a row, the machine will pay the general equilibrium jackpot.

Whenever IS is assumed to be shifted by the disturbance, the impact effect must be zero in the commodities markets. Holding IS constant, when LM is shifted, consequently, is a strong assumption. (iii) Next, interest rates decline in response to the ED_B and until this ED becomes zero; demand prices for assets rise relative to their current rental values and relative to their initial supply prices; planned investment thus exceeds saving so that the state of the economy at this stage is one of money ES and commodity ED. (iv) Looking at the third row of the Table, A and T believers will agree on what must happen next: Money income will rise.

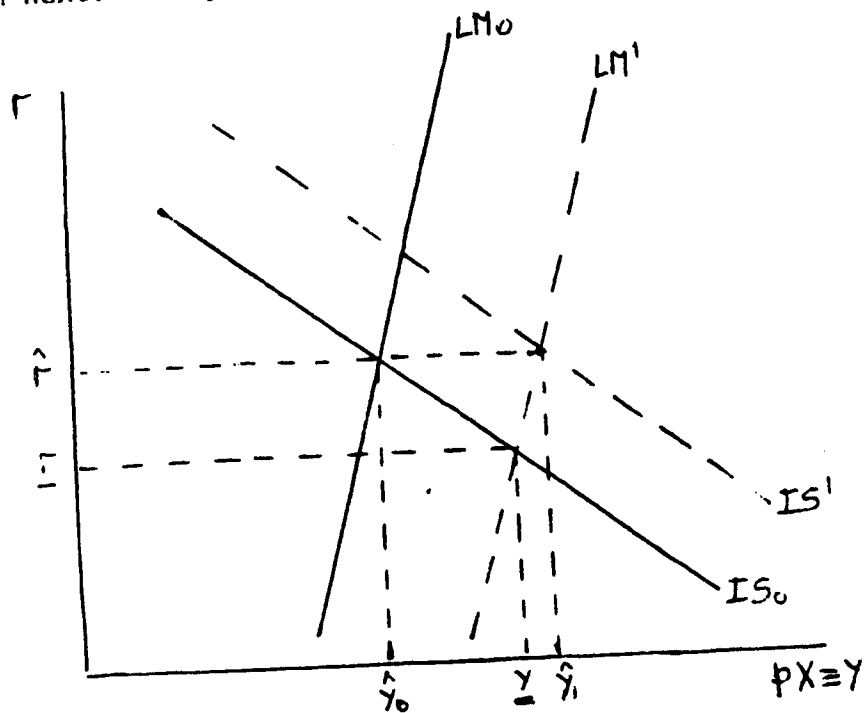


Figure 1

That finishes Phase 1 of the IS-LM tale. It takes us from the initial FIGE at (\hat{Y}_0, \hat{r}) in Fig. 1 to the IS-LM "short run" at $(\underline{Y}, \underline{r})$. But this cannot be a full STOP. There has to be a further GO at $(\underline{Y}, \underline{r})$ because in

the comparison of initial and terminal equilibria money must be seen to be neutral. This requires that we end up in some $FIGE_2$ with the same relative prices as in $FIGE_1$, e.g., at (\hat{Y}_1, \hat{r}) in Fig. 1.

Phase 2 of the story might run as follows: When at stage (iv) nominal income rises, some part of this is an increase in p but some part of it initially takes the form of an increase in real output, X , and employment. For concreteness we may suppose that these departures from "natural" FI activity levels are due to a temporary information asymmetry between employers and employed. Suppose that firms learn the truth about the new price level before workers do. Observing the demand-prices for their output going up in relation to money wages, firms find that they can hire labor at a reduced real wage. Workers whose perceptions of the inflation are lagging believe they are being hired at somewhat improved real wage rates. Consequently, the two sides of the market will agree (at some money wage between \hat{w}_0 and \hat{w}_1) to a volume of employment exceeding the FIGE one. (v) As prices (and nominal rentals) increase, aggregate demand in money terms will come proportionally to exceed the level indicated by IS_0 at whatever the interest rate happens to be. So IS shifts rightwards.²² (vi) In this process, workers discover that

²²If we had chosen to draw Fig. 1, with real income, X , rather than nominal income, $pX \equiv Y$, on the horizontal axis, this part of the story would be told in terms of rising prices gradually reducing real balances back to their initial level. LM would be shown to shift back rather than IS also shifting out.

For present purposes, having the diagram in terms of nominal income seems pedagogically preferable. Doing the exercise in real income has the advantage of highlighting the point of the Archibald-Lipsey critique of Patinkin, namely, that real balance effects result from evaluating nominal balances at disequilibrium prices. If and when we can assume that money balances are evaluated at equilibrium prices, we regain the valid Classical Dichotomy, that is to say, the FIM "independence" of real phenomena on monetary ones.

real wages are not what they supposed them to be. The initial overshooting of output and employment is corrected, so that with X declining back to \hat{X} , prices increase further. The process ends up with a new FIM state with the monetary impulse having affected only nominal magnitudes.²³ In terms of the IS-LM diagram, both schedules are shown to have shifted to precisely the same extent.

Once the sequence is spelled out in this way, it is obvious that the analysis definitely does assume incomplete information. It is these ignorance assumptions, moreover, rather than the steady-state interest-elasticities of money demand or investment that count in explaining the position of the system at stages intermediate between FIM's. It also becomes apparent that IS-LM can be a cumbersome, inappropriate framework for representing theories that make non-standard assumptions about the knowledge of transactors and, consequently, about the time-phasing of events.

In the above sequence, incomplete information is implied at two points. In Phase I, we have it at (iii), where the real interest rate and, therefore, the relative prices of assets and their services change away from their FIM values. Then, in Phase II, incomplete information is assumed at (iv), where activity levels and not just nominal values rise. If we replace the first one by an FI assumption, the result is an approximation to Friedman's Theory of Nominal Income, where the first information imperfection is minimized but the second admitted. In an IS-LM representation of the resulting theory, the effects of a once-over money injection are shown by simultaneously

²³ ...except insofar as the transitory period of producing at false prices has also left a legacy of disequilibrium stocks of capital (as in Hayekian overinvestment theory).

shifting both IS and LM outward to the same extent. The Phase I sequence is short-circuited. If we replace also the second IIM-assumption by an FI one, we obtain the Rational Expectations theory of the fully anticipated once-over money injection. No relative prices and no activity levels are affected, only nominal value change. Phase II also is short-circuited. The system jumps directly from $FIGE_1$ to a full STOP at $FIGE_2$, without passing any IS-LM GO en route. "Long run propositions become true in the short run."

Some twenty or thirty years ago, Keynesian doubts about the effectiveness of monetary policy were commonly couched in IS-LM terms: IS was interest-inelastic and LM very elastic, so that shifts in LM (IS staying put) could be seen not to have much effect on nominal income. There have been really two Monetarist counterarguments to this "fiscalist" position and it would probably have been helpful if the two had been more clearly distinguished than has been the case. Monetarist Counter No. 1 takes the sequencing of ED-Table 1 for granted and, therefore, concedes the appropriateness of posing the issue in terms of the IS-LM elasticities. Thus, in the early days of the controversy, the Monetarists were concerned to show or argue that each link in this particular transmission mechanism was more robust than Keynesians believed. In particular, they argued, firstly, that no "liquidity trap" was ever absolute; monetary policy was never quite a case of "pushing on a string", but the Central Bank would always bring about the situation in row 2 of the Table. Secondly, they argued that Keynesians tended to underestimate the interest-elasticity of aggregate expenditures in large part because of too narrow an interpretation of "the interest rate." In Keynesian theory, the term tended to signify "borrowing cost"; in a world where elasticities of substitution between various asset-types are high, the more appropriate

interpretation of the phrase "a fall in the interest rate" is that of "a rise in the demand prices of durables relative to their rental values." Going from row 2 to row 3 of the ED-Table, therefore, we should find a strong increase in the effective demand for output. This is because relative prices change everywhere in the economy. Monetary policy, in this account of the transmission mechanism,²⁴ is effective because of the pervasive non-neutrality of its "short-run" effects.

The Monetarist Counter No. 2 denies the above sequence and has the economy going directly from row 1 to row 3, omitting (or downplaying very much) row 2.²⁵ How is that story to be told? Assume a large subset of transactors who have accurate information on the supply of high-powered money and who understand that an increase in the money supply eventually must raise prices. As soon as the intentions of the Central Bank to expand base money become known, these agents will increase their demand for commodities at the old prices and the FI interest rate. At the same time, the increased supply of credit by the banking system is offset by the increased demand on the part of those who anticipate a rise in prices. The rate of interest does not

²⁴It is an account which I tend to associate especially with the work of Brunner and Meltzer in the 1960s. But cf., also M. Friedman and A. Schwartz, "Money and Business Cycles," Review of Economics and Statistics, Supplement, Feb. 1963.

²⁵I am thinking here of the later position of Friedman according to which the Central Bank has no influence over the real rate of interest, liquidity effects on the real rate are insignificant and evanescent, and the interest-elasticity of money demand is irrelevant to the effectiveness of monetary policy.

In my opinion, as is clear from the text, the IS-LM representation of this theory should show both IS and LM shifting together at the impact of a monetary disturbance. The elasticities are then irrelevant. However, Friedman has (I think) muddied the waters by suggesting that the IS schedule should perhaps be drawn horizontal. Cf., for example, his "Comment" in J.L. Stein, ed., Monetarism, Amsterdam 1976.

move and never plays any role in the transmission of the monetary impulse. We get to row 3 without it.²⁶⁾ In the analysis where the standard sequence is followed, the lowering of the rate of interest (at row 2) serves, we may conclude, to cajole those agents who do not know what is going on into nonetheless increasing their spending. When agents do know, there is no "transmission problem" and the whole notion of a "transmission mechanism" becomes somewhat meaningless.

This illustrates a more general proposition that the Rational Expectations literature is making exceedingly familiar, namely, that fully informed agents have no need for a price-mechanism to inform them about what is happening. Prices merely reflect what they already know.

10. The other question concerning the interaction of real and monetary phenomena asked why a change in the marginal efficiency of capital should produce a change in money income and perhaps also in employment. We take the case of a decline in MEC and we construe this to mean, in FIM terms, that the economy faces the problem of traversing to a new full information general equilibrium on a lower growth-path with a lower real rate of interest. In IS-LM, of course, the analysis is usually begun by shifting IS left, keeping LM put. Again, this procedure imposes a particular sequence of events; this sequencing implicitly rests on certain incomplete information assumptions and, hence, is no more immutable than these assumptions are.

Once more, we may use an Ed-Table to examine Phase I of the sequence: (i) The initial FI general equilibrium. (ii) Perceived

(26) Passing through the Monetarist Black Box that is so often the object of complaints.

ED Table II	L	X	B	M
FIGE ₁	0	0	0	0
MEC declines				
Impact effects	0	ES	ED	0
r declines				
Deflationary pressure	0	ES	0	ED
p ^X declines				
Nominal income "equil"	?	0	0	0

returns to investment decline. Firms decrease their demands for capital goods and their net issue of securities. The impact effects show that IS has shifted with LM constant (since ED for money is zero). (iii) Next--in the Loanable Funds sequence of events²⁷ -- the interest rate declines in response to the ED_B and finds the level at which this ED is zero; with a lower rate of interest the amount of money demanded at the initial level of money income will increase. (iv) Row 3 therefore, will show ES of commodities and an ED for money. T theorists and A theorists will agree that the spending of money on commodities must decline until the excess demand for money in terms of commodities is zero.²⁸ (v) If money wages fail to fall in proportion to this decline in nominal aggregate demand, there will be unemployment in the state portrayed in Row 4.

²⁷ For the contrast between Loanable Funds and Liquidity Preference, see section 11 below.

²⁸ Note that the Liquidity Preference theory of interest rate determination predicts, instead, that in the state depicted in Row 3 the interest rate will rise.

That would be Phase I of the usual IS-LM tale. It takes us from the initial FIGE₁ at (\hat{X}_0, \hat{r}_0) in Fig. 2 to the IS-LM unemployment state at $(\underline{X}, \underline{r})$.²⁹ Note that a significant interest-elasticity of money demand is crucial to the story. Unless an excess demand for money emerges, at Row 3, there will be no deflationary pressure on the level of money income and, consequently, no unemployment (whether or not money wages are sticky).

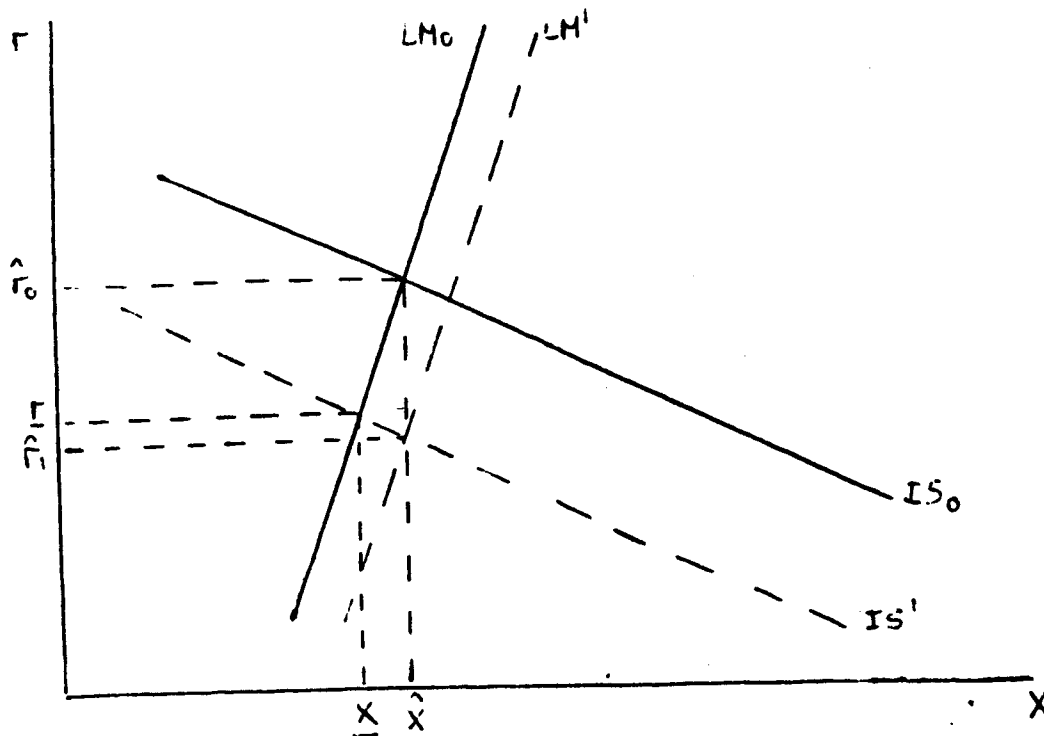


FIGURE 2

So Liquidity Preference in this sense of the interest-elasticity of money demand is a sine qua non to any Keynesian theory of employment fluctuations.³⁰ The reader may recall that Modigliani came to a different

²⁹ We have chosen to put real income, X , on the horizontal axis in this exercise.

³⁰ Liquidity Preference in the sense of the hypothesis that the ED for money governs the interest rate is better dispensed with, however. Cf. section 11.

conclusion in his influential 1944 assessment of Keynesian theory. Liquidity Preference, Modigliani argued, was not an essential part of Keynes' story. Instead, "the low level of investment and employment are both the effect of the same cause, namely a basic maladjustment between the quantity of money and the wage rate."³¹ This conclusion fits Monetarist theory, where unemployment arises either from a reduction of the money stock or from money wages rising faster than the money stock. But as a characterization of a Keynesian theory where unemployment arises in response to an unfavorable shift of MEC, Modigliani's conclusion is simply incorrect. It is the result of an investigation of the pure statics of the IS-LM model. If the comparative statics of IS-LM imposes a certain sequencing of events, the pure statics, naturally, ignores sequence--and causation--altogether. Consequently, it misidentifies "what goes wrong"--what rational adaptation to changing circumstances agents fail to see--in the Keynesian Theory.

There are two ways (not necessarily mutually exclusive) in which the crucial excess demand for money can be made to develop at the critical juncture of (Row 3) of the story.

The first relies on the speculative demand for money. We assume a money demand function, $M^d = f(p^X, r-r^*)$, which does not significantly depend upon the absolute level of the interest rate, r , but only on the

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Franco Modigliani, "Liquidity Preference and the Theory of Interest and Money," Econometrica 1944, reprinted (inter alia) in F.A. Lutz and L.W. Mints, eds., Readings in Monetary Theory, Philadelphia 1951. Quotation from this reprinting, pp. 224-25.

Cf. also Leijonhufvud, Keynes and the Classics: Two Lectures, London 1969, pp. 14ff., where "Keynes' special case"--as Modigliani called the Liquidity Trap possibility--is also considered.

difference between r and the perceived "normal" rate, r^* . If, then, we suppose an adverse change in the MEC taking place, while speculators fail to realize that a lower rate of return will be normal from now on, the system will fail to make the traverse smoothly. An excess demand for money will develop, as in ED Table II, and income and presumably employment will decline.³² If, on the other hand, the decline in MEC is correctly perceived and seen to be permanent, r^* will be reevaluated accordingly, and the downward adjustment of the growth-rate and of the real rate of return will proceed without creating deflationary pressure on the income level--as in our FIM model. In this version of the model, whether or not the real shock has monetary consequences is seen to depend on the state of information.

The second way to generate the Table II story is the more common one. We assume (8') $M^d/p = L(x,r)$ to be the steady-state money demand function and rely on the interest-elasticity of a Baumol-Tobin transactions demand to produce an excess demand for money as the interest rate declines. In this instance, the real shock will always produce a change in the price level, also in comparisons between FIM states. By the same token, the IS-LM solution at $(\underline{x}, \underline{r})$ of Fig. 2 is seen to be a temporary position of the system. There should be a Phase II to the sequence. In response to the unemployment of state (v), money wages and prices fall, thereby increasing the real value of the money stock until ED_M is zero. In the IS-LM Figure 2, this is shown as LM shifting right until the new equilibrium, $FIGE_2$, is reached

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Note that, since this unemployment disequilibrium is due to the inconsistency of the beliefs of entrepreneurs (with respect to MEC) and of securities markets investors (with respect to r^*), it is not to be cured by persuading wage-earners that the (FIM) level of wages is too high.

at $(\hat{\lambda}, \hat{r}_1)$.³³

In this second story of an IS-shift, we are supposing that people can know the real rate of return in the system so that there are no differences of opinion giving rise to a speculative demand for money. Agents all perceive the decline in MEC correctly, it is only that (when fully informed) they demand larger real balances when the return on alternative assets have fallen. But this adjustment down the steady-state demand for money function for a known decrease in the rate of profit should produce an entirely predictable decline in velocity. And, in turn, if everyone knows the extent of the required deflation, why should reservation-wages and prices be sticky? If they are not, then unemployment need not develop in the move from the initial to the terminal FIGE. The system would not pass through the point $(\underline{X}, \underline{r})$ in the course of its adaptation to the decline in MEC.

Once more, we conclude that, with a bit more information at their disposal, agents would short-circuit the particular sequence assumed in the usual IS-LM exercise. In that case, IS and LM have to be shown as shifting simultaneously.

11. The Liquidity Preference (LP) hypothesis of the interest rate mechanism maintains that the interest rate is governed by the excess demand for money: $\Delta r = f(M^d - M^s)$. It gives rise to a different sequence of events following a decline of the marginal efficiency of capital.

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Deflation helps in this instance because the new FIM state that the system should reach requires larger real balances. In the earlier exercise, where the ED_M developed for speculative reasons, the FIM money demand function was supposed to be interest-inelastic so that the new FIM equilibrium required the same wage and price level as the old one.

The characteristic LP sequence runs as follows.

ED TABLE III	L	X	B	M
	0	0	0	0
MEC declines	0	ES	ED	0
Output falls	(ES)	0	ED(?)	ES
r falls	(ES)	0	0	0

The impact effect of the MEC shift is, as before, an ES of commodities and an ED for bonds. Since, according to the LP hypothesis, the rate of interest will fall if and only if we have an ES of money, there is no interest rate response. Line 2 shows an intertemporal disequilibrium -- saving exceeds investment -- but intertemporal prices will not change. The Keynesian system that incorporates the LP hypothesis is altogether incapable of adjusting rationally to disturbances that require a change in the rate of capital accumulation.³⁴ The appropriate price-mechanism, it is assumed, will never work. The Loanable Funds hypothesis, in contrast, asserts that the interest rate is governed by the ES of securities: $\Delta r = g(B^S - B^d)$. This price-mechanism will work with well-informed speculators and will not do the job, of course,

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Model A - The "Keynesian Cross" -- properly portrays a system with the dynamic properties of ED Table III.

if speculators are ill-informed. The difference between the LP Keynesian and the LF Keynesian models is that between a system that cannot work properly and one that can, and presumably often does work, but that cannot be counted on to do so without fail. That difference is not a trivial theoretical issue.

The LP sequence contains another issue that is not trivial either. Comparison of lines 2 and 3 shows, first, that spending (of money on commodities) declines although the ED for money is zero and, second, that the decline in money income proceeds to produce an excess supply of money. This contradicts every possible Quantity Theory of nominal income, whereas the LF Keynesian model is consistent with Quantity Theory reasoning.

Keynes summarized his departures from Classical theory in two propositions: (i) saving and investment determine income--not the interest rate, as the Classics believed; (ii) liquidity preference and the money supply determine the interest rate--and not the price level as the Classics believed. Both propositions stem directly from the LP hypothesis (which remains the core of British Cambridge Keynesianism). They can be read off, in LP sequence, from ED-Table III.

Alvin Hansen, who was extremely influential in shaping the American Keynesian tradition, decided that Keynes' summary propositions were simple analytical mistakes and therefore meaningless. Saving and investment, Hansen argued, determine neither income nor the interest rate -- they give us the IS schedule. And money supply and demand, of course, give us the LM schedule. Everything has to be determined simultaneously. This is another argument that treats the model as if it was a purely static one. And, again, it misses the point -- an important point.

12. The simplest version of IS-LM can be produced by linking Models A and T by the rate of interest.³³ But Model A (especially) and Model T are incomplete information models. Their solutions portray market interactions that are, at least on the part of some group of transactors, based on misapprehension of the opportunities potentially present. It is to invite misunderstandings, therefore, to treat IS-LM solutions as if they were the static, short-run equilibria familiar from price theory.

One must pay attention to the sequencing of events in order to understand the theoretical reasons why the system is supposed not to be in full information general equilibrium and also in order to understand the interaction of real and monetary phenomena in the system.

IS-LM, handled as if it were a static construction, will pay no attention to the sequence of events. This use of the apparatus produced a nonsensical conclusion to the Keynes and the Classics debate, namely, that Keynes had revolutionized economic theory by advancing the platitude that wages too high for full employment and rigid downwards imply persistent unemployment. It failed to capture essential elements of Keynes' theory, namely, that the typical shock is a shift in investors' expectations and that it is the failure of intertemporal prices to respond appropriately to this change in perceived intertemporal opportunities that prevents rational adaptation to the shock. The same "as if static" method produced the conclusion that Liquidity Preference versus Loanable Funds was not

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...and looking elsewhere for the "missing equation(s)" that will determine the price and output components of nominal income.

a meaningful issue, i.e., that it does not matter whether the system is or is not potentially capable of adjusting intertemporal prices appropriately in response to changes in intertemporal opportunities.

The popularity and staying power of the IS-LM apparatus, especially in classroom teaching, does not rest on its static but on its comparative static uses, however. In the course of the Monetarist debate, this method was employed to bolster the suggestion that the steady-state interest-elasticities of the two schedules were central--or even the central--issues in contention. If the interest-elasticity of IS is pretty far from infinite and that of LM pretty far from zero, standard curve-shifting exercises suggest that real disturbances should have monetary effects and monetary disturbances have real ones--although these interdependencies do not occur in our FIM theory. When reasonable assumptions are made about the interest-elasticities of excess commodity and money demand, the IS-LM model seemingly will not allow the interest-rate to adjust appropriately "in the short run." Monetary disturbances are shown to have real (allocative) effects because the interest rate changes--when in FIM it should not. Real disturbances have monetary (income) consequences--because the rate of interest does not change as far as (in FIM) it should.³⁴

The reason why IS-LM seemingly will not allow equilibration in the short run, of course, is that it is habitually assumed that the disturbances in question will shift one reduced form and leave

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This maladjustment of the interest rate is the theme of my "The Wicksell Connection," op.cit.,

the other one put. Whether this procedure is justified or not is a question of some importance. Supply- and demand analysis, as Marshall noted, is a useful tool in so far as the forces that shift one schedule do not also tend to shift the other. The same is true in this case. IS-LM as a modelling strategy--i.e., first concentrating on obtaining the two reduced forms and then getting the answers by manipulating them--is really predicated on the procedure being justified. If, in response to the standard disturbances, IS and LM both shift, this modelling strategy makes little sense. When both shift more or less simultaneously, pre-occupation with the elasticities is on the whole a mistake.

But FIM analysis shows that both schedules should shift--ultimately. The use of IS-LM "as if" it was a comparative static apparatus is thus seen to involve the lag-assumption that one shifts before the other, that there will be a well-defined "short run" solution half-way in the process--and that macroeconomic policy-makers have their natural being in this halfway house. This imposed sequencing or lag-structure rests on assumptions of incomplete information on the part of various groups of agents.

So is the procedure of shifting LM, keeping IS constant -- or vice versa--justified? The answer is: Sometimes, perhaps often, but not necessarily or always. And that is very largely what is the matter with IS-LM.