ALTERNATIVE MONETARY INTEREST THEORIES:

A COMPARISON AND EVALUATION

by
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PREFACE

Although a great deal of time and effort has been spent in recent years in analyzing the determinants of the level of interest rates, it is nevertheless true that there are two monetary interest theories competing for the support of economists: the liquidity preference theory and the loanable funds theory. The consensus of opinion seems to be that the two theories are merely two different ways of saying the same thing, and several attempts have been made to show this. Nevertheless, several puzzling questions have arisen to which no entirely satisfactory answers have been given. Precisely how do savings and investment influence the interest rate? What difference, if any, does it make whether the analysis is carried out in terms of stocks or in terms of flows of money and securities? How does the interest rate behave during periods when income is changing?

After a brief survey, in Chapter I, of some of the major controversies of recent years, the present study attempts to deal with these questions by setting up macrodynamic models containing each of the two theories. This is done in Chapters II and III. The chief conclusion of this analysis is that the basic difference between the two theories lies in the fact that one (the liquidity preference theory) involves stocks of money

and securities while the other (the loanable funds theory) involves flows. Chapter IV takes up some complicating factors which were left out of account in Chapters II and III. The final chapter attempts an evaluation of the two theories in terms of the distinction between stocks and flows.

The author wishes to thank the members of his committee, and, in particular, Professor Musgrave, for advice and encouragement during the preparation of this study.

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CHAPTER I

A SURVEY OF RECENT LITERATURE ON MONETARY INTEREST THEORY

Economists have spent a great deal of time and written many pages on the subject of interest theory in the fifteen years that have elapsed since the appearance of Keynes' General Theory. The general, but, I suspect, somewhat uneasy, feeling is that most of the controversies arising out of Keynes' work on interest theory have been settled. Perhaps typical of the general attitude is the opening sentence of a recent article on the subject, "There is no one I suppose who would now dispute that the 'demand for money' approach to the determination of the rate of interest amounts to the same thing as the 'loanable funds' approach."[1] The writer of the article then goes on to try to make the reconciliation of the two approaches more complete.

It is true that an occasional dissent is still registered regarding the complete identity of the liquidity preference and the loanable funds doctrines.[2] But the general

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[1] C. Kennedy, "Period Analysis and the Demand for Money," Review of Economic Studies, XVI (1) (1948-49), 41.

[2] Cf. L. R. Klein, "Stock and Flow Analysis in Economics," Econometrica, XVIII (July, 1950), 235-241, and the ensuing comments and discussion by Klein, W. Fellner and H. M. Somers, and K. Brunner, pp. 242-252.

feeling seems to be that the two approaches are virtually perfect substitutes and that the choice between them is largely a matter of taste.

After reviewing briefly Keynes' views on the interest rate, the chief objections of some of his critics, and the various attempts that have been made to reconcile the liquidity preference and loanable funds approaches, we shall attempt to show that the two theories of interest, as usually formulated, are not by any means identical. The chief difference, as we shall see, is due to the difference between stock analysis and flow analysis and does not become apparent until the two theories are formulated in explicit dynamic models.

Keynes' Theory of Interest

The theory of interest provided by Keynes[3/] appeared to represent a radical departure from accepted doctrine. He denied the validity of the prevailing view that the rate of interest represented a return for saving or "waiting." His position is brought out in the following passage.

> It should be obvious that the rate of interest cannot be a return to saving or waiting as such. For if a man hoards his savings in cash, he earns no interest, though he saves just as much as before. On the contrary, the mere definition of the rate of interest tells us in so many words that the rate of interest is the reward for parting with liquidity for a specified period. For the rate of interest is, in itself, nothing more than the inverse proportion between a sum of money and what

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3/ J. M. Keynes, General Theory of Employment, Interest, and Money (New York: Harcourt, Brace & Co., 1936), chaps. 13-17.

> can be obtained for parting with control over the money in exchange for a debt for a stated period of time.
>
> Thus the rate of interest at any time, being the reward for parting with liquidity, is a measure of the unwillingness of those who possess money to part with their liquid control over it. The rate of interest is not the "price" which brings into equilibrium the demand for resources to invest with the readiness to abstain from present consumption. It is the "price" which equilibrates the desire to hold wealth in the form of cash with the available quantity of cash.....[4]

One question which needs to be dealt with in any discussion which abstracts from rate differentials and the pattern of interest rates is: What is meant by "the" interest rate? Keynes answers this by saying he means by the rate of interest "the complex of the various rates of interest current for different periods of time, i.e., for debts of different maturities."[5]

Keynes proceeds to develop a theory of interest which makes the interest rate depend upon the demand for and supply of money--or, as he puts it, liquidity preference and the quantity of money. The interest rate, so determined, together with the marginal efficiency of investment determines the amount of investment.[6] Keynes' theory can be described with

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[4] Ibid., pp. 166-167. (Italics added.)

[5] Ibid., p. 167, n. 2.

[6] We shall consistently use the term "marginal efficiency of investment" instead of the Keynesian term "marginal efficiency of capital." This is the terminology suggested by Lerner who has made a distinction between the marginal productivity of capital and the marginal efficiency of investment, the two being equal only when the rate of net investment is zero. See A. P. Lerner, The Economics of Control (New York: The Macmillan Co., 1944), pp. 334-338.

the aid of Figure I.

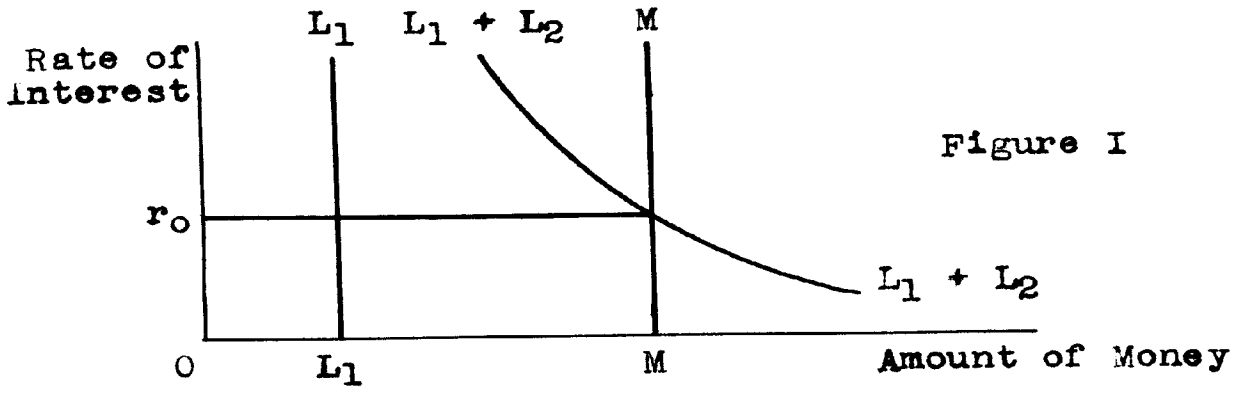


Figure I

He divides the stock of money (M) into two parts, money held to satisfy the transactions and precautionary motives (M_1) and money held to satisfy the speculative motive (M_2). Corresponding to these two classifications are two components in the demand for money, L_1 and L_2. L_1 (demand for transactions and precautionary balances), he says, depends chiefly on the level of income, and L_2 (demand for speculative balances) depends chiefly on the rate of interest. The behavior of investors is thought to be strongly influenced by the concept of a normal level of interest rates based on past experience. When the level of rates is low (in relation to normal), the purchase of securities is deferred and investors hold cash instead, awaiting a more favorable time to purchase securities. Thus, the lower the rate of interest, the larger will be the amount of cash that will be held for speculative reasons.[7/] In the above diagram,

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7/ A detailed discussion of the motives for holding money will be undertaken in Chapter V below. For our present purposes, it will suffice to accept Keynes' argument.

the supply of money (M), which is assumed to be determined independently by the monetary authorities, and the total demand for money ($L_1 + L_2$) determines the rate of interest (r) at r_o. Transactions and precautionary money, M_1, is equal to OL_1, and speculative balances, M_2, are equal to L_1M. Since the diagram is drawn on the assumption of a given level of income, the L_1 schedule is completely inelastic. The L_2 schedule, however, is elastic to the rate of interest.

This radical reformulation of interest theory aroused a storm of controversy among economists. One source of objection lay in Keynes' discussion of what he called the "Classical Theory of Interest."[8/] Keynes argued that the "classical" tradition "regarded the rate of interest as the factor which brings the demand for investment and the willingness to save into equilibrium with one another."[9/] Few prominent economists seemed willing to admit that they had subscribed to a simple savings-and-investment theory of interest. Furthermore, various critics suggested that Keynes had gone too far in the direction of making the rate of interest a purely monetary phenomenon when he left savings and investment out entirely as determinants of the interest rate.

8/ Keynes, op. cit., chap. 14.

9/ Ibid., p. 175.

Ohlin,[10] Robertson,[11] Haberler,[12] and others presented alternative formulations of monetary interest theory which have come to be called the loanable funds theory.

The Loanable Funds Theory

We will first attempt to present a formulation of the loanable funds theory which would presumably be acceptable to the writers mentioned and then focus our attention on the differences between the two theories and the attempts that have been made to reconcile them.

The loanable funds theory starts out by classifying elements in the demand for and supply of funds. The elements on the demand side include: (1) the demand for funds to be spent on new plant and equipment, replacement of worn out or obsolescent plant and equipment,[13] change in business

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[10] B. Ohlin, "Some Notes on the Stockholm Theory of Savings and Investment. II," Economic Journal, LXVII (June, 1937), 221-227; "Alternative Theories of the Interest Rate: Three Rejoinders," Economic Journal, XLVII (September, 1937), 423-427.

[11] D. H. Robertson, "Mr. Keynes and the Rate of Interest," in Essays in Monetary Theory (London: P. S. King & Son, Ltd., 1940), pp. 1-38; "Notes on Mr. Keynes' General Theory of Employment," Quarterly Journal of Economics, LI (November, 1936), 168-191. See also J. M. Keynes, "The General Theory of Employment," Quarterly Journal of Economics, LI (February, 1937), 209-223; and the controversy between Robertson and Keynes in the Economic Journal for June, September, and December, 1937, and June and September, 1938.

[12] G. Haberler, Prosperity and Depression (3d edition; Geneva: League of Nations, 1941), pp. 183-187, 195-221.

[13] We are formulating the theory in terms of gross saving and investment, since, if depreciation allowances and

inventories, and consumer durable goods,[14] and (2) the demand for additions to idle balances held for precautionary[15] and speculative purposes (net hoarding). The second of these items can be negative at high interest rates--i.e., idle balances may be reduced (net dishoarding). The elements on the supply side include: (1) new saving of individuals and business firms, (2) depreciation allowances,[16] and (3) new money created by government and/or the banking system. The first item could be negative if there was net dissavings by households and business in a particular period. The third item could be negative if the supply of money was reduced.[17]

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actual replacement expenditures do not match in a given period, the discrepancy may affect the rate of interest. Moreover, it is theoretically difficult and statistically impossible to distinguish sharply between new investment and replacement investment.

14/ Borrowing for the purpose of purchasing consumer durable goods could be incorporated into the analysis either as an element of investment on the demand side or as an element of negative saving (dissaving) on the supply side. In accordance with Department of Commerce practice in compiling national income statistics, we might consider borrowing to finance the construction of housing as a component in investment demand and borrowing to finance the purchase of other types of durable goods as dissaving.

15/ For the moment, we will forego discussing whether precautionary balances should be treated as being determined mainly by the level of income (as Keynes argued) or as depending partly on the rate of interest. Practice has differed in this respect, and we shall have to consider the question, but for our present purpose it is not important.

16/ See footnote 13.

17/ For a similar, though slightly different, classification, cf. Robertson, "Mr. Keynes and the Rate of Interest," op. cit., pp. 2-5.

The theory can be presented diagrammatically, as shown in Figure II.[18]

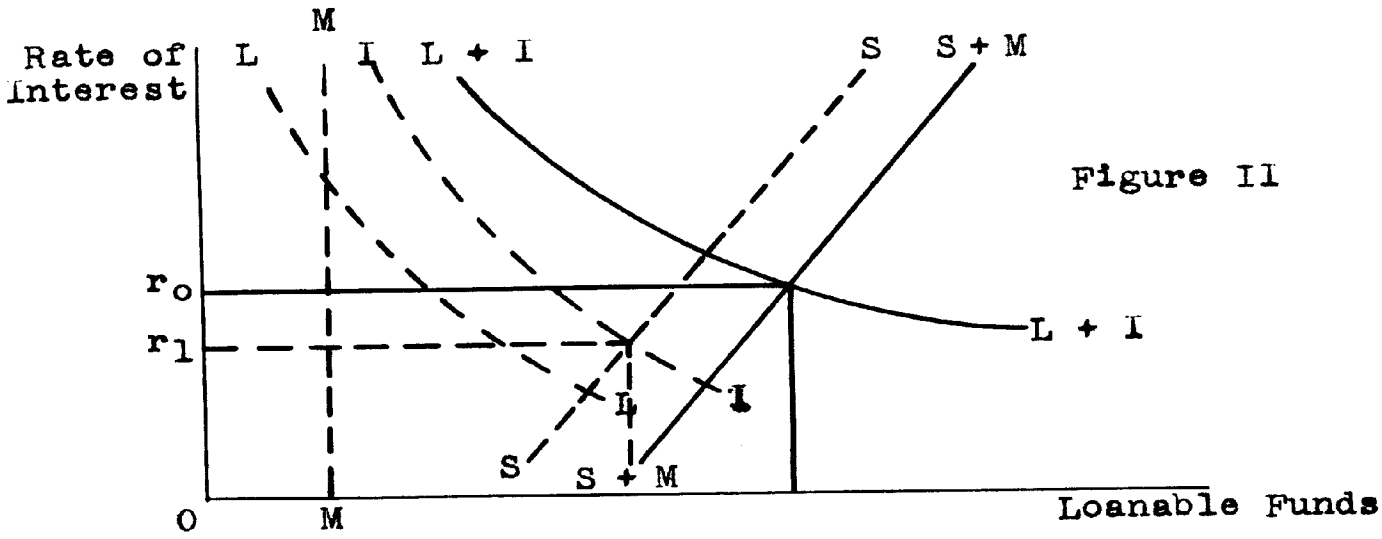


Figure II

In this diagram:

I = gross investment--item (1) under demand.

L = net hoarding--item (2) under demand.

S = gross saving--items (1) and (2) under supply.

M = increase in money supply--item (3) under supply.

Savings and investment must be defined as *ex ante* or planned rather than as *ex post* or realized magnitudes. A considerable amount of confusion has resulted from the failure of various writers to realize that the *ex ante* concepts are the relevant ones for purposes of interest rate determination.

In this scheme, the interest rate is determined by the total supply of and demand for loanable funds at r_o. The

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[18] Ours is very much like the analysis in Haberler, *op. cit.*, pp. 183-187. See especially the diagram on p. 185, which Haberler has taken over from A. P. Lerner, "Alternative Formulations of the Theory of Interest," *Economic Journal*, XLVIII (June, 1938), 211-230.

actual rate is, in this case, above the rate, r_1, which would equate planned saving and planned investment. At the actual rate, r_o, planned saving exceeds planned investment. Since

$$S + M = I + L,$$

therefore

$$S - I = L - M.$$

That is to say, the net amount hoarded exceeds the increase in the money supply by the amount of the excess of saving over investment. In effect, part of current gross saving was not channeled into productive investment, but instead flowed, along with the amount of new money that was created, into hoards.

It should be pointed out that this analytical apparatus is presumably used to study the capital market at a certain instant of time, with income, prices and other relevant factors taken as given. It is, furthermore, clear that there is a dynamics lying behind it, since the situation in the above case can not be one of equilibrium. The dynamic theory of income determination would indicate that income will fall and this will cause shifts in some or all of the schedules. None of the loanable funds theorists, so far as the author is aware, has given more than a very rudimentary attention to this important matter. There is, of course, also a dynamics hidden in the Keynesian apparatus of Figure

I, which has been left similarly unexplored.[19] Our task in later chapters will be to explore the dynamics of each of the theories and to compare them in a dynamic setting.

The Early Dispute about the Role of Saving and Investment

Before we begin our own analysis, however, we want to consider some aspects of the earlier controversy. D. H. Robertson has perhaps been the leading critic of Keynes' interest theory. Robertson's most serious objection was that Keynes gave no place to saving or investment in the determination of the rate of interest--or at first glance didn't appear to.[20] The marginal efficiency of investment schedule is set to one side and the rate of interest (determined by liquidity preference and the quantity of money), when applied to that schedule, determines the volume of investment. And the supply of saving seems to be left entirely out of the picture.

Actually, however, while saving and investment do not appear as direct determinants of the rate of interest in the

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19/ But see Kennedy, op. cit., where some consideration is given to systematic shifts in the schedules. Many dynamic formulations of the Keynesian system have been presented and discussed; however, they commonly do not include the interest rate and the money market. They assume either that the interest rate is a variable without significance for practical purposes or that it is held constant by the monetary authorities.

20/ D. H. Robertson, "Notes on Mr. Keynes' General Theory of Employment," op. cit., pp. 175-178; "Alternative Theories of the Rate of Interest: Three Rejoinders," Economic Journal, XLVII (September, 1937), 429-432.

Keynesian apparatus (as usually formulated[21]), they nevertheless have an important indirect effect. According to the Keynesian way of looking at things, for example, a rise in the marginal efficiency of investment schedule, due, say, to an improved business outlook, will result in increased investment. The increased investment will raise the level of income immediately (or soon) by the amount of the additional investment and eventually by several times that amount through the multiplier effect of the respending of a fraction of the additional income at each round on consumption goods. As income rises, the amount of money needed for transactions purposes (M_1) will increase,[22] leaving less to satisfy the demand for idle balances (M_2) and thereby raising the rate of interest.[23] Likewise, an autonomous upward shift of the schedule of savings in relation to income (decline in the propensity to consume, in the sense of the whole consumption-income schedule) would have a multiplier effect causing income

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21/ We will see later that the apparatus can easily be modified to introduce them.

22/ Keynes explicitly said that he regarded it as safe to consider the circuit velocity of active money (v) as constant in short-run analysis. This would mean that active money was a constant fraction of income (equal to 1/v). See Keynes, General Theory of Employment, Interest, and Money, p. 201. His ideas about precautionary balances (also included in M_1) are not entirely clear, but he apparently thought they also represented a fairly constant proportion of income.

23/ Cf. Haberler, op. cit., pp. 211-212; Robertson, "Notes on Mr. Keynes' General Theory of Employment," op. cit., pp. 181-183.

to fall, reducing transactions requirements for money, releasing more money for M_2 balances and <u>indirectly</u> causing a decline in the interest rate.

Applying the loanable funds theory to the cases just mentioned, it is easily seen that an increase in the marginal efficiency of investment would directly raise the rate of interest by increasing one component in the demand for funds. Similarly, an outward shift in the savings schedule would increase the supply and lower the rate.

As another example of the operation of the two theories, consider the effect of an increase in the supply of money. Here again, there is a cleavage between the two theories similar to the one indicated in the two cases already mentioned. The loanable funds theory shows the supply of funds directly increasing and the rate of interest falling, its fall being checked to the extent that total demand--including demand for hoarding purposes and for investment purposes--is elastic. The liquidity preference theory shows the supply increasing and the rate falling but being checked to the extent that speculative demand for idle balances is elastic. But again there is an <u>indirect</u> check to the fall, because, to the extent that the marginal efficiency of investment schedule is elastic, investment will increase, raising the level of income through the operation of the multiplier and drawing more money into M_1. This leaves less than the original increase in M to satisfy the M_2 demand

and further checks the fall in the interest rate.

This last example, however, illustrates a real difference between the two theories. This difference consists in the fact that, while Keynes makes it explicitly clear that by the term supply of money he means the stock of money in existence, the loanable funds theorists usually seem to mean the flow of new money into the system per period.[24] The latter are usually somewhat vague as to what they actually do mean by the supply of money and frequently try to argue that it doesn't make any difference. Whether it does or not is one of the questions we will try to answer in later chapters.

It is impossible to avoid the suspicion that Keynes' failure to admit that saving and investment have any direct influence on the rate of interest stems from his undoubted confusion about the meaning of the terms saving and investment as he defined them. Having defined terms in such a way that saving and investment were always identically equal, he seems to have been misled into believing that any increase in investment was immediately self-financing, because, in some mysterious way, it immediately called forth an equal

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[24] There is a similar difference in the meaning of hoarding or idle balances. Keynes' M_2 refers to the total stock of idle cash, while the term hoarding as used by the loanable funds theorists refers to the net addition to or subtraction from the stock of idle cash during the period, i.e., the net flow of funds into or out of hoards.

amount of saving.[25]

This suspicion that Keynes was misled by his own definitions is strengthened when we examine his concession on the so-called "demand for finance."[26] Here Keynes' reasoning seems open to question, and the concession appears to have been unwarranted, at least in part.

In the course of a reply to Ohlin's remarks[27] concerning interest theory, Keynes admitted that "an investment decision .... may sometimes involve a temporary demand for money before it is carried out, quite distinct from the demand for active balances which will arise as a result of the investment activity whilst it is going on."[28] Financial

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25/ A defense of the liquidity preference theory based explicitly on this idea has been provided by A. P. Lerner. We will examine Lerner's argument later in this chapter. See pp. 19-21, infra.

26/ J. M. Keynes, "Alternative Theories of the Rate of Interest," Economic Journal, XLVII (June, 1937), 246-248; D. H. Robertson, "Alternative Theories of the Rate of Interest: Three Rejoinders," op. cit., pp. 432-433; J. M. Keynes, "The 'Ex-Ante' Theory of the Rate of Interest," Economic Journal, XLVII (December, 1937), 665-669; D. H. Robertson, "Mr. Keynes and Finance: A Note," and J. M. Keynes, "Comment," Economic Journal, XLVIII (June, 1938), 314-318 and 318-322, respectively; D. H. Robertson, "Mr. Keynes and Finance," Economic Journal, XLVIII (September, 1938), 555-556; "Mr. Keynes and the Rate of Interest," in Essays in Monetary Theory, pp. 11-16; E. S. Shaw, "False Issues in the Interest Theory Controversy," Journal of Political Economy, XLVI (December, 1938), 838-856.

27/ B. Ohlin, "Some Notes on the Stockholm Theory of Savings and Investment. II," op. cit., pp. 221-227.

28/ J. M. Keynes, "Alternative Theories of the Rate of Interest," op. cit., p. 246. (Italics in original.)

provision may have to be made before the investment occurs, "that is to say, before the corresponding saving has taken place."[29] Keynes indicates that this so-called "demand for finance" is temporary. It may be met by means of a bank loan (tending to raise the rate of interest), but when the investment is actually made, new saving is immediately and somehow automatically generated, and this saving can be used to repay the loan. "During the interregnum--and during that period only--between the date when the entrepreneur arranges his finance and the date when he actually makes his investment, there is an additional demand for liquidity without, as yet, any additional supply of it necessarily arising."[30] Due to the temporary nature of the demand, Keynes seems to conclude that its effect on the rate of interest will be only temporary. He says, for example, "If investment is proceeding at a steady rate, the finance (or the commitments to finance) required can be supplied from a revolving fund of a more or less constant amount."[31]

There are several weaknesses in the concept of "demand for finance." First of all, let us assume for the moment that Keynes' analysis is generally correct. In this

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29/ Ibid. (Italics added.)

30/ J. M. Keynes, "The 'Ex-Ante' Theory of the Rate of Interest," op. cit., p. 665.

31/ J. M. Keynes, "Alternative Theories of the Rate of Interest," op. cit., p. 247.

case, the demand for finance is not a minor, marginal matter as Keynes seemed to imply. It is rather a fairly complete substitute for the marginal efficiency of investment schedule in the mechanism of interest rate determination, since presumably nearly every investment will require some advance financial provision. Furthermore its effect on the interest rate is not any more "temporary" than is the effect of a change in the investment schedule in the loanable funds theory. Presumably no one would argue that a constant, steady rate of investment would exercise a cumulative upward effect on the interest rate. A rise in the marginal efficiency of investment schedule would force up the rate of interest until dishoarding and increased saving out of a higher level of income, together with a backward shifting of investment along the new marginal efficiency of investment schedule, had brought the supply of and demand for funds into a new stable equilibrium. Similarly, according to Keynes, a rise in the marginal efficiency of investment schedule would give rise to an increased "demand for finance" to carry out the investment. This would raise the interest rate to a new higher level, and it would remain there as long as the marginal efficiency of investment remained at the new level.

But there is a more basic flaw in Keynes' argument than the fact that he thought the demand for finance was of a minor and temporary nature. The basic difficulty lies in his implicit argument that an increase in investment would immediately

generate additional saving sufficient to finance it. It is true that when the investment is made, its effects, measured statistically, on investment and on savings will be exactly equal. This equality will be brought about partly by disinvestment in inventories (if the investment goods are sold out of accumulated stocks) and partly by an increment to the saving of the entrepreneur whose profits have increased due to the sale of the investment goods. Only if the seller fails to restock inventories and instead repays a bank loan, retires a security issue, or puts the proceeds directly on the loan market will the disinvestment free funds to help finance the new investment. Likewise, only if the entrepreneur puts the increment to his profits onto the loan market, rather than earmarking it for consumption, will these funds help to finance the new investment without a rise in the interest rate. It cannot be assumed that either the disinvestment or the saving will thus be made available. That is to say, it would not generally be true that an increase in investment would automatically and immediately generate enough free and available voluntary saving to finance itself; hence the rise in investment would tend to push up the interest rate. Keynes' argument here rests on his ex post definitions of saving and investment, but these are not the relevant definitions for purposes of the problem being considered.

It is safe, then, to say that an increase in investment

will tend to push up the interest rate, whether advance financial provision is needed or not. What is now left of Keynes' concept of "demand for finance"? The answer is that to the extent that financial provision is needed prior to the actual investment outlays, it will affect the timing rather than the magnitude of the upward pressure on interest rates. It would be one of the numerous lags that would have to be allowed for in a realistic study of the money market.

Formal Attempts at Reconciliation

After considerable verbal sparring, the conclusion seemed to be rather hesitantly reached that the two theories of interest were really two ways of saying the same thing. Robertson, for example, said, "Nevertheless, when we have picked our way through these verbal tangles we are left, I think, in no doubt about the relation between the methods of approach. Essentially they are two different ways of saying the same thing."[32] Since 1938, a number of attempts have been made to prove that the two theories are identical or at least reconcilable. Usually, after showing to his own satisfaction the formal identity of the two approaches, the author of the reconciliation has expressed a preference for one or the other on grounds of emphasis. And, in this respect, differences in taste have been expressed. We will now consider, in turn, several of the attempts at formal reconciliation.

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[32] D. H. Robertson, "Mr. Keynes and the Rate of Interest," op. cit., p. 9.

The earliest published effort to show the identity of the two theories was that of A. P. Lerner.[33] He starts with a diagram similar to Figure II above. And, as in our analysis of the loanable funds theory, he adds S and M to get the total supply of funds and adds I and L to get the total demand. However, he explains that this formulation is not correct. He draws another diagram which, he thinks, corrects an error in the first. In this diagram, he draws a single curve (SI) for saving and investment, explaining that, "As soon as it is recognized that saving must always equal investment, we get Figure III, where the S and I curves coincide, giving the new curve SI."[34] The result is shown in Figure III below. He then points out that the interest

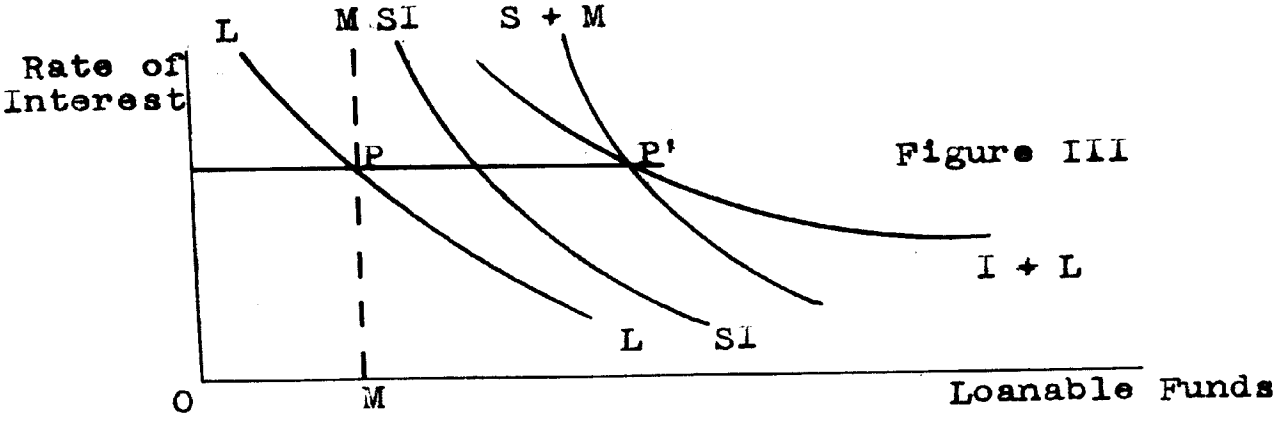


Figure III

33/ A. P. Lerner, "Alternative Formulations of the Theory of Interest," op. cit. See also A. P. Lerner, "Interest Theory--Supply and Demand for Loans or Supply and Demand for Cash," Review of Economic Statistics, XXVI (May, 1944), 88-91.

34/ A. P. Lerner, "Alternative Formulations of the Theory of Interest," op. cit., p. 215.

rate is unaffected by adding the SI schedule to both the demand and supply side--i.e., the interest rate determined at point P by the intersection of M and L is the same as the interest rate determined at point P' by the intersection of S + M and I + L. Hence, the liquidity preference and loanable funds theories boil down to the same thing--although he regards the inclusion of savings and investment as "empty ceremony." As a final step, he adds the stock of money in existence at the beginning of the period to both the demand and the supply since all the money was held by someone. This completes the transition to Keynes.

The error in this is clearly the use of the ex post "always equal" definitions of saving and investment. The interest rate established at the beginning of a period is obviously not going to be determined by what saving and investment turn out to be at the end of the period.[35] But it may very well be influenced by peoples' intentions or plans regarding saving and investment at the beginning of a period.[36]

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[35] More fundamentally, it would not even be possible to draw a schedule such as Lerner's SI schedule, since the ex post equality of saving and investment is not confined to any schedule--it covers the whole field of possible values of saving and investment.

[36] Lerner's error in this analysis has been alluded to by at least two writers. See the sarcastic remark about Mr. Lerner's "geometrical fantasia" in Robertson, "Mr. Keynes and the Rate of Interest," op. cit., p. 5, n. 1. Also G. Haberler, op. cit., p. 186, n. 1.

By redefining saving and investment, however, a limited validity can be restored to the Lerner diagram. For each interest rate, there is presumably an equilibrium level of income (in the macroeconomic sense). At each of the equilibrium levels, planned saving will equal planned investment; furthermore, the lower the interest rate, the higher will be the equilibrium level of income, saving, and investment. Thus, the Lerner SI schedule could be reinterpreted to mean the schedule of equilibrium saving and investment related to the interest rate. However, since the SI schedule, which is so unceremoniously removed from the scene by Lerner, now relates only to equilibrium levels of income, the theory becomes one which determines only the equilibrium interest rate which will eventually be reached and is incapable of telling us anything about the interest rate when the economy is in disequilibrium. Furthermore, even as a theory of the equilibrium rate, it covers up more than it reveals.[37]

Another treatment of interest theory is provided by Lange.[38] He sets up a simple mathematical model of the monetary sector of the economy, consisting of four equations as follows.

$$M = L(i, Y) \qquad (1)$$

$$C = \varphi(i, Y) \qquad (2)$$

$$I = F(i, C) \qquad (3)$$

$$Y \equiv C + I \qquad (4)$$

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[37] See the discussion on this point below in Chapter II, pp. 65-67.

[38] O. Lange, "The Rate of Interest and the Optimum Propensity to Consume," Economica, V, New Series (February, 1938), 12-32.

Here, M = money supply, i = interest rate, Y = income, C = consumption, and I = investment, all measured in wage units. M is assumed to be institutionally determined and is taken as given. This leaves four unknowns, i, Y, C, and I to be determined by four equations.[39] Making plausible assumptions about the general shapes of the functions involved, Lange develops a graphical illustration of the solution. Then he says that his system is a more general system of which both the Keynesian and traditional systems are special cases. These two cases are defined by Lange in the following way.

(1) The Keynesian theory of interest is the case in which the interest-elasticity of demand for liquidity is infinite, because if this is true, a change in the marginal efficiency of capital schedule or in the propensity to consume will not affect the rate of interest.

(2) The traditional theory of interest is the case in which the interest-elasticity of demand for liquidity is zero, because if this is true, the demand for money depends on income alone (as in the quantity theory).

Although Lange's article is, in general, excellent, it seems to the present writer that it misrepresents Keynes' ideas about the interest rate. Despite the fact that Keynes

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[39] This model goes a bit beyond Keynes, since the interest rate is included as a determinant of consumption (or saving), and consumption is included as a determinant of investment.

explicitly placed his stamp of approval on the Lange article,[40] Lange's Case (1), mentioned above, does not seem to reflect Keynes' position accurately. Although Keynes indicated that he thought the liquidity preference schedule might become completely elastic at very low interest rates, he certainly did not mean to rest his interest theory on that possibility. In fact, he clearly stated that he knew of no instance in which perfectly elastic liquidity preference had ever actually occurred.[41] He surely regarded his liquidity preference theory as a general theory, applicable at all times, and not, as Lange indicates, one which applies only when the liquidity preference schedule is perfectly elastic.

In addition to this unjustifiable interpretation of Keynes, Lange also appears to have made a slight slip in setting up his model. His equation (4) should have been

$$Y = C + I,$$

instead of

$$Y \equiv C + I.$$

If his model is to be consistent, this must be a true equilibrium relation rather than an identity. That is, in his other equations, investment and saving (Y-C) must be planned (ex ante) rather than realized (ex post) magnitudes. It is,

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40/ J. M. Keynes, "Comment," op. cit., p. 321, n. 1.

41/ J. M. Keynes, General Theory of Employment, Interest, and Money, p. 207.

for instance, planned investment rather than realized investment that bears a functional relationship to i and C (if, indeed, a stable relation of this sort exists at all). And income is not identically equal to the sum of consumption and planned investment, but is equal to this sum only at equilibrium.

When this change in equation (4) is introduced, the significance of Lange's system is altered somewhat. Whereas he apparently regards it as a mechanism capable of elucidating the forces determining the interest rate (and other variables as well) at any time, it now becomes a mechanism for determining only equilibrium interest rates. For example, if the economy is in macroeconomic equilibrium with a certain interest rate and level of income, and a change occurs--say, an increase in the marginal efficiency of investment--the Lange apparatus can tell us what will be the new equilibrium interest rate and level of income that will eventually be reached. It cannot, however, explain the determination of income or the interest rate at any time intermediate between the two equilibria. It is, in other words, completely static and suitable only for describing equilibrium positions.[42/] This does not mean that it is useless, but it does mean that it cannot say the last word about the determination of the interest

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42/ An elegant formulation of the Keynesian system, similar in many ways to Lange's, is advanced in J. R. Hicks, "Mr. Keynes and the 'Classics'; A Suggested Interpretation," Econometrica, V (April, 1937), 147-159. Hicks appears to recognize the equilibrium nature of his analysis, however.

rate. It would be most helpful to have a theory which is applicable to both equilibrium and non-equilibrium situations. This is especially true when one remembers that the economy is seldom (if ever) in a position of equilibrium.

An attempt to reconcile the liquidity preference and loanable funds theories has been made by Hicks.[43] He takes up the problem in a Walrasian general equilibrium framework. His analysis may be described as follows. Suppose we have an economic system in which there are n goods, consols, and money. Then we have, for any period, n supply and demand equations for goods, one for consols, and one for money. There are n prices of goods and one interest rate to be determined. This means we have n + 2 equations in n + 1 unknowns. By a familiar argument, one of the equations follows from all the rest; hence one equation can be eliminated, leaving n + 1 equations to determine n prices and the interest rate. Hicks then argues that the choice of an interest theory is the choice of which of two equations--the equation for consols or the equation for money--to eliminate. If the consols equation is eliminated, the money equation is retained and we are left with a liquidity preference theory of interest. If the money equation is eliminated, the consols equation is retained and we are left with a loanable funds theory of interest. Since both methods will obviously yield the

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43/ J. R. Hicks, Value and Capital (2d edition, Oxford: The Clarendon Press, 1946), chap. XII.

same interest rate, Hicks says either is legitimate, and the choice is one of taste, with each method having advantages for particular problems.

What this amounts to is that, in applying Marshallian partial equilibrium analysis to the money market, when we take the prices of all goods as being given, we can determine the interest rate by equilibrating the supply and demand for money or by equilibrating the supply and demand for claims (consols in the above case). Hicks' analysis seems perfectly valid as far as it goes, but it is too formal to be very helpful in settling the controversy. The original question concerning the relation of saving and investment to the interest rate is left unanswered. And it does not serve to answer the question whether it is stocks or flows of money and securities that are equilibrated by the price system. And, as we shall see, this is an important question.

One objection to the Hicks procedure has been raised which does not seem valid to the present writer. It has been said[44] that any other equation--say the equation of supply and demand for eggs--could have been eliminated instead of either the money equation or the claims equation. This would seem by analogy to Hicks to give us still another interest theory. In fact, by this procedure, we could get as many interest theories as there are commodities in the system.

44/ L. R. Klein, The Keynesian Revolution (New York: The Macmillan Co., 1947), p. 118.

However, what we are interested in is extracting from a general equilibrium system an apparatus for partial equilibrium analysis of the interest rate. Since any supply-and-demand equation includes all prices, at least theoretically, it is true that we could select any equation we pleased--say the equation of supply and demand for golf balls. Then we could say that, given the prices of all commodities, including golf balls, the golf ball market determines the interest rate. The only trouble with this is that, at least for ordinary purposes, it doesn't make any sense. Since it does make much more sense to regard the interest rate as being determined through the interchange of money against claims, a plausible case can be made for selecting either the money equation or the claims equation. Perhaps there is a basis for objection to Hicks' way of stating the problem. It is not really a question of which equation to eliminate in the process of solving a system of general equilibrium equations (since this is not what we are trying to do), but rather a question of which equation to select out of the system for partial analysis.

Actually the point Hicks makes is a rather simple one. It comes very close to saying that it doesn't matter whether we determine interest rates or the prices of claims. Since there is a determinate mathematical relationship (if the factor of risk is consistently handled) between the price of a claim and its yield, this proposition is pretty obvious. But it doesn't help much in clearing up the confusion about

the interest rate.

Fellner and Somers,[45] in their attempted reconciliation of the liquidity preference and loanable funds theories, follow essentially the same procedure as Hicks except that their framework is one of macroeconomic or partial-equilibrium analysis. They divide both the supply of and the demand for money into categories according to what it is being exchanged against. Their categories are (a) claims, (b) goods, and (c) reservation demand and supply. Since the demand for and supply of goods (b) is assumed to be interest inelastic[46] and since reservation demand and supply (c), though varying with the interest rate, are always equal by definition at any interest rate, these elements cancel out in determining the interest rate. The interest rate determined by total demand for and supply of funds is, therefore, the same as the rate determined by that part of demand and supply represented by category (a). This is shown in Figure IV, taken from the Fellner and Somers article.

45/ W. Fellner and H. M. Somers, "Alternative Monetary Approaches to Interest Theory," Review of Economic Statistics, XXIII (February, 1941), 43-48.

46/ In the context of this model, it would seem that total demand for and supply of goods would be elastic to the interest rate. However, since other prices are assumed to adjust to equate demands and supplies in markets for goods, it would still be true that total demand and supply in these markets would be equal (though different at different interest rates), and the analysis would still be correct.

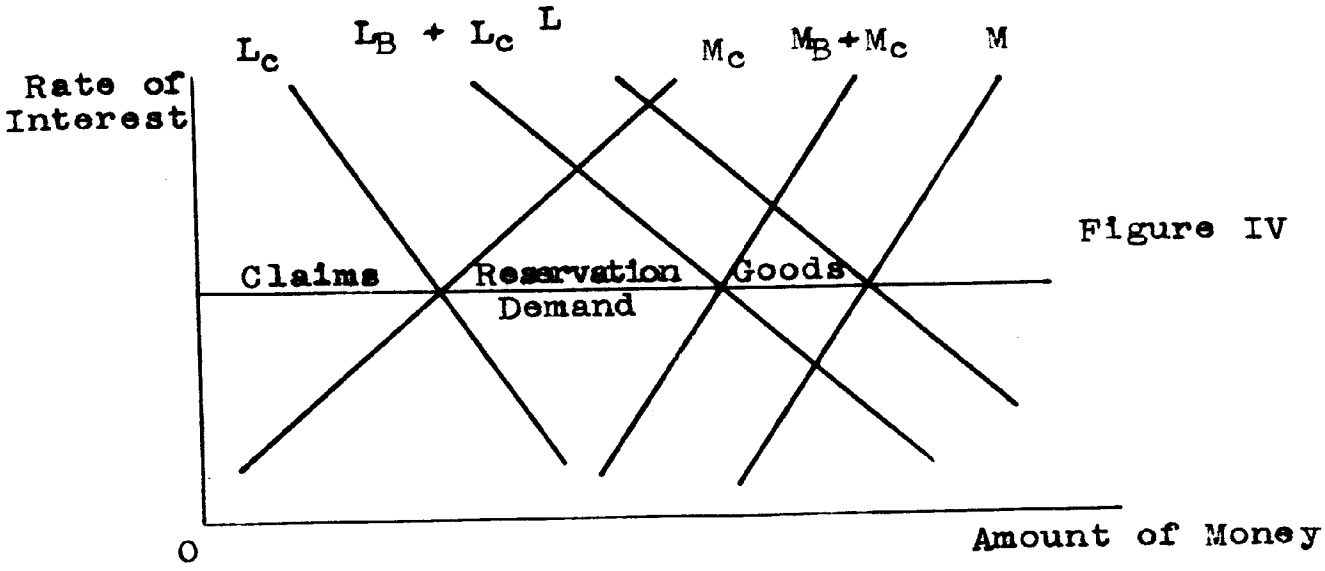


Figure IV

In this diagram, the interest rate, r_o, determined by total demand and supply (the L and M schedules) is the same as the rate determined by the demand for and supply of money offered against claims alone (the L_c and M_c schedules).

The liquidity preference approach to interest-rate determination uses total demand and supply, while the loanable funds approach confines itself to exchanges of money against claims and the demand and supply arising from that source. The two theories thus again come to the same thing, although Fellner and Somers feel that the liquidity preference theory is misleading because it involves, in effect, adding the same constant to both sides of an equation. In this respect, strangely enough, their preference for the loanable funds theory rests on the same argument as does Lerner's preference for the liquidity preference theory in the article discussed above.

The analysis of Fellner and Somers does not really settle any of the basic issues in the controversy about interest theory. Like Hicks' analysis referred to above, it boils down to the fairly obvious proposition that we may think of the problem alternatively as that of determining interest rates or as that of determining security prices. Moreover, since Fellner and Somers present their analysis entirely in terms of flows, they seriously misrepresent the liquidity preference theory, which is a stock theory.[47] This is a matter to which we will return in the following chapters.

Conclusion and Summary of Unsettled Issues

We will conclude this summary of recent work on interest theory with an attempt to assess the general state of affairs and to sum up the unsettled issues.

(1) It seems to be the case that if terms are properly defined, the liquidity preference and loanable funds theories are equivalent in a purely formal sense. That is, it makes no difference whether we regard the interest rate as being determined in a market where money is being exchanged for claims or where claims are being exchanged for money. This should certainly be true since interest is not paid for the

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47/ In a later article, Fellner and Somers argue that it really makes no difference whether stocks or flows are used--that the two approaches amount to the same thing. See "Note on 'Stocks' and 'Flows' in Monetary Interest Theory," Review of Economics and Statistics, XXXI (May, 1949), 145-146.

use of money except in those cases where some kind of claim is exchanged for the money--that is, only in the case of debt transactions.

(2) However, Keynes seemed to be saying that the speculative demand for money to hold as an asset occupies a position of special importance in the determination of the interest rate. Moreover, he indicated that saving and investment--i.e., the classical forces of time-preference and marginal productivity of capital--have no direct effect upon the interest rate. This has been disputed by Robertson and others, and the issue cannot be regarded as really settled. Most monetary theorists would probably now agree that saving and investment may affect the interest rate and that their effects were not adequately explained by Keynes. Obviously, an attempt to market additional new securities to raise money for investment can exercise an upward pressure on the interest rate, and increased saving with a constant demand for money to hold will mean additional bidding for securities and thus tend to lower interest rates. These influences do not seem to be satisfactorily allowed for by saying that changes in saving and investment will change the level of income and thereby the demand for active money, thus affecting the rate of interest. This may not be incorrect, but it is certainly misleading, since it gives the impression that there will be a substantial lag between the change in investment or saving and the resulting change in the interest rate. To the extent

that the omission of saving and investment as direct determinants of the interest rate rests upon confusion about definitions of saving and investments, as in the case of Keynes and Lerner, the issue can perhaps be regarded as settled. Few would now argue that saving and investment are incapable of affecting the interest rate because they are "always equal." However, this leaves unanswered the question as to how the effects of saving and investment should be shown in the Keynesian system.

(3) An important difference between the liquidity preference and loanable funds theories, as they are usually formulated, has been almost completely neglected in most discussions. This difference consists in the fact that the liquidity preference theory runs in terms of stocks of money and securities, while the loanable funds theory is usually stated in terms of flows of money and securities into the market during a period of time. Does it make any difference whether the interest rate is regarded as a price which equilibrates the flow of money and the flow of claims or as a price which equilibrates stocks of money and claims? If it does make a difference, which type of equilibration is the "right" kind--that is, which type is consistent with the probable behavior and motivation of asset holders? And, finally, should the choice of stocks or flows as a basis for analysis influence our choice of the appropriate type of interest theory?

(4) All the formulations of interest theory to which we have referred have been entirely static. They make no attempt to trace out the time-path followed by the interest rate in the process of moving from one equilibrium position to another. Some of them are applicable only to the determination of equilibrium rates of interest (Lange and Lerner, when properly interpreted). Others, such as the analyses of Hicks and Fellner and Somers, are applicable under all conditions, but are still entirely static. Frequently some discussion of dynamic change has been included in the analysis, but the framework has not been expressly dynamic.[48/] If we can put the problem in a dynamic setting, some hitherto unnoticed aspects of it may be brought to light.

(5) Related to this last point, it would be interesting to see what connection can be developed between Wicksell's concepts of the real and market rates of interest and the modern view developed by Keynes and others which includes the interest rate as part of the equilibrating mechanism which determines the level of national income and employment, as well as the price level.

We shall attempt to deal with some of these problems by starting with rather simple models representing the liquidity preference and loanable funds theories. From these models in which our concepts will have a clear meaning, we hope to

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48/ One exception is the article by Kennedy, op. cit.

extract answers to some of the questions and to settle some of the controversies. Then by gradually relaxing assumptions and introducing complications, we shall try, in so far as possible, to push closer to reality.

One important aspect of the problem which should be incorporated into our analysis is the structure of interest rates. However, we shall not attempt to deal with that problem extensively. It will not be possible to leave it out of account entirely, but no elaborate analysis will be attempted. And a good part of our analysis will abstract from this problem completely.

CHAPTER II

THE LIQUIDITY PREFERENCE THEORY OF INTEREST

In this chapter and the next, we are going to formulate first, the liquidity preference and then the loanable funds theory of interest in such a way that the two theories can be compared. We will put each in its setting as part of a simple economic system and we will use a dynamic formulation for each theory. It appears that some aspects of interest theory have been overlooked because the dynamics have not been worked out.

Since we are going to have to work with simplified models which are specially designed to throw the behavior of the interest rate into bold relief, a number of assumptions will be made. The purpose of these assumptions is twofold: first, to make our analysis sufficiently manageable so that we can explore its implications, and, second, to avoid complications which might distract our attention from the main purpose of the analysis. We will relax some of the restrictive assumptions at a later stage.

Assumptions and General Description of Models

Before beginning the analysis, we will attempt to catalogue the aforementioned assumptions, to explain the precise meaning of terms as they are used here, and to describe

the working of the simplified economy with which we are dealing. Most of what we have to say at this point will be applicable also in Chapter III when we take up the loanable funds theory.

(1) In our introductory analysis in this chapter and the next, we will assume that money wages remain constant up to full employment and there are unused resources and constant returns so that total output changes in response to changes in total expenditure with no accompanying change in the price level. The assumptions of constant money wages and constant returns are merely made for purposes of simplicity. As will be shown in section (1) of Chapter IV, our conclusions are not significantly changed if we assume that the level of money wages is a function of the level of employment and if we allow for diminishing returns. However, if we assume that the supply of labor is a function of the real wage and that money wages are flexible, entirely different factors dominate the determination of the interest rate. This matter is taken up in section (2) of Chapter IV.

We will take no account of changes in relative prices--which could be interpreted to mean either that no changes in relative prices occur or that those which do occur have no effect on total expenditure or its major categories.

(2) In order to avoid ambiguities and complications connected with the structure of interest rates, we will assume that the only type of debt or security in the economy

is consols,[1] all of which are regarded by investors as being subject to the same risk of default. When firms want to raise capital, they sell consols, and these consols are the only debt available for individuals and banks to invest in. Thus, there is only one interest rate--the yield of consols.[2] Some observations on the maturity structure of interest rates will be made in Chapter V, but no exhaustive analysis will be attempted.

(3) We will treat the money supply as an exogenous variable subject to precise control by the central bank. Commercial banks are subject to legal minimum reserve requirement, and they always keep their reserves in this ratio to their deposits--i.e., they always lend "up to the hilt." The public's desired currency-to-deposit ratio is assumed constant. Lags in the adjustment of the banking system to a

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[1] Our model is in this respect similar to Hicks' "spot economy with long lending." Cf. Value and Capital, p. 149.

[2] It is true that there is a structure of implicit interest rates applying to borrowing for different periods which depends upon the present consol rate and the expected consol rates (prices of consols) at future dates. For example, a firm could raise funds for one year by issuing consols today at the current interest rate and buying back (retiring) the consols at the end of one year at the then prevailing market price. But these rates would be, in a sense, "shadow" rates, since the rate for such borrowing would not be established by contract and would not be determined until the period was over--unless, of course, there existed a futures market in consols. There is, therefore, only one security price and, associated with it, only one interest rate, in the objective market sense. This interest rate will, of course, be strongly affected by what it is expected to be in the future--this, in fact, is a major element in our analysis.

change in its reserves are disregarded. In section (4) of Chapter IV, we will consider briefly possible methods of fitting the banking system more satisfactorily into the analysis.

(4) For the present, we will confine ourselves to discussing a system of laissez faire in which the fiscal effects of government activities are so small that they can safely be disregarded and no measures are deliberately undertaken by government to influence employment and the price level except monetary policy.[3/] In section (3) of Chapter IV, the effects of fiscal policies will be discussed.

(5) Certain assumptions about the nature and timing of the economic process will be made. The planning period and the income period are assumed to be coextensive. The planning period is the interval between successive dates on which plans are made regarding investment activity, consumption expenditures, and the composition of asset portfolios.[4/] The income period is the average length of time it takes a dollar of income which is spent on final output to generate a dollar

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3/ Laissez faire is given a similar meaning in Joan Robinson, "The Rate of Interest," Econometrica, XIX (April, 1951), 92.

4/ On the concept of planning and a planning period, see B. Ohlin, "Some Notes on the Stockholm Theory of Savings and Investment: II," Economic Journal, XLVII (March, 1937), 53-69, and F. A. Lutz, "The Outcome of the Saving-Investment Discussion," Quarterly Journal of Economics, LII (August, 1938), 588-614.

of additional income, after allowing for all intermediate transactions (restocking of inventories), starting up production lines, and so on.[5] We shall use this coextensive income and planning period as our basic unit of time, and we shall call it the production-planning period. A further assumption is that this period is constant.

(6) Our hypothetical economy functions somewhat as follows. At the beginning of Period 1, households decide, on the basis of income earned[6] in Period 0, how much to spend on consumption goods and how much to save in Period 1. At the same time, firms establish and execute their investment plans for Period 1, subject to adjustment depending on what the interest rate turns out to be--i.e., they establish their demand schedules for funds for investment. Holders of disposable cash and securities (consols) establish plans for adjusting their portfolios. These plans, like the investment plans of firms, are subject to adjustment depending upon what the interest rate turns out to be. Firms desiring funds for investment, savers having funds to allocate, and holders of

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[5] Cf. L. A. Metzler, "Three Lags in the Circular Flow of Income," in Income, Employment, and Public Policy: Essays in Honor of Alvin H. Hansen (New York: W. W. Norton & Co., Inc., 1948), pp. 11-32. Our income period equals the sum of the first two lags studied by Metzler--the lag of consumption expenditure behind income and the lag of production behind sales. The relation of the income period to the circuit velocity of money will be discussed later in this chapter.

[6] No distinction is made between earned income and disposable income.

disposable cash and existing securities meet in a market. Those on the demand side of this market include:

(a) Firms wanting funds for expenditure on investment goods.

(b) Persons wanting cash to hold as an asset (including savers who want to reserve a part of their savings in cash and those who want to sell part of their holdings of previously-issued consols).

The suppliers of funds include:

(a) Savers. All saving is regarded as going into the market, though some savings may be retained in cash (the reservation demand mentioned under (b) above).7/

(b) Those wishing to reduce their holdings of cash (dishoard).

(c) The banking system, which adjusts its holdings of assets to correspond to the amount of reserves

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7/ Both investment and saving are defined in the "gross" sense, so that they include replacement demand and depreciation allowances, respectively. This is necessary both because it is impossible to segregate statistically new investment and replacement investment, and because the difference between replacement outlays and depreciation allowances in any period may affect the interest rate. Surplus funds arising from depreciation allowances may be loaned out in the market or may be utilized to finance new investment which would otherwise have required the borrowing of funds. An excess of replacement outlays over depreciation allowances may result in additional demand for funds from the market, just as will new investment. We make no distinction between net personal saving and gross business saving, since we are not primarily interested in explaining saving. In a more complete model, they could be separated and handled in different ways.

supplied by the central bank.[8/]

A price of consols (or interest rate) which clears the market is determined at this time. Consumers and investors execute their plans and spend the amounts decided upon. Plans are held unaltered until the beginning of Period 2, and the spending generates an equal amount of production and income in Period 1.

(7) We are going to use the term "hoarding" to mean the net addition to the holdings of asset money in any period. Asset money means money held to satisfy the precautionary and speculative motives. Thus, hoarding would be equal to item (b) on the demand side minus item (b) on the supply side in the above listing of demand and supply factors. Hoarding, as thus defined may, of course, be either positive or negative. Under the assumed conditions, the term "hoarding" takes on a clear meaning, since once a person has adjusted his stock of asset money, he holds it idle (by definition) for a whole period, at the end of which time his asset position comes up for review again.

(8) There is obviously considerable arbitrariness in our classification of items as demand factors and supply

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8/ Banks, of course hold only consols and cash, and, for the banking system, the ratio of consols to cash is held constant. This ratio is the coefficient of expansion of the banking system, and it is equal to $1 + p/r + p$, where p is the public's desired ratio of currency to deposits, and r is the required legal reserve ratio of the banking system. If the central bank desires to increase the money supply by a certain amount, it buys securities in the open market to the extent of $r + p/1 + p$ times that amount.

factors. For example, when the banking system sells securities, it absorbs cash, and we could regard this as a demand factor rather than as a (negative) supply factor. It should be understood that the commercial banking system is included among those who are adjusting their asset portfolios in the above scheme.

(9) We are going to neglect the effect of investment on income which would occur through the increase in capital stock and productive capacity. Like Keynes, we are considering the short-run problem of utilization of existing capacity in the economy as a whole. This assumption raises certain problems and difficulties related to monetary theory which we will discuss later.[9/]

(10) We assume a closed economy.

In view of the assumptions and restrictions we have just listed, it is clear that our hypothetical economic system differs considerably from the real world. But in many respects it appears to be a reasonably accurate idealization of reality. Moreover, some of the restrictive assumptions will be relaxed at a later stage.

In this chapter, we will assume that owners of wealth in our model economy act in accordance with the principles set forth in Keynes' General Theory, with two modifications: (1) we will take account of the lags implicit in our description

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9/ See pp. 208-213, infra.

of the working of the economic system, and (2) we will include the level of income as one of the determinants of the rate of investment. The first modification is, of course, necessary if we are to explore the dynamics. The second makes the analysis a little more interesting and perhaps more realistic than it would be if we assumed that the marginal efficiency of investment schedule remained unchanged during a period of dynamic change. Moreover, the assumption that a rise in the level of income will raise the marginal efficiency schedule has some theoretical justification, since at higher levels of income, real profits will be higher. If expectations are elastic, this will mean higher profit expectations and a higher marginal efficiency schedule. Of course, the accumulation of capital during a period of expansion would exercise a very important offsetting force, which we are unable to take explicitly into account.[10/]

One limitation of our analysis is that it will be necessary to assume linear relationships throughout in order

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10/ We could incorporate the acceleration principle into our models by making the level of the marginal efficiency schedule depend upon the rate of change of income (or consumption). However, this would introduce essentially extraneous elements into the behavior of our system which would make it more difficult to focus attention on the interest rate. A more complete analysis might classify expenditures as determined by the level of income, the rate of change of income, the rate of interest, and perhaps other factors. Cf. J. R. Hicks, A Contribution to the Theory of the Trade Cycle (London: Oxford University Press, 1950); S. S. Alexander, "Issues of Business Cycle Theory Raised by Mr. Hicks," American Economic Review, XLI (December, 1951), 861-878.

to be able to trace out the dynamics. To a certain extent, we can allow for nonlinearity by taking account of probable changes in the coefficients during a period of change or by allowing for the fact that they are likely to vary with changes in business conditions.

The Liquidity Preference Model

Our model of the slightly modified version of the Keynesian system is described by the following system of equations.

$$I_t = aR_t + bY_{t-1} + c \qquad (1)$$

$$C_t = \alpha Y_{t-1} + \beta \qquad (2)$$

$$M_{2,t} = dR_t + eR' \qquad (3)$$

$$Y_t = M_{1,t} \qquad (4)$$

$$Y_t = C_t + I_t \qquad (5)$$

$$M_{2,t} = M - M_{1,t} \qquad (6)$$

In these equations, I = investment expenditures, R = the rate of interest on consols, Y = gross national product, C = consumption expenditures, M_1 = the amount of active money, M_2 = the amount of idle money, M = the total stock of money, t = time (measured in production-planning periods).

Equation (1) states that investment expenditures for the current production-planning period depend linearly upon the current period's interest rate and the previous period's income. Knowing the previous period's income, this allows us

to establish a relation between investment and the interest rate (the marginal efficiency of investment schedule). Then, as income changes through time, the level of the marginal efficiency schedule changes.

Equation (2) is the consumption function. Since it follows the Robertsonian scheme of making consumption depend upon the previous period's income,[11] it might appear to imply that the lag employed in our model is the lag between the receipt of income and the expenditure of that part of it which is spent on consumer goods. This would not be the proper lag to use on the basis of either analytical correctness or empirical evidence.[12] In order to get around this difficulty and at the same time bring the forces of supply and demand in the securities market into sharp focus, we must necessarily place a special and rather unrealistic interpretation on the timing of economic activity. We must assume that all incomes are received at the end of each period and that all spending is done at the beginning of the period. Under this interpretation, even though consumption expenditures depend upon the previous period's income, the lag between receipt and expenditure is only a single day (from the end of one period to the beginning of the next), and the important

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[11] Our consumption function actually represents the propensity to consume out of gross national product, rather than out of national income or disposable income.

[12] See the article by L. A. Metzler, op. cit.

lag becomes that between expenditure and the receipt of the income it generates. This also means that the statistical ex post identity of saving and investment in any production-planning period is brought about entirely by "unplanned" saving equal to the rise in the level of income since the previous period. Inventories are assumed to be adjusted to the desired level within each period so that no "unplanned" investment or disinvestment is allowed to occur except over periods shorter than a full production-planning period. The writer does not feel that these subtleties about timing are really very important, but merely sets them forth for logical completeness and because others may not agree that they are unimportant.

Equation (3) represents the Keynesian "speculative motive" for holding money or "liquidity preference proper."[13] It represents the hypothesis propounded by Keynes that the lower the interest rate, the larger the stock of money that investors will want to hold for speculative reasons. The liquidity preference schedule would slope downward to the right, its slope being the coefficient d, and its level depending mainly on investors' ideas about the "normal" level of the interest rate. The variable R' stands for some index

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[13] For the present, we will not take explicitly into account the precautionary motive for holding money. This can be interpreted to mean that we assume the amount of precautionary balances to be constant and define M as the money supply net of such balances.

of this subjectively-determined "normal" level of interest which is supposed to influence investors.[14] It is presumably heavily influenced by convention or historical experience,[15] being perhaps best thought of as related to a moving average of the interest rates which have prevailed in years past, with greater weight given to more recent experience. At the same time, however, it may be possible to influence it by deliberate policy measures, and this is our chief justification for including it explicitly as a variable.[16] R' is

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[14] It is best regarded as a kind of index number, since there is not a single idea of the normal level of rates for the whole community. Investors will differ, under given circumstances, in their opinion regarding the "normal" rate, although their ideas presumably will cluster around some central value. Even when the rate is high, it will be below the normal level for some investors, and when it is low, it will be above the normal level for some. As the actual rate falls, it passes below the normal for more and more investors, thus giving them an incentive to hoard for speculative reasons. This matter is discussed in greater detail in Chapter V.

[15] Keynes, General Theory, pp. 202-205.

[16] There would be theoretical justification for making the demand for asset money depend upon the rate of change of the interest rate ($R_t - R_{t-1}$) as well as upon its deviation from normal. These two factors would work against each other--i.e., a rapidly falling rate might lead investors to expect a further decline and give them an incentive to dishoard, while a low rate (in relation to normal) would lead them to expect a rise and give them an incentive to hoard. Speculation may exercise either a stabilizing or a destabilizing effect on price, depending upon whether a given change in price causes speculators to expect a reversal of the movement or a further change in the same direction. Both factors might be important in the same market, one being dominant under some conditions and the other dominant under different conditions. It is not difficult to construct models along the lines of the ones employed here which allow for both

an exogenous variable, and changes in it cause shifts in the liquidity preference schedule.

Equation (4) needs a brief explanation. Since our unit of time is the production-planning period, the amount of money in active circulation is by definition exactly equal to the gross national product of that period. This amount of money is put into circulation by expenditure on consumption goods and investment goods at the beginning of the period, and, by definition, remains in circulation throughout the period.[17/]

Equations (5) and (6) are familiar definitional relationships which require no explanation.

Our model has consumption depending on the previous period's income, and investment depending on the previous

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forces, but the results are not particularly interesting. Perhaps the chief justification for omitting the factor of destabilizing speculation is that it is probably largely a transitory phenomenon that appears in the early stages of a rise or fall in interest rates and accentuates the speed of the change, thus moving interest rates quickly to a point where stabilizing speculation (based on a normal) takes control. Keynes' theory of liquidity preference, of course, allows only for speculation of the stabilizing variety.

17/ If our amounts for Y, C, and I referred to current annual rates, rather than to actual amounts for each production-planning period, equation (4) would become $M_{1,t} = kY_t$, where k would be equal to the number of days in a production-planning period divided by the number of days in a year. It would be the (marginal) Marshallian k (limited to active balances) or the reciprocal of the (marginal) circuit velocity of active money. Otherwise the analysis would be unchanged. Cf. F. Machlup, "Period Analysis and Multiplier Theory," Quarterly Journal of Economics, LIV (November, 1939), 1-27.

period's income and the current interest rate. The interest rate could be introduced as a determinant of consumption--and therefore saving--without any difficulty, as we shall see later. A check will quickly show that all the elements we listed as affecting the money-consols market[18] are included in the model. However, one assumption about economic behavior is involved to which attention should be directed because of its great importance in what follows. This is the assumption that people adjust their stocks of money and securities to the current interest rate. This is the assumption made by Keynes in the General Theory. As we shall see later, in our loanable funds model we assume that they adjust not their stock of money but changes therein.

If we regard M, the total stock of money, as a parameter which is determined by the policy of the central bank, we have six equations in six unknowns. We can find the static equilibrium values for all the variables by removing the time subscripts and solving the equations. These will be the values which the variables will tend to approach starting from any initial position, assuming certain simple stability conditions are fulfilled. And if we know the initial value of Y, the only lagged variable, the dynamic system determines the time-path of all the variables.

We will begin by working out our model on the assumption

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[18] See pp. 39-41, supra.

of a given money supply. By substituting from equations (1) - (4) into equations (5) and (6) and simplifying, we get the following pair of difference equations in Y and R.

$$Y_t - \frac{d(\alpha + b)}{a + d} Y_{t-1} - \frac{a(M - eR') + d(\beta + c)}{a + d} = 0,$$

and

$$R_t - \frac{d(\alpha + b)}{a + d} R_{t-1} - \frac{(M - eR')(1 - \alpha - b) - \beta - c}{a + d} = 0.$$

The equilibrium solutions of these two difference equations, obtained by substituting the equilibrium value, $\bar{Y}$, for Y_t and Y_{t-1}, and the equilibrium value, $\bar{R}$, for R_t and R_{t-1}, are

$$\bar{Y} = \frac{\frac{a}{d}(M - eR') + \beta + c}{1 - \alpha - b + \frac{a}{d}} \qquad (7)$$

$$\bar{R} = \frac{(M - eR')(1 - \alpha - b) - \beta - c}{d(1 - \alpha - b + \frac{a}{d})} \qquad (8)$$

This means that, if the system is stable so that it will eventually approach some constant values of Y and R, these values ($\bar{Y}$ and $\bar{R}$) are given by the above equations (7) and (8). The stability of the system depends on the parameters α, b, a, and d. If the condition,

$$\alpha + b < \frac{a + d}{d},$$

is fulfilled, the system will be stable and will approach the equilibrium values specified by (7) and (8). This condition is sufficient to make the system dynamically stable--not only will the system remain at the equilibrium values if it gets

to them, but it will gradually return to the equilibrium position if it is displaced from it by some shock. Corresponding equilibrium values also exist for C, I, M_1, and M_2.

Numerical Illustration

Perhaps the best way to bring out the properties of the system is by means of a numerical illustration. Let us assume the following values for the parameters of the system.

$a = -100$	$\beta = 30$
$b = 0.2$	$d = -500$
$c = 18$	$e = 4{,}000$
$\alpha = 0.6$	$R' = .06$

The particular values of the parameters in this illustration have no special significance. They were selected with a view to providing a suitable illustration rather than on the basis of any empirical study. The coefficients of R and R' (a, d, and e) measure the effect on investment and holdings of asset money of changes in the actual market interest rate and of changes in the normal (expected) interest rate. For instance, with e = 4,000, a change of 1% in R' will cause investors to add 40 to their holdings of asset money at any market interest rate.

We can bring out many of the essential features of the system by showing the effect of a change in the money stock. We will, therefore, start from a position of equilibrium and trace out the changes caused by an increase in the stock

of money. Suppose that, to start with, the money stock is 300 and the level of income is 150, which is the equilibrium income for that amount of money. The values of the other variables can be computed from the original equations ((1) - (6), page 44). These values are given in the first column (Period 0) of the table below (Table I).

Now suppose that, at the beginning of Period 1, the central bank increases the money stock by 100 through the purchase of consols in the open market.[19] After thus increasing the stock of money, the central bank takes no further action in future periods. The authorities merely sit back and watch the economy adjust to the larger stock of money.

What we now have is our system of difference equations with the parameters listed above, with the constant M = 400, and with the initial values of income and the interest rate Y_o = 150 and R_o = 18%. With these given values, our difference equations will trace out a time path for each variable--that is, all future values of all variables are automatically generated.

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[19] To increase the money supply by 100, the central bank would not have to buy a full 100 of consols. Rather, it would have to buy only 1/v(100) of consols, where v is the expansion coefficient of the banking system. This is because the money supply will be increased by an amount equal to the added reserves of the commercial banks multiplied by v. v, in turn, is equal to 1 + p/r + p, where p is the public's desired ratio of currency to deposits and r is the required reserve ratio of the commercial banks. Other factors, such as the public's desired ratio of time deposits to demand deposits, together with required reserve ratio for time deposits, would also influence v. Cf. footnote 8, supra.

The following table (Table I) shows the sequence of values for the first few production-planning periods and the levels that will ultimately be reached (Column N).

TABLE I

	Production-planning Period					
	0	1	2	3		N
Y	150	166.67	177.78	185.19	.....	200
C	120	120.00	130.00	136.67	.....	150
I	30	46.67	47.78	48.52	.....	50
S	30	30.00	36.67	41.11	.....	50
M_1	150	166.67	177.78	185.19	.....	200
M_2	150	233.33	222.22	214.81	.....	200
M	300	400.00	400.00	400.00	.....	400
R	.18	.0133	.0356	.0504	.....	.08
R''	.18	.18	.1466	.1245	.....	.08
V[a]	1.50	1.25	1.33	1.39	.....	1.50

[a] Income velocity (of total money) per annum on the assumption that the production-planning period is one-third of a year.

From the above table, we can trace out the chain of events which occurs when 100 of additional money is introduced into the economy. The first impact of the increase of 100 in M in Period 1 is to increase the liquidity of those who sold securities to the central bank and to increase the reserves of the banking system by the amount of the purchases. The increased liquidity of the banks, as well as other

investors, causes a sharp lowering of the interest rate. At the lowered interest rate, there is a considerable increase in investment expenditures. Hence only 83.33 of the 100 of new money goes into idle balances, 16.67 being drawn into active circulation by the increase in investment. The rise in investment increases production and incomes, and this rise results in a further expansion of consumption and investment demand in Period 2. This draws still more of the added 100 of money into active circulation and pushes up the interest rate in Period 2. Thus an expansion is under way. This expansion continues until eventually income has risen by 50 and reached a new equilibrium at a level of 200, the interest rate has been pushed back up to 8%, and 50 of the 100 of new money has been drawn into active circulation, leaving the other 50 in idle balances. The injection of new money results in a growth in the proportion of national income devoted to investment--investment was 20% of national income to begin with, but after the expansion has been completed, it is 25% of national income.

The last row of figures in Table I shows the behavior of income velocity[20/] over the period. These calculations are based on the assumption that the production-planning period has a uniform length of four months. This would mean

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20/ We are referring here to income velocity of total money. The income velocity of active money is 3 (the number of production-planning periods in a year).

that in each period income at an annual rate would be three times the actual income for the period. Annual income velocity is obtained by dividing the annual rate of income by the total stock of money. For example, income velocity for Period 0 is computed as follows:

$$V_1 = \frac{3 \times 150}{300} = 1.5.$$

It will be noted that in this illustration, velocity starts out at 1.5, drops sharply immediately after the money is injected, then gradually rises until it reaches 1.5 again in equilibrium.[21/]

The row marked R'' in Table I shows the equilibrium rate of interest in each period. It will be referred to later.

Determination of the Interest Rate

Now we want to examine our model to see whether the interest theory embedded in it should best be described as a liquidity preference theory or as a loanable funds theory. We can start by going back to our original set of equations

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[21/] Although it happens that in this particular illustration, due to the values selected for the parameters, velocity is always 1.5 at any equilibrium level of income, it is not true in general that velocity has the same value at the equilibrium level of income corresponding to every possible quantity of money. Equilibrium velocity is a linear function of equilibrium income, and may rise, fall, or remain constant as equilibrium income rises, depending on the particular values of the parameters. The marginal circuit velocity of money is, however, a constant when the calculation is made between successive equilibrium levels of income. That is the same as saying that the multiplier for increases in the money stock is constant.

and solving them for R_t, the rate of interest that prevails in period t. Doing this, we get the following:

$$R_t = -\frac{\alpha + b}{a + d}Y_{t-1} + \frac{M - \beta - c - eR'}{a + d}.$$

This is a rather complex expression, but the main point that it brings out is that the rate of interest in any period depends upon (a) the existing level of income (for the previous period), (b) the stock of money, and (c) all the parameters of the model system. It doesn't depend upon d, e, and R', the parameters of the demand for idle money any more than it depends upon the other parameters. It does depend upon a, the interest coefficient of the investment function, which is the slope of the marginal efficiency of investment schedule when the last period's income is given and determines the level of the schedule.

Some of the problems and controversies connected with the determination of the rate of interest in the Keynesian system can now be cleared up by going back to the original Keynesian-type diagram (Figure I, page 4) and making a slight modification in it. Keynes assumed, as we did in drawing that diagram, that L_1, the demand for money for transactions purposes is independent of the interest rate and dependent on the level of income. This was the flaw in his theory of interest which was the cause of most of the controversy with Robertson about the effects of savings and investment on the rate of interest. The diagram should be altered, as we have

have done in Figure V.

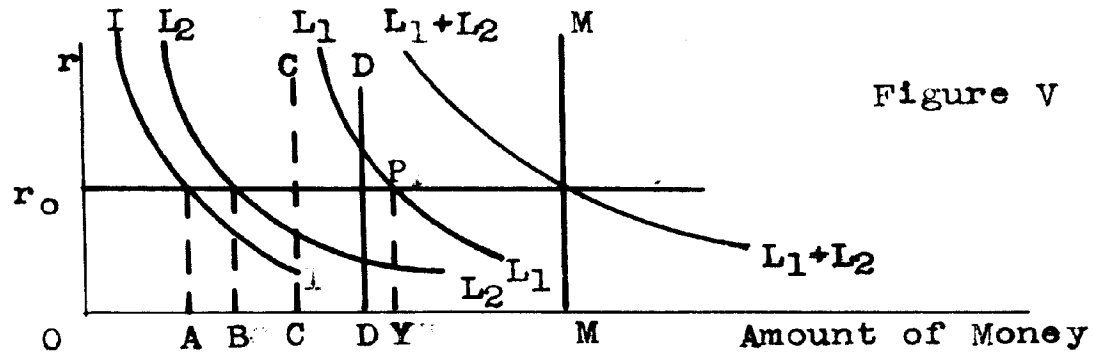


Figure V

This diagram is assumed to be drawn at a certain stage in a dynamic process, at the beginning of one production-planning period with the previous period's income given. If we choose as our unit of time the production-planning period, as pointed out above, the current period's income will be just equal to the amount of active money.[22/] The amount of active money will now be a function of the rate of interest, not because the amount of money needed for transactions purposes at a given income level is a function of the interest rate, but because current income itself depends directly on the interest rate. In Figure V, the curve I is the marginal efficiency of investment schedule, the vertical line C represents the demand for money to finance consumption expenditure (regarded as independent of the interest rate and determined by the previous period's income, and curve L_1 represents the

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22/ If our Y, C, and I magnitudes are expressed as annual rates, the proportionality factor k (see footnote 17, supra) can easily be introduced to adjust the demand for active money.

demand for transactions money obtained by adding the I and C schedules horizontally. Finally, adding the L_2 schedule (demand for asset money) to L_1 gives the total demand schedule ($L_1 + L_2$). M is the stock of money available, and the intersection of the M schedule and the $L_1 + L_2$ schedule (supply and total demand) determines the interest rate. Thus, in Figure V, OA (= CY) is investment expenditures, OC is consumption expenditures, OB (= YM) is the amount of asset money, and OY is the current period's income and the amount of active money.

If saving as well as investment depends upon the interest rate, this fact can very easily be introduced into our picture. For example, if at a given level of income more is saved (i.e., less is spent on consumption) at high than at low interest rates, the C-schedule can simply be drawn sloping downward to the right rather than vertically as in Figure V.

This type of diagram is perfectly general in its applicability--that is, it is satisfactory for depicting non-equilibrium as well as equilibrium situations. The addition of the vertical line DD, drawn at a distance along OM equal to the previous period's level of income permits us to show the equilibrium condition on the chart. (OC/OD is equal to the average propensity to consume.) CD is the amount of voluntary saving in the current period (previous period's income minus current consumption expenditures). If CD equals

CY, so that lines DD and YP coincide, voluntary saving is equal to investment and the situation is one of equilibrium. If CY exceeds CD, as in Figure V, the situation is one of expansion, and DY represents the amount of dishoarding in the current period and also the amount of "unplanned" saving that eventuates at the end of the period to make ex post saving and investment equal.

The sense in which this formulation is an improvement over Keynes can be illustrated by considering two examples. Consider, first, the effects of an increase in the money stock. Keynes would say that the increase in money stock causes the interest rate to fall, its fall being checked to the extent that the liquidity preference schedule is elastic. Then, at the lower rate of interest, investment is increased to the extent that the marginal efficiency schedule is elastic. Finally, the rise in investment raises income which raises the demand for transactions money. This pushes out the money demand schedule and raises the rate of interest back toward its original level. Thus, it is only by a roundabout process (and, at least by implication, with a substantial lag) that investment affects the interest rate. In our formulation, it is recognized that initially some of the new money will be used to buy new securities which are sold to finance a larger volume of investment as the interest rate falls. This adds another component to the elasticity of demand making the elasticity greater and thus keeps the interest rate from

falling as much as it would in the Keynesian formulation. Of course, there are additional indirect effects in both formulations, which result from the multiplier process as additional consumption (and, in our model, investment) is induced, thus causing a further rise in income and an increase in transactions cash requirements.

The superiority of our model over Keynes is even more apparent when we consider the effects of an autonomous rise in the marginal efficiency schedule. Keynes would say that the interest rate is initially unaffected. Investment rises by the amount of the shift in the marginal efficiency schedule at the old interest rate. Then the induced rise in income raises transactions cash requirements and indirectly pushes up the interest rate. In our model, the rise in marginal efficiency of investment exerts an immediate upward pressure on the interest rate by increasing one component in the demand for money. Surely this is correct--an attempt by entrepreneurs to borrow more money from banks or issuance of additional new securities to finance investment will immediately and directly tend to push up the interest rate. Of course, since the sale of securities or the borrowing from banks always precedes by some time the actual expenditures on investment goods, Keynes' "demand for finance" can be brought in to explain why the rise in interest rates is likely to <u>precede</u> the actual increase in investment. This would mean the entrepreneurs borrow money to hoard it temporarily, pending their actual investment

expenditures, and this demand should be reflected in L_2. But whether there is advance financial provision or not, surely an increase in investment will tend immediately and directly to raise the interest rate. As was explained in Chapter I,[23] Keynes' confusion on this point clearly stems from his "always equal" definitions of saving and investment, which led him to believe that an increase in investment always resulted immediately in enough voluntary saving to finance the increase. If this were true, an increase in investment could not affect the interest rate.

Now admittedly the above is a technical and, in a sense, an unimportant modification of Keynes. Final results are not altered in any very significant sense by allowing for a direct as well as an indirect effect of investment (and saving) on the interest rate. Nevertheless, the correction of Keynes' analysis seems useful for three reasons. First, it makes the theory more technically correct and eliminates the obviously anomalous situation of the marginal efficiency schedule having an interest elasticity and at the same time standing off by itself and having no direct part in determining the rate of interest. Second, it answers the objections of Robertson and others to Keynes' interest theory, which were discussed in Chapter I.[24] Finally, from a

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[23] See pp. 14-18, supra.

[24] See pp. 10-14, supra.

pedagogical standpoint, it makes the Keynesian system at once simpler and more accurate. Graphically, by telescoping liquidity preference and marginal efficiency of investment into a single diagram, it permits the Keynesian system to be presented by means of two interrelated diagrams (the other being the consumption function-multiplier diagram) instead of the usual three (liquidity preference, marginal efficiency of investment, and consumption function-multiplier).

What kind of interest theory does this apparatus imply? Is it a liquidity preference theory or a loanable funds theory? This raises a basic question with respect to the meaning of the label, "liquidity preference theory." If it means, as Keynes seems to imply, that the interest rate is determined by the demand for asset money and the supply of money available, the above is not a liquidity preference theory. When we went back to our system of equations, we found that it was necessary to make use of every equation in the system to calculate the interest rate for any period. Diagrammatically, the L_1 schedule, which reflects the demand for money for transactions purposes (consumption and investment), is just as much a component of the total demand as is L_2 ("liquidity preference proper").[25] However, if the

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[25] This would be equally true if the L_1 curve were completely inelastic--i.e., even then a shift of the L_1 curve (due to a change in the marginal efficiency of investment or of the consumption line) would have a direct effect on the interest rate. However, in this case, the L_2 schedule would occupy a more unique role in determining the interest rate,

liquidity preference theory merely means that the interest rate is determined by the demand for and supply of money--and this is a meaning that frequently seems to be attached to it--then it is an unexceptionable theory. But it would be equally correct to call the above interest theory a loanable funds theory, since, by any sensible definition of terms, money and loanable funds are identical in this scheme.

Now it must be recognized that, under some circumstances, the L_2 demand may dominate in determining the rate of interest. This will happen if the liquidity preference schedule is extremely elastic, while the marginal efficiency of investment schedule is relatively inelastic. But it is equally possible that the marginal efficiency schedule (or, for that matter, the consumption schedule) might be the more elastic under other conditions and become the dominant factor.[26] The limiting case in this direction is the situation where the liquidity preference schedule is entirely inelastic. Under these circumstances, saving and investment take over the entire job of determining the interest rate.

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since it would be the only schedule with any elasticity--i.e., without it the interest rate would be either zero, infinite, or indeterminate!

[26] Cf. H. M. Somers, "Monetary Policy and the Theory of Interest," Quarterly Journal of Economics, LV (May, 1941), 488-507, where the marginal rates of return on resources in all uses are related to the interest rate, and it is shown that different margins may dominate depending upon circumstances.

Any increase in the stock of money will go entirely into active circulation, and the level of income, measured as an annual rate, will immediately rise by an amount equal to the circuit velocity of active money times the increase in money stock and will remain indefinitely at the higher level. This is the case of the more or less "crude" quantity theory of money.

It does seem that the name "liquidity preference" has had the unfortunate result of overstressing one element in the apparatus. It sounds as though the tendency to stay liquid and hold idle cash has some unique function in determining the interest rate under all circumstances. In fact, it appears that Keynes selected the name for his interest theory, which is supposed to be perfectly general in its application, by referring to the peculiar circumstances of depression when the tendency to hoard is great, the rate of interest is low, and the liquidity preference schedule is highly elastic. A more neutral name--such as "supply-and-demand-for-money theory of interest"--might have been better. This is perhaps better than the term "loanable funds theory of interest," because it focuses attention on the motives for holding money without overstressing them.

Thus far it sounds as though the loanable funds and liquidity preference theories are likely to turn out to be identical. However, we have not yet started to analyze the loanable funds theory as it is customarily formulated. When

we do (in Chapter III), we shall find it considerably different from Keynes' theory. But the difference turns upon a distinction that has been commonly regarded as incidental and minor[27]--the distinction between stocks and flows. Keynes' theory is a stock theory. The loanable funds theory is a flow theory. This is a real difference, and it is an important one, as we shall see.

There is, however, another aspect to Keynesian interest theory that needs to be considered. May it not be that, while liquidity preference, narrowly construed, has no unique role in determining the rate of interest when the economy is in disequilibrium in the Keynesian sense (as in the periods between O and N in our illustration), it does occupy a key position in the determination of the equilibrium interest rate (as in Period O or Period N)? This possibility was mentioned in Chapter I when we discussed Lerner's attempt to reconcile the liquidity preference and loanable funds theories.[28] We saw then that Lerner's analysis was incorrect in a period of disequilibrium, because in this case

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[27] It is true that the difference between stock and flow analysis has not gone entirely unrecognized. Klein has pointed out that the liquidity preference theory is not identical with the loanable funds theory and that "it would be misleading simply to write off flow analysis and stock analysis as equivalent." See Klein, "Stock Analysis and Flow Analysis in Economics," op. cit., p. 236. However, so far as the author is aware, no full analysis of the two theories in terms of the stock and flow distinction has been carried out.

[28] See pp. 19-21, supra.

planned saving and planned investment are not equal and therefore could not legitimately be regarded as cancelling each other out. But it was pointed out that if we confined ourselves to periods of equilibrium, we could legitimately draw an SI curve[29] like Lerner's. Then saving and investment do appear to cancel each other out, and a true liquidity preference theory may be all right.

We can settle this matter also by referring back to our original equations. Equation (8),[30] which is repeated below, is the equation for the equilibrium rate of interest in our system.

$$\bar{R} = \frac{(M - eR')(1 - \alpha - b) - \beta - c}{d(1 - \alpha - b + \frac{a}{d})} \qquad (8)$$

When we look at this equation, we immediately see that all the arguments we applied against a straight liquidity preference theory of interest in discussing the dynamic analysis apply with undiminished strength here. For expression (8) involves (a) the money supply, and (b) every single parameter of the system. A change in money supply or in any parameter is thus capable of changing the equilibrium rate of interest. If a simple liquidity preference theory were suitable, this expression should involve only M, d, e, and R'--the quantity of money and the parameters of the liquidity preference function.

29/ See Figure III, p. 19, supra.

30/ See p. 50, supra.

The explanation of this in terms of the Lerner diagram is that the position of the L-schedule in Figure III--its distance from the vertical axis--depends upon all the relationships in the system.

If we want a graphical method for determining the equilibrium level of income and the equilibrium rate of interest, we can use the method developed by Hicks.[31] It is easy to apply this to our model. First we substitute equations (1) and (2) into equation (5), assuming equilibrium values for Y and R, and we get one (linear) equation connecting $\bar{Y}$ and $\bar{R}$.

$$\bar{Y} = \frac{a}{1 - \alpha - b}\bar{R} + \frac{\beta + c}{1 - \alpha - b}$$

This is the equation for Hicks' IS-schedule. Then by substituting from equations (3) and (4) into equation (6), we get another (linear) relation between $\bar{Y}$ and $\bar{R}$,

$$\bar{Y} = -d\bar{R} + M - eR'.$$

This is Hicks' L-schedule. Using M = 400 and the values of the parameters in our illustration, the two equations turn out to be

$$\bar{Y} = -500\bar{R} + 240$$

$$\bar{Y} = 500\bar{R} + 160$$

Graphically, the solution is shown in Figure VI.

31/ J. R. Hicks, "Mr. Keynes and the 'Classics'; A Suggested Interpretation," op. cit. Hicks' scheme is also developed in A. H. Hansen, Monetary Theory and Fiscal Policy (New York: McGraw-Hill Book Co., Inc., 1949), chap. 5.

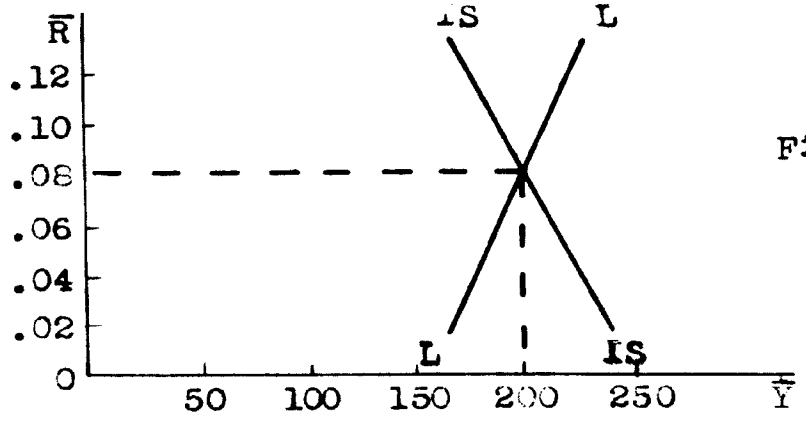


Figure VI

The IS-schedule and L-schedule are linear only because all the equations in our model are linear. In the general case, they will be curvilinear as in Hicks' article.

From our equilibrium equations (7) and (8), we can derive monetary policy multipliers, showing the relation between changes in the stock of money and changes in the equilibrium levels of income ($\bar{Y}$) and of the interest rate ($\bar{R}$). The multiplier formulas are

$$\Delta\bar{Y} = \frac{\frac{a}{d}}{1 - \alpha - b + \frac{a}{d}}\Delta M \qquad (9)$$

and

$$\Delta\bar{R} = \frac{1 - \alpha - b}{d(1 - \alpha - b + \frac{a}{d})}\Delta M \qquad (10)$$

Since a and d are presumably both negative, an increase in the money stock will ordinarily raise the level of income and lower the rate of interest, as one would expect. The income multiplier (9) will be small if a is very small or if d is very large, and the interest rate multiplier (10) will be small if d is very large. It has been pointed out many times that a very elastic liquidity preference schedule

or a very inelastic marginal efficiency of investment schedule may take away the power of monetary policy to affect the level of income. Our multipliers clearly demonstrate this possibility.

Multipliers could also be developed to show the effects of autonomous shifts of the investment schedule, the consumption function, and the liquidity preference schedule. The results would be in full accord with our expectations.

Relation of Keynes to Wicksell

By means of a slight extension of the method we have been using, we can bring out the relation between the Keynesian system and the monetary theory of Knut Wicksell. In the row labelled R'' of the illustrative table on page 55 are shown the respective rates of interest which would have made investment equal to the saving that was done in each period, given the level of income for the previous period. These values were obtained by substituting savings (for investment) and the previous period's income into equation (1) and solving for R. The values of R'' bear some analogy to the concept of real or natural interest rate employed by Wicksell,[32] while the actual values of R correspond to his concept of the market

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[32] K. Wicksell, Lectures on Political Economy (London: George Routledge and Sons, Ltd., 1935), Vol. II, chap. IV; Interest and Prices (Geldzins und Guterpreise), translated from the German by R. F. Kahn (London: Macmillan & Co., Ltd., 1936), pp. 102-156. See also G. Myrdal, Monetary Equilibrium (London: William Hodge and Co., Ltd., 1939).

rate of interest. In the early stages of our sequence, the real rate is substantially above the market rate, and the process of approaching equilibrium involves a fall in the real rate and a rise in the market rate until, in equilibrium, the two are equal at 8%. Thus the interest rate performs an integral part in the macroeconomic equilibration process. Given the values of the parameters of the system and given the money stock, there is an equilibrium rate of interest that tends to be approached, as well as equilibrium values of all the other variables.

However, the general relation between the interest theories of Wicksell and Keynes can be brought out through a modification of the model employed above. The essential features involved in Wicksell's concept of the real rate of interest are brought out in the following passage.

> The rate of interest at which the demand for loan capital and the supply of savings exactly agree, and which more or less corresponds to the expected yield on the newly created capital, will then be the normal or natural real rate. It is essentially variable. If the prospects of the employment of capital become more promising, demand will increase and will at first exceed supply; interest rates will then rise and stimulate further saving at the same time as the demand from entrepreneurs contracts until a new equilibrium is reached at a slightly higher rate of interest. And at the same time equilibrium must ipso facto obtain--broadly speaking, and if it is not disturbed by other causes--in the market for goods and services, so that wages and prices will remain unchanged.33/

33/ Wicksell, Lectures on Political Economy, Vol. II, p. 193. (Italics in original.) Wicksell's terminology is sometimes rather confusing, since he uses the terms, "normal" and "natural," as well as "real" and "market." However, we shall use the term "real" to refer to the concept explained in the quoted passage.

This passage brings out the essential criteria involved in Wicksell's concept of monetary equilibrium. Monetary equilibrium is attained when the actual market rate of interest is equal to the real rate of interest. The real rate of interest is the rate which simultaneously fulfills three conditions.[34]

(1) It is equal to the marginal productivity of real capital.

(2) It brings about equality between *ex ante* saving and *ex ante* investment.

(3) It results in stability of the price level of commodities.

The assumption is that these three conditions are equivalents and are never mutually inconsistent, i.e., that there is always an interest rate which will fulfill all three conditions at the same time.

The first of Wicksell's conditions can be rejected and dropped completely from the analysis, because it fails to take account of the fact that the marginal productivity of capital is a schedule concept and that any interest rate will be equal to the marginal productivity of capital (or, in Keynesian terminology, the marginal efficiency of investment).[35] Thus equality with the marginal productivity of capital

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[34] Myrdal, *op. cit.*, pp. 37-38.

[35] This flaw in Wicksell's first condition is pointed out in H. Neisser, "Monetary Equilibrium and the Natural Rate of Interest," *Social Research*, VIII (November, 1941), 455-457.

cannot serve as a criterion for defining any particular rate of interest.[36]

It should be noted also that Wicksell assumed that prices and wages were flexible and that such flexibility of wages and prices was capable of preventing the development of involuntary unemployment.[37] Consequently, fluctuations in total expenditure bring corresponding fluctuations in the price level. Under these conditions, if the market rate of interest is below the real rate, investment will exceed saving and the price level will rise. If the market rate is equal

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[36] It has been pointed out to me by Professor R. A. Musgrave that this criterion may be useful in defining disequilibrium in a dynamic system, since it is a temporary discrepancy between the interest rate and the marginal efficiency of investment which causes investment to change and thus impels the system along its time-path. As a formal criterion of equilibrium, however, it is not necessary since such a discrepancy can exist only within a unit time period (in each period investment is adjusted to make the marginal efficiency of investment equal to the interest rate) and, therefore, it does not appear in the formal analysis.

[37] On this point, he says, "It is, of course, not impossible for the rise in prices to be counteracted to a certain extent by an increase in production, for example if previously there had been unemployment, or if higher wages had induced longer working hours, or even by the increasing roundaboutness which is undoubtedly invoked by a fall in interest rates, even if it occurs artificially. But all these are secondary considerations. As a first approximation we are entitled to assume that all production forces are already fully employed, so that the increased monetary demand principally takes the form of rivalry between employers for labour, raw materials and natural facilities, etc., which consequently leads to an increase in their price, and indirectly, owing to the increased money income of labour and landlords and the increased demand for commodities, to a rise in the price of all consumption goods in addition to that which arises from diminished savings." Lectures on Political Economy, Vol. II, p. 195. (Italics added.)

to the real rate, investment and saving will be equated, total expenditures will be constant, and the price level will be stable. If the market rate is above the real rate, saving will exceed investment, total expenditures will be decreasing, and the price level will fall.[38]

Wicksell is rather vague concerning the determinants of the market rate of interest. He seems to assume that the banking system and the monetary authorities can set the market rate. Then the task of the monetary authorities in attempting to maintain economic stability becomes that of trying to keep the market rate equal to the real rate. Like Keynes, he stresses "real" rather than "monetary" factors as the primary cause of instability--that is to say, in Keynesian terminology, he stresses the instability of the marginal efficiency of investment as a causal factor. This is brought out in the following passage.

> The fluctuations in commodity prices which are not directly caused by changes in gold production must therefore have another cause in many cases, namely the changes which occur from time to time in the real rate of interest.

38/ In a longer run analysis, in which allowance is made for the growth of the labor force and of the stock of capital through investment, equality of saving and investment would not be compatible with both full employment and stability of the price level. A moving equilibrium of this sort with continuous full employment would require a continuous excess of ex ante investment over ex ante saving in order to maintain stability of the price level. Hence Wicksell's last two conditions for monetary equilibrium are consistent with each other (and full employment) only in short run analysis, in which the stock of capital and the labor force are assumed to be constant. In this respect, Wicksell's system is similar to Keynes'.

> This is not to be understood as meaning that the level of this interest makes commodities on the average cheaper or dearer, for that, as we have seen is generally not the case, but because the loan rate does not adapt itself quickly enough to these changes, so that the influence of the banks on commodity prices is in fact a consequence of their passivity, and not of their activity, in the loan market. In other words, the difference between the actual loan and normal rates, which we have already designated as a major cause of fluctuations in commodity prices, arises less frequently because the loan rate changes spontaneously whilst the normal or real rate remains unchanged but on the contrary because the normal rate rises or falls whilst the loan rate remains unchanged or only tardily follows it.39/

Wicksell is concerned with trying to set up a criterion for monetary policy to follow in seeking to achieve economic stability (which he conceives to be virtually equivalent to price level stability). He centers his attention mainly upon the rate of interest as the independent variable which monetary managers should attempt to influence, shifting his attention away from the quantity of money which had been the independent variable in classical monetary theory.

The idea that discrepancies between the market rate of interest and the real rate lead to cumulative inflation or deflation of prices cannot, in general, be accepted as adequate, since fluctuations in the level of production and employment are left out of account. Nevertheless, there is one special case in which Wicksell's monetary theory is useful and informative. If we start from a situation of full-employment equilibrium with a stable price level, and the monetary authorities, by open market or other policies, reduce the rate

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39/ Ibid., p. 205. (Italics in original.)

of interest below the existing (equilibrium) level and maintain it at the lower level, what will happen?[40] In this case, the rate of interest becomes the independent variable, as in Wicksell, and the quantity of money has to be expanded in such a way as to maintain that rate of interest. Moreover, since production cannot be expanded, any increase in total expenditures must be reflected in a corresponding rise in the price level.

By a modification of the assumptions underlying our earlier illustration, we can develop this case and show the relation between the interest theories of Wicksell and Keynes. Let us assume that the level of national income reached at the end of the period of cumulative expansion in Table I (page 53) corresponds to full employment. Now let us suppose that, having reached this position, the monetary authorities take the action necessary to reduce the interest rate to 6% and to maintain it, period after period, at that level. Table II shows the process of dynamic change that might be expected to result from this policy. In this table, we have two new variables, P, the price level of final output (Period 0 = 100), and y, the volume of final output (valued at Period 0's prices).

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[40] The same type of situation would arise if, under conditions of full employment, the marginal efficiency of investment schedule should rise while the monetary authorities took the necessary steps to keep the interest rate constant. This is perhaps more representative of Wicksell's ideas, since he stressed the instability of the real rate.

TABLE II

	Production Planning Period				
	0	1	2	3	
Y	200	202	204.02	206.0602	.....
C	150	150	151.50	153.0150	.....
I	50	52	52.52	53.0452	.....
S	50	50	50.50	51.0050	.....
M_1	200	202	204.02	206.0602	.....
M_2	200	210	210.00	210.0000	.....
M	400	412	414.02	416.0602	.....
R	.08	.06	.06	.06	.....
P	100	101	102.01	103.0301	.....
y	200	200	200.00	200.0000	.....

In the construction of this table, it was assumed that real investment expenditures depend upon the level of real income and the interest rate. Thus, lowering the interest rate from 8% to 6% initially raises investment from 50 to 52. Since physical output cannot expand above 200 and the interest rate is held constant, thereafter, investment continues to be 26% (52/200) of income. Similarly, real consumption is a function of real income, and since real income is constant, consumption continues to be 75% of income. Since consumption (75%) and investment (26%) add up to 101% of income in each period, there is cumulative inflation at a rate of 1% per production-planning period. Under these circumstances,

the money supply becomes a dependent variable, since enough money must be introduced into the economy each period to keep the interest rate from rising above 6%. In the first period, 10 of new money must be provided to satisfy the desire for liquidity at a 6% rate and 2 more must be provided for transactions purposes. Thereafter enough new money must be created each period to fulfill transactions requirements at successively higher price levels. Beginning with Period 2, money income, money consumption, money investment, active money, and the price level all rise by 1% per period, while idle money, real income, and the interest rate all remain constant.

It is not difficult to show that, if the parameters of the system and the full employment level of income are given, the percentage rate of price inflation per production planning period is a function of the rate of interest. Any change in the rate of interest will cause a change in the rate of price inflation according to the following formula.

$$\Delta\left(\frac{P_t}{P_{t-1}}\right) = \frac{a}{y}\Delta R$$

A rise in the interest rate back to 8% will stop the inflation at any point, although it will not, of course, cause the price level to return to its original value.

The above analysis is meant to cover only those monetary aspects of cumulative inflation that were stressed by Wicksell. Numerous factors which, in practice, would influence the process and its outcome are entirely left out of account.

Changes in the distribution of income among social classes which might raise the propensity to save could check the inflation process. The rise in the price level itself might very well cause speculative inventory investment by both business firms and households, thus increasing the speed of the inflation. We are interested only in the monetary aspects, and especially in showing the relation between the analysis of Wicksell and that of Keynes.

Our analysis has shown that there is, according to Keynes, an equilibrium rate of interest corresponding to full employment (8% in the above illustration). Moreover, we have shown that if the rate of interest is forced below this level by monetary action and held at the lower level, as a first approximation, we might expect a cumulative inflation of the Wicksellian type. Wicksell's real rate of interest corresponds to the full employment equilibrium rate of Keynes, and Wicksell's market rate corresponds to the actual prevailing rate which in Keynesian analysis is influenced by monetary forces.

Wicksell, of course, held that a market rate <u>above</u> the real rate would result in a cumulative <u>deflation</u> of prices. In this connection, Keynesian analysis would maintain that, due to rigidity in the wage structure, the deflation would involve primarily a fall in the level of income and employment, rather than merely a fall in prices. That is to say, inflation and deflation are symmetrical concepts in Wicksell,

but they are asymmetrical in Keynes, because Keynes conceives wages to be flexible in an upward direction from full employment, but not in a downward direction.

The Meaning of Equilibrium

The whole equilibrium approach to monetary problems may be open to question, in view of the fact that "monetary equilibrium" is surely an unattained and possibly an unattainable state of affairs. However, it does seem certain that there are equilibrating tendencies and that it is convenient to use them as a basis for analysis, even though actual equilibrium positions be rarely, if ever, attained. Moreover, most theorizing in the field of interest and money has to do with nothing but equilibrium positions. At least, we have made an attempt to distinguish equilibrium from non-equilibrium situations and to deal with both.

The term "equilibrium," as it is used in economics, has many different meanings. Different meanings are appropriate in connection with the study of different problems. We must, therefore, attempt to make clear the sense in which we have been using the term.

The analysis we have been developing is "short-period" analysis in exactly the same sense as Keynes' original General Theory. Although Keynes does not appear to have said so explicitly, it is quite clear that he regarded his theory of employment to be a short-period analysis in a sense closely

analogous to Marshall's short-period partial equilibrium analysis. The Marshallian short period, as applied to a firm or an industry, means a period during which an adaptation to a change in demand is made by varying output from existing plant capacity, with no adjustment in that capacity.[41] Although, as Marshall was careful to point out, "there is no hard and sharp line of division between 'long' and 'short' periods,"[42] the distinction is a useful analytical one.

Since Keynes assumed the aggregate stock of capital in the economy to be given,[43] his theory seems superficially similar to Marshall's. Moreover, the static nature of the analysis developed in the General Theory tended to obscure the differences. The impression given is that the multiplier process operates with great speed so that the time elapsing between a rise in the rate of investment and the arrival of the level of income at the new equilibrium corresponding to the new higher rate of investment is quite short. Little discussion is devoted to the time lags involved.[44] It was

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41/ A. Marshall, Principles of Economics (8th edition; New York: The Macmillan Company, 1920), p. 379.

42/ Ibid., p. 378.

43/ Keynes, General Theory, p. 245.

44/ Keynes does point out that if expansion occurs due to "an increase in the output of the capital-goods industries which was not fully foreseen," it will "only [produce] its full effect on employment over a period of time." He goes on to explain how, in such a case, his theory of the multiplier will continue to hold because the marginal propensity

not until the dynamic process of continued respending lying behind Keynes' static multiplier was worked out that the true nature of the lags began to become apparent. While we still have no more than a hazy idea of the amount of time required for the major part[45] of a multiplier expansion to work itself out--the time undoubtedly varies depending on underlying conditions--it is now generally recognized that the time is likely to be rather substantial.[46] Goodwin, for example, after computing the time required to get 90% of the total

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to consume (and hence the multiplier) will be forced temporarily below its normal level due to the unavailability of goods. He points out that "except in conditions where the consumption industries are already working almost at capacity so that an expansion of output requires an expansion of plant and not merely the more intensive employment of the existing plant, there is no reason to suppose that more than a brief interval of time need elapse before employment in the consumption industries is advancing pari passu with employment in the capital-goods industries with the multiplier operating near its normal figure." The tenor of the whole discussion is that the lags are normally short and that income rises very rapidly. Ibid., pp. 122-125.

45/ The time required for the full expansion is, of course, infinite.

46/ G. Ackley, "The Multiplier Time Period: Money, Inventories, and Flexibility, American Economic Review, XLI (June, 1951), 350-368; R. M. Goodwin, "The Multiplier," The New Economics, ed. by S. E. Harris (New York: Alfred A. Knopf, 1947), pp. 482-499; Machlup, "Period Analysis and Multiplier Theory," op. cit. On the relation of business inventory policy and short-term expectations to the multiplier, cf. also L. A. Metzler, "The Nature and Stability of Inventory Cycles," Review of Economic Statistics, XXIII (August, 1941), 113-129, and "Factors Governing the Length of Inventory Cycles," Review of Economic Statistics, XXIX (February, 1947), 1-13.

multiplier effect on the basis of several (very simple) alternative assumptions, concludes, "None of these can be called small with respect to any but quite long-run problems."[47] Most authors agree that the unit time period (of which our production planning period is a stylized version) is likely to be several months long.[48] Since a number of such unit periods will almost always be required to produce a substantial portion of the ultimate total effect, everything indicates that a typical multiplier expansion is likely to take many months--perhaps several years.[49]

If the time period of the multiplier were as short as Keynes apparently thought it was, the assumption that the stock of capital and the state of technique are constant might

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[47] Goodwin, op. cit., p. 491.

[48] Those who have analyzed the problem most carefully have also stressed its probable irregularity. See Ackley, op. cit., and Metzler, "Three Lags in the Circular Flow of Income," op. cit.

[49] Of course, there are some factors not recognized in the usual sequence analysis of the multiplier which would probably tend to speed up the process. These include (1) elastic expectations which would cause businessmen to produce in anticipation of expected further increases in sales, and (2) attempts to maintain inventories constant or, more likely, to increase them roughly in proportion to the increase in sales. The inventory factor (inventory accelerator) is capable of producing various time-patterns, including cycles or explosive expansion, depending upon relative values of the desired ratio of inventories to sales and the marginal propensity to consume. See Metzler, "The Nature and Stability of Inventory Cycles," op. cit., and "Factors Governing the Length of Inventory Cycles," op. cit. Even allowing for the accelerating effects of these factors, however, it seems a fair guess that the time period is likely to be quite substantial in the typical case.

not be far from correct. But when it is clearly recognized that a number of rounds of investment at the higher rate are involved and that the process is likely to take many months, it becomes plain that such assumptions may seriously distort the results. Marshall's concept of the short period is defensible on analytical grounds, while Keynes' assumption of fixity in the total stock of capital is defensible only on grounds of convenience and is without analytical justification.

The implications of the change in the stock of capital, as such, within the Keynesian framework are outside the scope of our analysis. However, the growth in capital necessarily involves a growth in wealth which has monetary implications. The bearing of the growth in wealth on monetary theory is a question we will discuss in Chapter V.

Thus, the equilibrium with which we are concerned is an equilibrium of national income over moderately short periods of time ranging probably from several months up to three or four years, depending upon general conditions, the speed of reactions of businessmen, and, to some extent, the values of the parameters of the system. And, while the imperfections introduced into the theory by the assumption of fixity in the stock of capital and in the state of technique may sometimes be rather serious, the writer feels (1) that qualitative allowances for the effect of changes in these factors can be introduced where they are appropriate, and (2) allowance for them would not change the theory in its

basic essentials.

We have made two assumptions relative to the equilibrium concept and the time interval involved that are of crucial importance for our theory of interest. One relates to money wages and the other relates to uncertainty and the dynamic nature of the economic system we are concerned with.

First, as to wages, we must assume either that money wages are fixed over the period covered by the analysis (as we have assumed up to now), or that bargaining in the labor market is in terms of money wages so that there is a determinate level of money wages associated with each possible level of output.[50] This is an important restriction, but it does not appear to be particularly unrealistic. If wages (and prices) are flexible, the determination of the interest rate is considerably changed, as we will see when we examine this problem in section (2) of Chapter IV. The assumption of rigidity or at least stickiness in the money wage structure is connected with the concept of equilibrium and the time period involved in our models. One may grant that real wages will tend to fall under pressure of unemployment and still expect to find stickiness and rigidity over a period as long as the one we are considering.[51]

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[50] This less restrictive situation will be considered in section (1) of Chapter IV.

[51] On the stickiness of wages in the depressions of 1920-21 and 1929-33, see A. Rees, "Wage Determination and Involuntary Unemployment," Journal of Political Economy, LIX

Second, as to uncertainty and the nature of the economic system, we must regard ourselves as analyzing a (somewhat idealized) short period of change in an economic system subject to more or less continuous or at least frequent changes in data. That is, we must assume that even if the parameters of our model system remain stable long enough to permit us to reach (approximately) the new equilibrium, further change can be expected to occur soon which will call for further adjustments. For, if we regard the economy as approaching a permanent equilibrium in which no further change is expected, the whole idea of liquidity preference takes on an aspect of unreality. The holding of money as an asset makes sense only under conditions of uncertainty. We could not, for example, use our present line of analysis in discussing the "thorough-going equilibrium" of Pigou's stationary state.52/ However, since economic affairs are actually conducted under conditions of continuing uncertainty, this does not seem to be an important restriction.

To sum up, we may say that we mean by equilibrium the new position that will tend to be approached within a moderately short period of time as a result of a change in underlying

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(April, 1951), 143-153. This article also suggests that rigidity of money wages under conditions of unemployment may be due more to the hesitancy of employers about cutting wages than to unwillingness of workers to accept wage cuts.

52/ A. C. Pigou, "Economic Progress in a Stable Environment," Economica, XIV, New Series (August, 1947), 180-188.

conditions if money wages are rigid or sticky and if further changes of an unknown character are expected to occur. What we have said about the meaning of equilibrium here is equally applicable to our discussion of the loanable funds theory of interest in Chapter III.

Conclusions

In this chapter, we have tried to accomplish the following things:

(1) To examine the Keynesian theory of interest and money under both equilibrium and non-equilibrium conditions.

(2) To demonstrate that liquidity preference (in the narrow sense) plays no special role in determining the rate of interest.

(3) To demonstrate a method of presenting the Keynesian theory which avoids the customary overemphasis on "liquidity preference proper" and admits the possible direct effects of savings and investment.

(4) To examine the role of the interest rate in the equilibration process.

(5) To bring out the role of the money stock and of changes in it--and to emphasize the "stock" character of the theory.

(6) To show the relationship between the monetary theory of Keynes and that of Wicksell.

In the following chapter, we will attempt an analysis,

along similar lines, of the loanable funds theory of interest in order to provide ourselves with a sound basis for comparison between the two theories.

CHAPTER III

THE LOANABLE FUNDS THEORY OF INTEREST

The general theoretical framework and the basic assumptions which we will employ in this chapter in our analysis of the loanable funds theory are practically the same as those we used in the last chapter.[1/] To begin with at least, we assume stability of the wage and price level, avoid the complications of the rate structure by assuming a system in which the only assets available for investors to hold are money and consols, and make the same assumptions about the timing of the economic process that we made in our earlier analysis.

The Loanable Funds Model

Perhaps the best way to begin is by writing down the equations of our new model system. The equations are as follows.

$$I_t = aR_t + bY_{t-1} + c \qquad (1)$$

$$C_t = \alpha Y_{t-1} + \beta \qquad (2)$$

$$\Delta M_{2,t} = dR_t + eR' \qquad (3)$$

$$S_t = Y_{t-1} - C_t \qquad (4)$$

[1/] For a list of the assumptions and a description of the working of the economic system, see pp. 35-44, supra.

$$Y_t = C_t + I_t \qquad (5)$$

$$\Delta M_{2,t} + I_t = S_t + \Delta M \qquad (6)$$

The only new variables here are ΔM_2, hoarding, i.e., the net addition to the stock of idle balances, and ΔM, the net change in total money stock. It should be noted that M, the total stock of money and M_2, the stock of asset money do not appear in this system.

We assume, as we did before, that the commercial banks always lend "up to the hilt" on the basis of their existing reserves, so that the change in money supply (ΔM) is an exogenous variable subject to the control of the central bank through its open market operations. ΔM in any period is equal to the change in bank reserves multiplied by the coefficient of expansion of the commercial banking system.

Equations (1) and (2), the investment and consumption relationships require no further discussion, since they are the same as the equations employed in our models of the liquidity preference theory in Chapter II.[2/] Equation (3), however, differs from our earlier liquidity preference equation, since it states that the change in holdings of idle balances, rather than the total amount of such balances held, depends upon the rate of interest. The rate of hoarding instead of total hoards is a function of the rate of interest. That is to say, at a given rate of interest, investors will

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[2/] Cf. pp. 44-48, supra.

not merely make a single adjustment in their stock of idle balances, but will rather continue to hoard or dishoard at a certain rate per period as long as this interest rate continues to prevail.

Equation (4) is merely the definition of savings as the difference between income earned the previous period and consumption expenditures of the current period, which are based on that income. Equation (5) is a familiar definitional relationship.

Equation (6) is the equation of supply and demand for loanable funds. It is the market equation for the money market (or securities market, if one prefers). The left-hand side is the demand, and the right-hand side is the supply side (when it is regarded as a money market). Funds are demanded to be added to hoards and to be spent on new investment. The sources from which such funds come are current saving and new increments to the money supply brought about by central bank operations. The classification into demand and supply categories is partly arbitrary, of course, since both hoarding and change in the money supply can easily take on negative values.[3/] Our formulation of the loanable funds theory

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3/ Since we are talking about financial plans in an ex ante sense, total saving and total investment (in the gross sense in which we are using them) could be negative at some rates of interest. Investors in the aggregate could plan to liquidate all their accumulated savings and go into debt to buy consumer goods, or business firms could plan to sell all their capital goods. These plans could not materialize, however, since gross savings and investment in an ex post sense cannot be negative--i.e., production of investment goods cannot be negative.

corresponds quite closely to the expositions of the theory given by Robertson,[4] and Haberler.[5] Transactions in already existing securities are included in the schedules. The offer of existing securities on the market for cash is included in hoarding, for example. All savings are treated as though they pass through the money market, even though some savings may be reserved in the form of cash by the saver.[6]

To begin with, perhaps we should attempt to demonstrate that the only significant difference between our present model and the models used in the last chapter to illustrate the liquidity preference theory is that the present model treats all the monetary variables as flows. The fact that the two models are essentially similar in all other respects is not difficult to demonstrate. From equations (4) and (5) above, it is easy to derive the relationship,

$$I_t - S_t = Y_t - Y_{t-1}.$$

Substituting this into equation (6) and transposing variables, we get,

$$\Delta M - \Delta M_{2,t} = Y_t - Y_{t-1}.$$

Utilizing the fact that

$$\Delta M_{1,t} = \Delta M - \Delta M_{2,t},$$

4/ D. H. Robertson, "Mr. Keynes and the Rate of Interest," op. cit., pp. 2-5.

5/ G. Haberler, Prosperity and Depression, pp. 183-187.

6/ For a more extended discussion of the elements of supply and demand, see pp. 6-8, and pp. 39-41, supra.

and writing $Y_t - Y_{t-1}$ as ΔY_t, we obtain,

$$\Delta M_{1,t} = \Delta Y_t. \qquad (4')$$

If we make use also of the relation,

$$\Delta M = \Delta M_{1,t} + \Delta M_{2,t},$$

or

$$\Delta M_{2,t} = \Delta M - \Delta M_{1,t} \qquad (6')$$

which is true by definition, we can rewrite our system of equations, substituting (4') and (6') for (4) and (6).

$$I_t = aR_t + bY_{t-1} + c \qquad (1)$$

$$C_t = \alpha Y_{t-1} + \beta \qquad (2)$$

$$\Delta M_{2,t} = dR_t + eR' \qquad (3)$$

$$\Delta M_{1,t} = \Delta Y_t \qquad (4')$$

$$Y_t = C_t + I_t \qquad (5)$$

$$\Delta M_{2,t} = \Delta M - \Delta M_{1,t} \qquad (6')$$

This is simply another version of the system given by equations (1) - (6); it yields the same solution in all respects as that system. A comparison of the revised system with the system used in dealing with the liquidity preference theory[7] shows that the two are identical except for the fact that the present one involves money flows while the earlier one involves money stocks. Since equations (1) - (6) are somewhat easier to work with than the revised system and since they also shed somewhat more light on the economic process and are in closer accordance with the usual presentations of

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[7] See p. 44, supra.

the loanable funds theory, we will use them for working purposes. But we can now do so with the realization that the difference in our methods of formulating the two theories of interest does not conceal alterations in our assumptions, other than the change from stock analysis to flow analysis.

Before we proceed with the study of our new model, perhaps we should clarify its relation to our liquidity preference model of Chapter II. The basic difference lies in the nature of the liquidity preference or hoarding function in the two models. Equation (3) of Chapter II,[8] has been removed, and in its place we have put our present equation (3),

$$\Delta M_{2,t} = dR_t + eR'.$$

It should be clearly understood that this change is not dictated by any theoretical considerations but is simply a result of our attempt to translate the loanable funds theory into simple mathematical terms so that we can incorporate it into a dynamic macroeconomic model. It is merely a symbolic version of the statement commonly made by loanable funds theorists that the amount of net hoarding--i.e., net increase (or decrease) in idle balances--is a function of the rate of interest.[9]

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[8] See p. 44, supra.

[9] Statements by loanable funds theorists that hoarding (change in idle balances) is an element in the supply of funds will be found in Robertson, "Mr. Keynes and the Rate of Interest," op. cit., p. 3, and Haberler, op. cit., p. 185. (The

It can hardly be said that we are placing two extant and clearly defined "theories" beside each other for comparison, because scarcely any of the writers involved have recognized that they are different. We are merely translating their statements into the form of dynamic models. If it turns out that the two modes of analysis are different, then we will be faced with the problem of deciding which is "correct" or at least which is preferable. Of course, the two approaches do turn out to be different, and we will have to consider this problem.

It is easy to see why the two theories have commonly been regarded as identical. A change in the stock of anything always implies an incremental adjustment to bring it about. Unless the adjustment process is formulated symbolically, superficial (or even careful) thought about the matter is likely to lead one to the conclusion that it makes no difference whether the adjustment of the stock or the incremental adjustment is regarded as the objective to be achieved. As soon as the two theories are expressed mathematically, however, the distinction is quite apparent--in the stock theory, it is total holdings of idle balances that depends on the

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statement in Haberler is a quotation from Lerner in which Lerner attempts to state Ohlin's version of the loanable funds theory. This statement of the theory receives Haberler's endorsement.) Cf. also a more recent formulation of the loanable funds theory in A. H. Leigh, "Supply and Demand Analysis of Interest Rates: A Further Attempt at Synthesis," American Economic Review, XLI (September, 1951), 584-585.

interest rate, while in the flow theory, it is the rate of change of idle balances that depends on the interest rate. The distinction is most clearly apparent under conditions of equilibrium when the interest rate has adjusted to underlying conditions. According to the stock (liquidity preference) theory, investors would have adjusted their holdings of idle balances to the interest rate as a part of the process which produced the equilibrium, and when equilibrium was reached no further adjustments would be made, and the stock of idle balances would remain constant (zero hoarding), pending some new disequilibrating change in data. According to the flow (loanable funds) theory, investors would have adjusted their rate of change of idle balances to the interest rate and would be changing their idle balances (hoarding or dishoarding) at a constant rate per time period. This equilibrium rate of change in idle balances would remain constant pending some new disequilibrating change. It is apparent that these two ideas are quite different, and we will see that they produce different results in our models.10/

We now have, in equations (1) - (6), a simple working model involving the orthodox loanable funds theory of interest. Following the same procedure as we did in Chapter II with the

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10/ It should be understood that the parameters d and e in our two equations are quite different and that the two sets of parameters bear no relation to each other. The reason for this is that if one equation applies, the other doesn't--one cannot be translated into the other.

liquidity preference theory, we can substitute from the first four equations into the last two and by further substitution arrive at two difference equations, one in Y and one in R.

$$Y_t - \frac{a + d(\alpha + b)}{a + d} Y_{t-1} - \frac{d(\frac{a}{d}(\Delta M - eR') + \beta + c)}{a + d} = 0.$$

and

$$R_t - \frac{a + d(\alpha + b)}{a + d} R_{t-1} + \frac{(1 - \alpha - b)(eR' - \Delta M)}{a + d} = 0.$$

Given the values of all the parameters, the change in the money supply per period, and an initial value of Y, these equations will permit us to determine all future values of Y and R (and, of course, we can determine the values of all the other variables as well).

We can get the equilibrium solutions for these difference equations by substituting $\bar{Y}$ (equilibrium income) for Y_t and Y_{t-1} and $\bar{R}$ (equilibrium interest rate) for R_t and R_{t-1} and simplifying. The equilibrium solutions, so obtained, are

$$\bar{Y} = \frac{\frac{a}{d}(\Delta M - eR') + \beta + c}{1 - \alpha - b}, \qquad (7)$$

and

$$\bar{R} = \frac{\Delta M - eR'}{d}. \qquad (8)$$

Equations (7) and (8) permit us to determine what levels of Y and R will eventually be reached if money keeps flowing into the system at a rate of ΔM per period, assuming that the system converges to an equilibrium--a question we shall now consider. There are two matters to be considered:

(1) Does an equilibrium solution for income exist?

(2) Will the level of income converge to this equilibrium value through time if the system is displaced from it or if it starts from some other position?

What we want to know are the limitations on the slopes of the various schedules which must be met in order that there be an equilibrium solution and that the equilibrium be stable (the system converge to the equilibrium). Taking the existence of an equilibrium first, it is easy to see from equation (7) that a positive equilibrium level of income will exist if $\alpha + b < 1$. In other words, the condition necessary for an equilibrium to exist is that the ordinary multiplier mechanism be stable (sum of propensities to spend less than unity).

In order to determine the stability conditions, we must examine the complete general solution for Y_t, which is as follows:

$$Y_t = \bar{Y} + A\left(\frac{a + d(\alpha + b)}{a + d}\right)t, \qquad (9)$$

where

$$A = Y_o - \bar{Y}, \qquad (10)$$

Y_o being the initial value of income that must be given. The parameters a and d are both negative, while α and b are both positive, under normal conditions. If the system is to approach

equilibrium,

$$A\left(\frac{a + d(\alpha + b)}{a + d}\right)^t$$

must approach zero as t gets large, so that Y_t will approach $\bar{Y}$. This will be the case if

$$\frac{a + d(\alpha + b)}{a + d} < 1,$$

that is, if

$$\alpha + b < 1.$$

We may conclude that if $\alpha + b < 1$, the system will possess a stable equilibrium value for the level of income. Under the same conditions, the other variables in the system will also have stable equilibrium values, since they follow essentially the same law as income.

Numerical Illustration

The best way to study the behavior of this model and to compare it with the operation of our earlier liquidity preference model is to work out another numerical illustration. We will assume the following values for the parameters of the system.

$a = -300$	$c = 18$	$e = 1000$	$\alpha = 0.6$
$b = 0.2$	$d = -750$	$R' = 0.05$	$\beta = 30$

These parameters were selected arbitrarily for purposes of illustration and have no empirical basis. Moreover, the parameters a, d, and e are different from and unrelated

to the same parameters used in our illustration of the liquidity preference theory in Chapter II.[11]

We will start from a position of equilibrium in Period 0, in which the level of income (Y) has adjusted itself to the rate of change in the money supply (ΔM). This condition will be satisfied at a level of income of 150 with the money supply increasing by 5 per production planning period. The equilibrium levels of the other variables corresponding with income of 150 and increase of money supply of 5 per period are shown in the first column (Period 0) of Table III. For example, the equilibrium interest rate when Y is 150 and ΔM is 5 is 6%. Now we suppose that a sharp change in monetary policy occurs, and the central bank begins to increase the money supply by 15 per period through open market purchases of securities.[12]

Using our system of difference equations with the parameters given above, $\Delta M = 15$, and the initial value of income, $Y_o = 150$, we can work out a sequence of values for all variables showing the process by which a new equilibrium is approached, corresponding with the new ΔM.[13]

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[11] See n. 10, p. 95, *supra*.

[12] Note that the *change* in ΔM is 10--from 5 to 15.

[13] Given the parameters, together with ΔM and Y_o, we could, if we cared to, work out the solution for Y_t from equations (9) and (10) above. This would permit us to calculate directly the value of Y for any period without first calculating the values for all prior periods.

Table III below shows the values for the first few periods and, in Column N, the new equilibrium values that will ultimately be reached if the parameters remain unchanged and the money supply continues to increase at a constant rate of 15.

TABLE III

	Production-planning Period					
	0	1	2	3		N
Y	150	152.86	155.31	157.41	.....	170
C	120	120.00	121.72	123.19	.....	132
I	30	32.86	33.59	34.22	.....	38
S	30	30.00	31.14	32.12	.....	38
ΔM_2	5	12.14	12.55	12.90	.....	15
ΔM	5	15.00	15.00	15.00	.....	15
R	.06	.0504	.0499	.0495	.....	.0467
ΔM_1	0	2.86	2.45	2.10	.....	0

The developments shown in the table may be explained as follows. In Period 0, the interest rate, at 6%, is just sufficiently high, in relation to general interest rate expectations of which R' is an index, to induce investors in the aggregate to add to their hoards as much money (5 per period) as is being made available each period by the central bank's monetary policy. With hoarding exactly absorbing the increase in the money supoly, investment demand for funds is

just sufficient to take up all current savings.[14] With saving equal to investment, the level of income is in equilibrium.[15] When the central bank changes its policy in Period 1 and starts to inject money at 15 per period, the interest rate is depressed to around 5%. At this lower interest rate, hoarding is considerably increased and investment is increased somewhat. The rise in investment causes an increase in the level of income. The rise in the level of income causes a further increase in investment and still bigger increase in saving in Period 2. The fact that saving is increased more than investment means that the supply of loanable funds is augmented by a greater amount than the demand and the rate of interest is further depressed to a little less than 5%. The process continues, and, since the multiplier mechanism is stable, saving continues to grow faster than investment. The interest rate is gradually pushed down to 4.67%, at which level hoarding has been expanded until it is absorbing the full increase in money supply of 15 per period. At this point, the system has reached a new equilibrium level,

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[14] Of course, some investment demand may be met out of new money, provided just enough new saving is held in the form of cash to offset it. In other words, there is not necessarily exact matching of saving with investment and of new money with hoarding; there is merely equality between each of these pairs of variables in the aggregate.

[15] There is no reason to suppose that it is a full employment equilibrium; rather the very fact that an increase in income occurs in later periods when the flow of money is increased implies that it is not a full employment equilibrium.

with income at 170, as shown in Column N. Once again, saving is equal to investment and hoarding is equal to the increase in the money supply.

Determination of the Interest Rate

This seems to be the kind of model of the economic system the loanable funds theorists have usually had in mind, although, not having pushed their reasoning to its logical conclusion, they probably have not realized its implications. Now let us try to see what kind of an interest theory is embedded in it. The rate of interest for any period can be determined from the following equation, given the level of income for the previous period.

$$R_t = \frac{1 - \alpha - b}{a + d} Y_{t-1} - \frac{eR' + \beta + c - \Delta M}{a + d} .$$

It is again true, as in the case of the Keynesian theory of interest, that we need to make use of all the equations of the system to determine the interest rate for any period. A change in any of the parameters of the system or in the rate of flow of new money can change the interest rate. Thus, a liquidity preference theory of interest is not appropriate. The interest rate is determined by the full money market complex. The situation is depicted graphically in Figure VII.

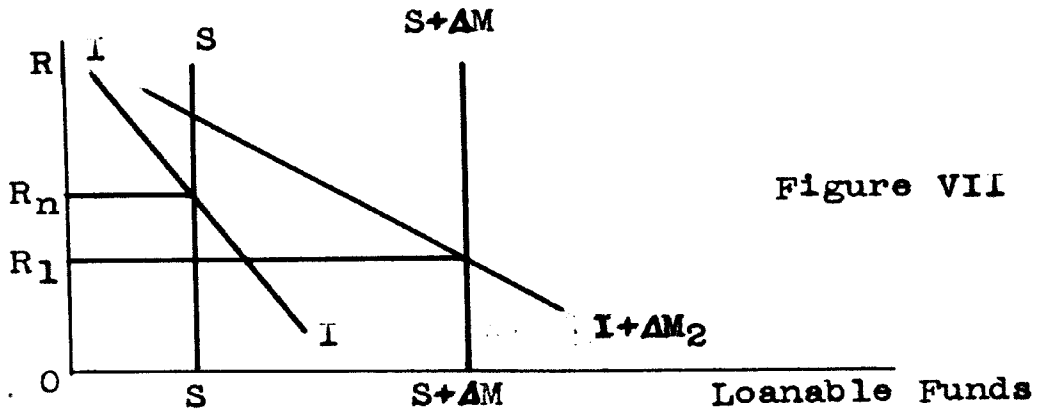


Figure VII

This diagram represents the situation in the money market on a planning date, and it is drawn on the assumption that the income of the previous period is given. Then R_1 is the market rate of interest which equates the total supply of and demand for funds (or money). At this rate, investment exceeds savings, thus causing income to rise in the present period above the level for the previous period. The change in the level of income causes the saving and investment schedules to shift in a way indicated by the system of equations so that a new set of supply and demand curves rules on the next planning date. This process continues from period to period until a new equilibrium is reached as depicted in Figure VIII.

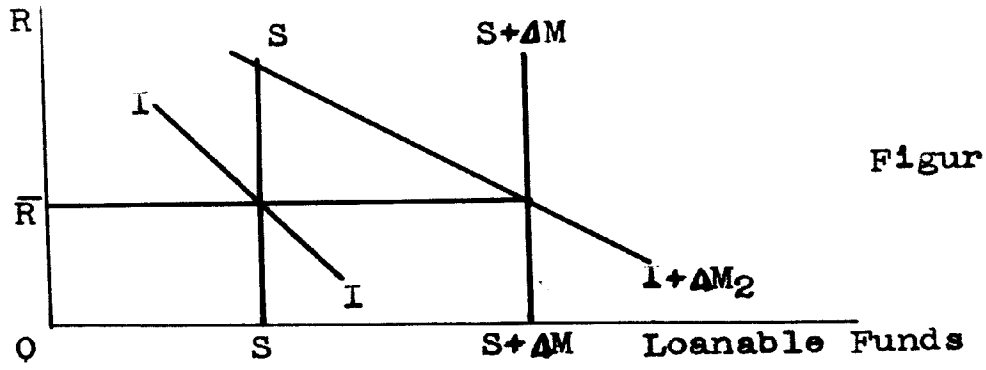


Figure VIII

In this position, saving and investment are equal, and income will remain unchanged in the next period. Thus, equilibrium has been approached by a process of shifting of supply and demand schedules--a process which eventually results in the market rate of interest determined by the total demand and total supply reaching a level at which planned saving and planned investment are equated. It should be noted that, since one component of the supply (saving) has been rendered equal to one component of the demand (investment), the remaining components of supply and demand must be equal--that is, net hoarding must be equal to the increase in the money supply in equilibrium.[16/]

It should be a comparatively simple matter to allow, in our analysis, for the possibility that the interest rate has a significant influence over the volume of saving that is done. In that case, the S and S + ΔM schedules in Figure VII and Figure VIII would possess some degree of slope. The nature of the equilibration process would not be changed, except that the elasticity (slope) of the savings function would be an additional factor in determining the interest rate.

It is safe to conclude that, in the loanable funds type of analysis, the interest rate in a period in which the

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16/ The diagrams used here are similar to the description of the loanable funds theory in Haberler, op. cit., pp. 183-187, except that we have traced out the dynamics of the theory and attempted to show how equilibrium would be approached.

economy is not in equilibrium depends upon and is determined by all the factors of demand and supply in the market for funds. However, the equilibrium situation needs to be examined a little more carefully. Equation (8), the equation for the equilibrium interest rate is repeated below.

$$\bar{R} = \frac{\Delta M - eR'}{d}. \qquad (8)$$

The only elements from our system of equations that are included in this equation, and therefore the only factors which enter into the determination of the equilibrium rate are ΔM, the rate of change of the money supply, and e, R', and d, the parameters of the liquidity preference function. Here, where we might least expect it, we have a situation in which a true liquidity preference theory holds. Autonomous shifts in the investment function or in the consumption function are incapable of affecting the equilibrium interest rate. All they can do is cause the market rate of interest to depart temporarily from equilibrium and influence the time path along which it returns to equilibrium. The equilibrium rate itself will be what it was to start with unless the supply of money (in the flow sense, ΔM) has changed or the liquidity preference schedule has shifted (due to a change in e, R', or d). Equilibrium with respect to the rate of interest is a situation in which the rate is at such a level that hoarding (or dishoarding) is taking place at a rate just sufficient to absorb (or release) money as fast as the money supply is

being increased (or decreased). If new money is flowing into the economy at a constant rate, the interest rate will eventually adjust to a level such that hoarding will absorb all the new money. If money is being withdrawn from the economy at a constant rate, the market rate must eventually adjust to a level at which investors will dishoard each period the amount that is being withdrawn. If the money supply should be constant ($\Delta M = 0$), the interest rate will tend toward a level at which there will be neither net hoarding nor dishoarding. We have arrived at the paradoxical result that the loanable funds formulation of interest theory provides the only valid example we have been able to find of a real liquidity preference theory! Moreover, since the level of the liquidity preference schedule presumably depends chiefly upon R', the index of investors' ideas of the level of the interest rate that is "normal," based largely on past experience, one of the two main elements determining the equilibrium interest rate (the other main element being the increments to the money supply) is what it has customarily been in the past. Here it would appear that we really have a "grin without a cat," to quote Robertson's expression.[17/]

The contrast between the liquidity preference and loanable funds theories with respect to the forces determining

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[17/] D. H. Robertson, "Mr. Keynes and the Rate of Interest," op. cit., p. 25.

the equilibrium interest rate is perhaps best brought out by considering the ultimate effect on the interest rate that will be produced by a rise in the marginal efficiency of investment schedule under the two theories. According to the liquidity preference theory, the rise in marginal efficiency of investment will increase the demand for money and raise the interest rate. This will attract funds from idle balances into active circulation, thus leaving less of the fixed stock of money to satisfy the demand for idle balances. The rise in investment will start an expansion of income of the multiplier type. As income rises, if the system is stable, saving will rise faster than investment. Each period until the new equilibrium is reached, however, there will be some excess of investment over saving to be financed by withdrawing funds from idle balances. Thus the rate of interest will gradually rise during the expansion but at a decreasing rate since the gap between saving and investment to be filled by dishoarding is constantly getting smaller. When the new equilibrium is reached, the rise in income has been enough to induce enough additional saving to finance the larger investment. The interest rate is, however, permanently higher since funds have been drawn from idle balances into active circulation thus leaving a smaller amount of money to meet the demand for money to hold.

According to the loanable funds theory, a rise in marginal efficiency of investment will also have the immediate

effect of raising the rate of interest. This will divert some of the flow of new money into the system (assumed constant) so that it will go into active circulation instead of into idle balances, as it would have done had the interest rate not changed. Income will rise according to the multiplier. As it rises, saving will rise faster than investment if the system is stable. Hence the amount that has to be diverted into active circulation out of each successive increment of new money becomes constantly smaller as the gap between saving and investment is reduced. When income has risen to the new equilibrium so that saving is again equal to investment, no diversion is called for so that the whole of the increment of new money is available to meet the demand for additions to idle balances. When this happens the interest rate must be such as to induce investors to add this much to their balances per period. If there has been no movement of the liquidity preference schedule (demand for <u>additions</u> to idle balances) and no change in the rate of flow of money into the system, the interest rate must necessarily be back where it started from. Thus the equilibrium interest rate is unaffected by the rise in marginal efficiency of investment.

The reader will undoubtedly notice that in discussing these two cases we made different assumptions about the behavior of the total money stock. In discussing the liquidity preference theory, we assumed the money stock to be constant, and in discussing the loanable funds theory, we assumed the

money stock to be increasing at a constant rate. And it may appear that the difference in our conclusions is a result of this difference in assumptions. This, however, is not the case. We must make such different assumptions if we want to discuss equilibrium situations under the two theories. If, in discussing the liquidity preference theory, we had assumed that the money supply was increasing at a constant rate, we would have been faced with an explosive situation, with income rising and the interest rate falling indefinitely (or at least until the interest rate reached some floor set, for example, by perfectly elastic liquidity preference). In discussing the loanable funds theory, we could have assumed the money supply constant if we had cared to since this would have meant that the rate of change of the money stock (ΔM) was also constant (and equal to zero). But the significant fact would have been not the size of the money stock but the fact that its rate of change was equal to zero. The rate of interest and the level of income would, for instance, be exactly the same whether the money stock was 100 or 150 provided it was not changing. And the behavior of the interest rate would, in general, be the same as that indicated above in our discussion of the loanable funds theory--it would rise at first when the marginal efficiency of investment shifted and then gradually decline to its original level consistent with an unchanging money stock.

One question which may puzzle the reader at first is:

What happens to all the money that is pumped into the system but is not added to hoards during a period in which the money supply is being expanded? And where does all the money come from that is withdrawn but not taken from hoards during a period of contraction? The answer is that it is active circulation which absorbs or releases the required amount of money due to a rise or fall in the level of income. In the loanable funds formulation, the transactions need for money takes care of itself in this way. The change in the quantity of active money from one production-planning period to another is always equal to the change in the level of income between the two periods. This is indicated by equation (4'). This equation is always satisfied, although we chose not to use it as a part of our system of equations because we had sufficient equations without it, and our alternative version seemed better.

The <u>average</u> circuit velocity of money cannot be determined from our system since the <u>stock</u> of money is not known. However, the <u>marginal</u> circuit velocity of active money is equal to the number of production-planning periods contained in a year, i.e., it is dependent upon the length of a production-planning period. For example, if the production-planning period is three months, the marginal circuit velocity of active money is four per year.[18/] The marginal circuit

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18/ In reality, the exact equality of cash expenditures and income is destroyed to the extent that purchases

velocity of total money is, of course, equal to the change in income expressed as an annual rate (by multiplying the change in a single production planning period by the number of such periods in a year) divided by the change in the quantity of money. It will vary depending upon the proportions of the change in money stock that are active and idle. In equilibrium, velocity will be declining (if the money stock is increasing) since the increments of new money are going entirely into idle balances.

Carrying forward the comparison with our earlier model, we can compute multipliers applicable to monetary policy in the present case. These are comparable to formulas (9) and (10) in Chapter II.[19/]

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are financed on a book credit basis. Hence there is not exact equality between the change in the level of income and the change in active money, although, if the fraction of total transactions handled on a book credit basis is fairly constant, there should be a reasonably stable relation between them. However, the practical usefulness of the relationship is almost nil for two reasons: (1) Except in very simple and idealized models like the above, it is impossible to divide economic activity into discrete time segments, and (2) the production-planning period depends upon many complex and changeable factors, such as how fast orders are placed when the expansion begins, how long it is before orders in later stages of production are placed to replace depleted inventories, how long it takes to activate idle facilities, hire workers, etc. There is, however, almost surely a relation between the length of the production planning period and the marginal circuit velocity of active money, and it seems better to think of the length of the period as determining marginal velocity, rather than regarding the speed of money's circulation as determining the length of the period. Cf. Ackley, op. cit.; Machlup, op. cit.; Goodwin, op. cit.

19/ Cf. pp. 68-69, supra.

$$\overline{Y} = \frac{\frac{a}{d}}{1 - \alpha - b}\Delta(\Delta M), \qquad (11)$$

and

$$\overline{R} = \frac{1}{d}\Delta(\Delta M). \qquad (12)$$

As before, both a and d are presumptively negative, so (11) is positive and (12) is negative. The income multiplier (19) bears a superficial resemblance to (9) in Chapter II, but actually it is decidedly different. The multipliers applicable to the earlier liquidity preference model relate to a change in the money stock, while those for our present model relate to a change in the rate of change of the money stock. In our present model, a single injection of money (increase in the money stock) will raise the level of income only temporarily, after which there will be a gradual decline to the original level. Likewise, the interest rate will be only temporarily depressed and will gradually return to its original position. On the other hand, a continuous injection of money period after period will gradually push income up to a new higher equilibrium and slowly depress the interest rate to a new lower equilibrium. In this model, injections of money have effects similar to injections of private investment or deficit-financed government expenditures in the ordinary multiplier analysis. In our earlier model, a single increase in the money stock will raise income and lower the interest rate to new equilibrium levels, while a continuous injection of money will cause a cumulative expansion at a geometric rate, even if the system is stable.

The possibility of monetary policy running into a snag if the marginal efficiency of investment is very inelastic (a is very small) or if the liquidity preference schedule (demand for increments to asset money) is very elastic (d is very large) is again apparent here, but this time the responsiveness we are concerned with is the responsiveness of the economy to changes in the rate of inflow or outflow of new money rather than to changes in the stock of money.

Our present model possesses an unusual feature in the way it divides when we get to equilibrium. The money market equation (6) is always satisfied, of course, in any period.

$$I_t + \Delta M_{2,t} = S_t + \Delta M \qquad (6)$$

But when the economy is not in equilibrium, $I_t \neq S_t$, and $\Delta M_{2,t} \neq \Delta M$. However, when an equilibrium is reached, $I_t = S_t$, and $\Delta M_{2,t} = \Delta M$, that is, saving equals investment, and new money creation equals net hoarding. Thus, not only is equation (6) satisfied, but the two separate elements of demand and supply are respectively equated. It is now simple to see where the equilibrium interest rate comes from--since ΔM must equal $\overline{\Delta M_2}$ (the equilibrium amount of hoarding).

$$\Delta M = d\overline{R} + eR'$$

$$\overline{R} = \frac{\Delta M - eR'}{d}.$$

Some aspects of the relation between stock equilibrium and flow equilibrium can be brought to light now by referring back to the model developed in Chapter II to illustrate the

working of the liquidity preference theory. In that system, we had an equation

$$M_{2,t} = M_t - M_{1,t}.$$

It follows from this that

$$M_{2,t} - M_{2,t-1} = M_t - M_{t-1} - (M_{1,t} - M_{1,t-1}),$$

or

$$\Delta M_{2,t} = \Delta M_t - \Delta M_{1,t}. \qquad (13)$$

We also had the equation,

$$Y_t = M_{1,t},$$

which implies that

$$Y_t - Y_{t-1} = M_{1,t} - M_{1,t-1},$$

or

$$\Delta M_{1,t} = Y_t - Y_{t-1}.$$

Since, by definition,

$$Y_t = C_t + I_t,$$

and

$$Y_{t-1} = C_t + S_t,$$

it follows that

$$Y_t - Y_{t-1} = I_t - S_t,$$

and, therefore,

$$\Delta M_{1,t} = I_t - S_t. \qquad (14)$$

Substituting from (14) into (13), we obtain

$$\Delta M_{2,t} = \Delta M_t - (I_t - S_t),$$

or

$$\Delta M_{2,t} + I_t = S_t + \Delta M_t. \qquad (15)$$

It is apparent that (15) is the same as (6), the money market equation in the loanable funds model we have been considering in this chapter. Thus we see that if investors behave in such a way as to equilibrate their total holdings (stocks) of money and securities at the interest rate prevailing in each period, flows of money and securities are likewise automatically equilibrated, i.e., stock equilibrium implies flow equilibrium. However, we cannot reverse this process of reasoning. If we assume only that investors behave in such a way as to equilibrate flows of money and securities at the interest rate prevailing in each period, as we have done in our loanable funds model in this chapter, we cannot deduce that stocks are equilibrated in any meaningful sense. Stock equilibrium is, in other words, a stronger condition than flow equilibrium.

Relation of the Loanable Funds Theory to Wicksell

In the last chapter, we attempted to show the relation between the monetary theories of Wicksell and Keynes by showing the effect under the liquidity preference theory of a permanently maintained discrepancy between the market rate of interest and the real rate under conditions of full employment. We saw that if the monetary authorities establish a market rate below the rate consistent with full employment equilibrium, the result will be a cumulative inflation of

prices. In order to do this under the liquidity preference theory of interest, the monetary authorities must inject enough money into the economy in the first period to lower the rate of interest to the desired level and must thereafter provide enough additional money to keep it there. After the first period, all that is required is that enough money be provided to meet transactions needs at the continuously rising price level. We will now attempt, in a similar way, to show the relation between Wicksell's monetary theory and the loanable funds theory of interest. This will also help us to compare the liquidity preference and loanable funds theories under conditions of inflation.

Returning to Table III, let us assume that the level of national income reached at the end of the period of expansion (170) represents a condition of full employment. The prevailing rate of interest (4.67%) is the rate which corresponds with this level of income and employment. Now suppose the monetary authorities take action to force the rate of interest down to 3% and to hold it at that level. Table IV shows the results that might be expected from this action. As in Table II,[20] P is the price level of final output (Period 0 = 100), and y is the volume of final output (valued at the prices of Period 0).

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[20] Cf. p. 76, *supra*.

TABLE IV

	Production-planning Period					
	0	1	2	3	4	
Y	170	175.0	180.1	185.3	190.8	.....
C	132	132.0	135.8	139.8	143.9	.....
I	38	43.0	44.3	45.5	46.9	.....
S	38	38.0	39.2	40.3	41.4	.....
ΔM_2	15	27.5	27.5	27.5	27.5	.....
ΔM_1	0	5.0	5.1	5.2	5.5	.....
ΔM	15	32.5	32.6	32.7	33.0	.....
R	.0467	.03	.03	.03	.03	.....
P	100	102.9	106.0	109.1	112.3	.....
y	170	170.0	170.0	170.0	170.0	.....

We assume here that real consumption is a function of real income and that real investment is a function of real income and the interest rate--the same assumptions we made in this connection in Chapter II. When real income is 170 and the interest rate is 3%, consumption is 132 or 77.6% of income, and investment is 43 or 25.3% of income. These amounts add up to 102.9% of income, and as a result the price level continues to rise at a rate of 2.9% per period as long as the interest rate is maintained at the 3% level. As far as the relation between the interest rate and the price level is concerned, the results here are exactly the same as those we obtained in Chapter II. The rate of price inflation depends

upon the rate of interest. A change in the rate of interest will cause a change in the rate of price inflation according to the formula,

$$\Delta\left(\frac{P_t}{P_{t-1}}\right) = \frac{a}{y}\Delta R,$$

which is the same as the formula given in Chapter II. Moreover, a rise in the rate of interest back to the original level (4.67% in our example) will stop the inflation at any point.

The difference between the liquidity preference and loanable funds theories in this connection lies in the nature and extent of the monetary expansion that is required to support the inflation. In our earlier example, it was shown that under the liquidity preference theory after an initial increase in the money supply to satisfy the demand for idle balances at the lower interest rate, the money supply needed to be expanded only to the extent necessary to keep pace with the growth of money income due to the rise in prices. In our present illustration under the loanable funds theory, the money supply must be continuously expanded to meet rising transactions needs as prices rise, and there must <u>also</u> be a continuous growth in idle balances to hold the interest rate at 3%. Thus a greater amount of continuing monetary support is required than would be called for under the liquidity preference theory.

Conclusions

In this chapter, we have attempted to trace out the implications of the loanable funds theory of interest along lines parallel to those followed in our analysis of the liquidity preference theory in Chapter II. Despite the fact that we have worked with very simple models, we have succeeded in isolating certain tendencies which have hitherto been overlooked in other discussions of the subject. Moreover, it seems reasonable to suppose that these tendencies may be of some importance under certain conditions, provided investors behave as they are assumed to by the loanable funds theorists. It should be pointed out that we have not made any serious attempt to analyze the realism of either interest theory. We have been almost wholly concerned with the logical implications of the theories.

On the basis of the analysis in this chapter and the preceding one, it seems safe to state certain conclusions concerning the relation between the two theories of interest.

(1) In general, liquidity preference, in the narrow sense of the demand for idle balances, occupies no special place as a determinant of the interest rate in either theory. Under special circumstances, such as when the liquidity preference schedule is very elastic, its importance may be so greatly increased that it overshadows all the other determinants. This, however, can as easily be true under one theory as under the other. Moreover, under other circumstances, some

other factor, such as the marginal efficiency of investment or the supply of money, may be dominant. Oddly enough, the loanable funds theory provides the one instance in which the liquidity preference schedule together with the supply of money (in the flow sense) really determine the rate of interest independently of everything else. This, as we saw, is the case with respect to the equilibrium rate of interest in a model involving the loanable funds theory.

(2) The real difference between the two theories is that one (the liquidity preference theory) treats the demand for idle balances as a stock concept, while the other theory (loanable funds) treats this demand as a flow concept. This is a real and important difference. There is also a difference in the meaning of money supply, but this merely stems from the difference in definition of demand for idle balances.

(3) When the theories are formulated dynamically, it is apparent that both of them give the rate of interest a role in the macroeconomic equilibration process. This role has not been clearly brought out heretofore because dynamic analysis has not been applied to interest theory.

(4) Under inflationary conditions when the monetary authority pursues a policy of maintaining a constant interest rate, Wicksell's theory of money and interest rates can be considered a special case of either the liquidity preference or loanable funds theory.

We have decided that the basic difference between

the two theories is related to the distinction between stocks and flows. We must, therefore, try to decide whether stock analysis or flow analysis is more appropriate in monetary theory. This we will undertake to do in Chapter V. First, however, in Chapter IV, we will relax some of our restrictive assumptions and consider certain complications that have been left out of account in our preliminary analysis.

CHAPTER IV

SOME FURTHER COMPLICATIONS

Having constructed models based on the simplest assumptions to bring out the basic character of the liquidity preference and loanable funds theories of interest, we will now attempt to relax some of the rather restrictive assumptions and to consider some further aspects of the differences in the two theories.

In this chapter, we will attempt to drive the two theories in double harness. We will take up successively several topics, and we will consider each in relation to the two theories. The reason for following this method of organization is that it stresses contrasts and similarities between the two theories more clearly than would be the case if we took each theory and considered all the problems relating to it before taking up the other theory.

Changes in the Price Level

In this section, we will attempt to show how allowance can be made for the tendency of the price level to vary with the level of output. This can be done in a simple way by introducing the price level into the consumption and investment functions and including an additional equation to determine the price level.

Liquidity preference theory.--Our new system of equations is as follows:

$$C_t = \alpha Y_{t-1} + \beta P_{t-1} \qquad (1)$$

$$I_t = aR_t + bY_{t-1} + cP_{t-1} \qquad (2)$$

$$M_{2,t} = dR_t + eR' \qquad (3)$$

$$P_t = gY_t + h \qquad (4)$$

$$M_{1,t} = Y_t \qquad (5)$$

$$Y_t = C_t + I_t \qquad (6)$$

$$M = M_{1,t} + M_{2,t} \qquad (7)$$

P is a price index of final output and the other variables are defined as before. The price level has been introduced into equations (1) and (2). Equation (1) now states that real consumption is a linear function of real income, i.e.,

$$\frac{C_t}{P_{t-1}} = \alpha \frac{Y_{t-1}}{P_{t-1}} + \beta,$$

which is consistent with usual homogeneity postulate about consumer behavior. Equation (2) should be

$$\frac{I_t}{P_{t-1}} = aR_t + b\frac{Y_{t-1}}{P_{t-1}} + c,$$

if real investment depends on real income and the interest rate. Our equation (2) is the closest we can come to this and still keep our system linear.[1/] According to equation (4), the price

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1/ There is some doubt as to how the price level affects investment anyhow.

level is a linear function of the money value of output. It would be perhaps a little better to have the price level depend on the volume of real output. However, over a limited range, the same results could be obtained either way in a linear approximation, and the above formulation preserves the linearity of the system.

In equation (4), g would presumably be positive, indicating that the price level rises as total expenditure increases. If h is positive, the price level will rise less than in proportion to the rise in expenditures; if h is negative, the price level will rise more than in proportion to expenditures. If h = 0, the price level will rise in the same proportion as expenditures. This implies that h would normally be greater than zero, since this would mean that rising expenditures are accompanied by both rising prices and rising output.[2/] Pure inflation, with fixed output, is a situation in which h = 0.

The price level may rise as aggregate demand or total expenditures increases because of diminishing returns (including bottlenecks in specific sectors of the economy), because of an increase in the average degree of monopoly as demand rises, or because money wage rates have a tendency to

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2/ If h were negative, the price level would rise more than in proportion to expenditures, which would mean that the price level would vary inversely with output--i.e., rising output would be accompanied by falling prices.

rise with output. All these tendencies may be regarded as being reflected in equation (4). We do not include here, however, the case of flexible wages in which money wages fall without limit whenever the supply of labor exceeds the demand and rise without limit whenever the demand exceeds the supply. This situation will be considered in the next section. Here we assume that the supply of labor is a function (presumably a rising function) of the money wage.

The price level is lagged in equations (1) and (2)--consumption and investment in period t depend upon the price level in period t-1. This means that there is a lag in the adjustment of expenditures by consumers and investors to changes in the price level. However, the elimination of this lag would have no appreciable effect on the results.

The equilibrium solutions of the above system for income and the interest rate are

$$\bar{Y} = \frac{\frac{a}{d}(M - eR') + h(\beta + c)}{1 - \alpha - b - \beta g - cg + \frac{a}{d}} \qquad (8)$$

and

$$\bar{R} = \frac{(M - eR')(1 - \alpha - b - \beta g - cg) - h(\beta + c)}{d(1 - \alpha - b - \beta g - cg + \frac{a}{d})} \qquad (9)$$

For this system to possess a positive equilibrium solution, the denominator of equation (8) must be positive, i.e.,

$$1 - \alpha - b - \beta g - cg + \frac{a}{d} > 0.$$

This requires that

$$\alpha + b + \beta g + cg < \frac{a + d}{d}. \qquad (10)$$

The analogous condition for the simpler model in which no allowance was made for price level changes was[3/]

$$\alpha + b < \frac{a + d}{d}.$$

The complete basic difference equation for the above system is

$$Y_t - \frac{d(\alpha + b + \beta g + cg)}{a + d} Y_{t-1} - \frac{a(M - eR') + dh(\beta + c)}{a + d}.$$

The solution of this equation is of the form

$$Y_t = \bar{Y} + A\left(\frac{d(\alpha + b + \beta g + cg)}{a + d}\right)^t \qquad (11)$$

where A is a constant which depends upon the initial level of income from which the dynamic process starts.

Y will approach the equilibrium level given by equation (8), starting from a disequilibrium position (and other variables will approach their equilibrium values) if the second part of equation (11) vanishes as t gets large (thus making Y_t approach $\bar{Y}$). The second part of equation (11) will vanish when t gets large if

$$\frac{d(\alpha + b + \beta g + cg)}{a + d} < 1.$$

This condition will be satisfied if

$$\alpha + b + \beta g + cg < \frac{a + d}{a},$$

which is the same as the condition stated by (10) above. The analogous condition for our earlier system was

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3/ Cf. p. 50, *supra*.

$$\alpha + b < \frac{a + d}{d}$$

We may conclude that if

$$\alpha + b + \beta g + cg < \frac{a + d}{d},$$

the system will possess an equilibrium solution and the equilibrium will be stable.

Allowing for the possibility of price changes has made no serious change in our results. However, the system is somewhat more likely to be unstable than before. This result seems reasonable enough, since g measures the tendency of prices to rise as income rises, and β and c measure the tendency of expenditures to rise as prices rise. If these tendencies are large (g, β, and c are large), rising expenditures will generate still greater expenditures in the future and promote instability.

Pure inflation, where output is assumed constant, presumably at the full employment level, is a special case. Here, if Q is the fixed volume of real output,

$$Y_t = P_t Q,$$

so in equation (4), $g = \frac{1}{Q}$, and $h = 0$. Thus, even if output is completely fixed, an increase in expenditures will not result in a runaway inflation if

$$\alpha + b + \frac{\beta}{Q} + \frac{c}{Q} < \frac{a + d}{d}$$

This result is quite sensible. $\alpha + \frac{\beta}{Q}$ is the average propensity to consume (percentage of income spent on consumer

goods) at full employment. $b + \frac{c}{Q}$ is the percentage of income spent on investment goods at full employment (disregarding the effect of the interest rate). A large value of the sum of these two will clearly be inflationary. On the other side, if a is large (investment is elastic to the interest rate) and d is small (demand for idle balances is inelastic), this will tend to check the inflation through a tightening in the money market. If a = 0 (investment totally inelastic to the interest rate), the condition will reduce to

$$\alpha + b + \frac{\beta}{Q} + \frac{c}{Q} < 1,$$

i.e., monetary factors will contribute nothing to check the inflation, and the result is the same as would be obtained by leaving out the monetary factor entirely.[4/]

Loanable funds theory.--The effects of changes in the price level under the loanable funds theory can be handled in parallel fashion. Our system of equations (analogous to the system employed above) is

$$C_t = \alpha Y_{t-1} + \beta P_{t-1} \qquad (12)$$

$$I_t = aR_t + bY_{t-1} + cP_{t-1} \qquad (13)$$

$$\Delta M_{2,t} = dR_t + eR' \qquad (14)$$

$$P_t = gY_t + h \qquad (15)$$

4/ Of course, it is hard to imagine a runaway inflation with a fixed money supply. If the parameters of the system were such as to result in instability, at some point during the inflation, they would have to change--an infinite volume of expenditures cannot be financed with a fixed quantity of money.

$$S_t = Y_{t-1} - C_t \tag{16}$$

$$Y_t = C_t + I_t \tag{17}$$

$$I_t + \Delta M_{2,t} = S_t + \Delta M \tag{18}$$

The set-up is quite similar to that employed in the previous section, except that it is modified to fit in with the loanable funds formulation.[5/]

The equilibrium solutions are

$$\overline{Y} = \frac{\frac{a}{d}(\Delta M - eR') + h(\beta + c)}{1 - \alpha - b - \beta g - cg}, \tag{19}$$

and

$$\overline{R} = \frac{\Delta M - eR'}{d}.$$

As usual, it is the change in money stock rather than the stock itself which enters into these equations. The equilibrium interest rate is entirely unaffected by allowing for changes in the price level.

An equilibrium solution exists if the denominator of (19) is positive, i.e., if

$$\alpha + b + \beta g + cg < 1.$$

The analogous condition in our earlier loanable funds model was[6/]

$$\alpha + b < 1.$$

[5/] Once again, the lag assumed in the effect of the price level makes no appreciable difference in the results.

[6/] Cf. p. 98, *supra*.

The basic difference equation is

$$Y_t - \frac{a + d(\alpha + b + \beta g + cg)}{a + d} Y_{t-1} + \frac{a(eR' - \Delta M) - dh(\beta + c)}{a + d} = 0,$$

for which the general solution is

$$Y_t = \bar{Y} + A\left(\frac{a + d(\alpha + b + \beta g + cg)}{a + d}\right)^t.$$

The equilibrium will be stable if

$$\frac{a + d(\alpha + b + \beta g + cg)}{a + d} < 1,$$

i.e., if

$$\alpha + b + \beta g + cg < 1.$$

Again the criterion in our earlier model was $\alpha + b < 1$.

Thus if the condition

$$\alpha + b + \beta g + cg < 1$$

is satisfied, an equilibrium will exist, and it will be stable. Allowing for changes in the price level has again had little effect on our results, except to increase the possibility of instability somewhat.

Pure inflation, with physical output fixed and denoted by Q, gives us again $g = \frac{1}{Q}$ and $h = 0$. Our stability criterion becomes

$$\alpha + b + \frac{\beta}{Q} + \frac{c}{Q} < 1.$$

There will be an explosive inflation if, under conditions of full employment, the sum of the average propensities to consume and to invest is greater than unity. In this case, the

monetary system provides no check on inflation.[7]

We can conclude from the above discussion that under neither of our two interest theories are the results fundamentally changed when we allow for changes in the price level. Of course, prices would actually enter into the picture in other ways. We could allow for speculative effects by introducing such terms as $P_{t-1} - P_{t-2}$ into our consumption and investment equations. Whether this would have a stabilizing or destabilizing effect would depend upon the nature of the speculative activity. If a change in prices generates expectations of a further change in the same direction, it will tend to destabilize the system. On the other hand, if buyers' psychology is dominated by some notion of a "normal" price level, a movement of prices in one direction may lead them to expect a reversal and the result will be to add to the stability of the system.[8] Of course, both tendencies may be present at the same time, with one dominant under some conditions and the other dominant under other conditions. In a more complete treatment the effect of wage rate changes on the distribution of income and thereby on consumption and

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[7] Again, inflation increasing at a geometric rate could not go on indefinitely unless the money supply eventually began to increase at a geometric (rather than arithmetic) rate--the parameters of the system would eventually have to change.

[8] This amounts to saying that elastic expectations (elasticity greater than unity) reduce stability while inelastic expectations (elasticity less than unity) add to stability.

investment should be taken into account. Relative price changes, particularly changes in the relation of consumer goods prices to producer goods prices, probably also have important effects. However, most of these effects would be difficult to deal with in dynamic models, and we do not propose to carry the analysis any further.

The Effects of Wage Flexibility

Thus far throughout our discussion we have assumed that money wages are rigid or at least that they are sticky in the sense that the supply of labor is a function of the money wage level.[9/] We want now to examine this assumption and see what happens if we remove it. Since it is chiefly the downward flexibility of wages that is in question, we will consider how our results are altered if we assume both that workers compete for jobs by offering to work for lower money wages whenever the demand for labor falls short of the supply at the going wage and that employers take advantage of any opportunities to reduce their wage costs.

The dynamics of such a situation are highly complex; hence we will attempt only a static analysis of the situation. We will try to do this successively for our two alternative interest theories.

9/ The stickiness may arise from reactions on the demand side also--employers may hesitate to reduce money wages even though they can. See n. 51, p. 84.

Liquidity preference theory.--In order to deal with this problem, we will have to introduce additional relationships into our systems to represent the "real" part of the economy and the labor market. Our equations are as follows.

$$\frac{I}{p} = f(y, r) \qquad (1)$$

$$\frac{C}{p} = Q(y, r) \qquad (2)$$

$$\frac{M_2}{p} = X(r) \qquad (3)$$

$$Y = py \qquad (4)$$

$$Y = C + I \qquad (5)$$

$$y = \chi(N) \qquad (6)$$

$$\frac{w}{p} = \chi'(N) \qquad (7)$$

$$\frac{w}{p} = F(N) \qquad (8)$$

$$M_1 = Y \qquad (9)$$

$$M = M_1 + M_2 \qquad (10)$$

Here we have ten equations and ten unknowns: Y, C, I, y, p, r, N, w, M_1, and M_2. We assume, as we have up to now, that M is an exogenous variable determined by the monetary authority.

Equations (1), (2), and (3) are the familiar investment function, consumption function, and liquidity preference function. It makes little difference whether we include the interest rate in equation (2) as a factor affecting consumption (saving). Equation (4) merely defines money income as

real income (output) times the price level. Equation (5) is an equilibrium condition. Equation (6) is the aggregate production function, showing aggregate output as a function of aggregate employment, on the assumption that the stock of capital and natural resources is fixed. Equation (7) is the demand for labor equation, which says that the real wage is kept equal to the marginal product of labor.[10] Equation (8) says that the supply of labor is a function of the real wage. Equation (9) represents the demand for transactions balances--as usual, we measure income on the basis of our production-planning period, so that income for the period just equals active money.[11] Equation (10) is a familiar definition.[12]

This system of equations breaks into several component parts, permitting us to run through its solution step by step. Equations (6), (7), and (8) form a separate and independent system (the "real" part of the economy). These equations determine aggregate employment (N), the real wage ($\frac{w}{p}$), and

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[10] We assume perfect competition throughout. However, we could allow for monopoly and monopsony by introducing terms for the average elasticities of demand for products and supply of labor. Our results would not be greatly altered.

[11] Our results would be essentially the same if M_1 was not equal (or even proportional) to Y--just so long as it was some increasing function of Y.

[12] Systems of equations more or less similar to ours have been employed by various writers. Cf. F. Modigliani, "Liquidity Preference and the Theory of Interest and Money," Econometrica, XII (January, 1944), 45-88; L. R. Klein, "Theories of Effective Demand and Employment," Journal of Political Economy, LV (April, 1947), 108-131, and The Keynesian Revolution, pp. 199-206.

aggregate output (y). Next equations (1), (2), and (5) (rewritten in real terms) form the following system

$$\frac{I}{p} = f(y, r)$$

$$\frac{C}{p} = Q(y, r)$$

$$y = \frac{C}{p} + \frac{I}{p}$$

This system determines real investment ($\frac{I}{p}$), real consumption ($\frac{C}{p}$), and the interest rate (r). Substituting from (4), (9), and (3) into (10), we obtain

$$M = kpy + pX(r) \qquad (11)$$

Since M is given and y and r are already determined, this equation serves to determine the price level (p).[13/] From

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13/ Incidentally, it makes no material difference in the result whether equation (3) represents a demand for idle balances in "real" terms (as above) or in dollar terms. If equation (3) were

$$M_2 = X(r), \qquad (3')$$

thenequation (11) would become

$$M = kpy + X(r), \qquad (11')$$

which would still determine the price level. And the demand for idle balances could be made to depend upon the level of income as well as the interest rate. Moreover, results are not essentially changed by the introduction of a "money illusion" throughout. If equations (1), (2), and (3) were

$$I = f(Y, r) \qquad (1')$$

$$C = Q(Y, r) \qquad (2')$$

$$M_2 = X(r) \qquad (3')$$

equations (1'), (2'), (3'), (9), and (10) would form an independent system of "monetary equilibrium," which would determine money income (Y). This system and the "real" system (equations (6), (7), and (8)) would "meet" in equation (4) to determine the price level. This is the case in Modigliani's formal equations for a "generalized" classical system, although the effects of the price level on consumption and investment are discussed in the text of the article. Cf. Modigliani, op. cit.

here on, it is easy to determine all the remaining variables in the system.

This process of "solving" systems of mathematical equations is rather sterile and not particularly edifying; however, it does serve the purpose of demonstrating that the system is logically complete. The results obtained above can be explained in common-sense terms.[14] In a system with flexible wages--i.e., in which the supply of labor is a function of the real wage level--the level of employment is determined in the labor market by forces representing the real productivity of labor (demand side) and the disutility of labor to the worker (supply side). The real wage measures both the marginal productivity and the marginal disutility of labor. Since demand for and supply of labor are equated, there is no involuntary unemployment. With a given stock of capital and natural resources, the level of employment determines the volume of output and real income. This level of income determines the investment demand and the supply of savings as functions of the interest rate. Savings and investment then determine the interest rate. The demand for idle balances at that interest rate determines how much of the given money stock remains idle. The circulation of the remainder of the money stock against a given supply of goods determines the price level and the money wage level.

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[14] But important qualifications to the argument must be made. See the following pages.

Now the significance of all this from the standpoint of monetary and interest theory is that in a system with flexible wages such as we have been describing the quantity of money and liquidity preference have absolutely no effect on the interest rate.[15] Real product or income, real consumption, real investment, employment, the real wage, and the interest rate are determined independently of the monetary mechanism. The quantity of money and liquidity preference serve to determine merely the level of money wages and prices. For example, an increase in the money supply will not affect the interest rate (which is determined by the savings-investment mechanism), and, unless the liquidity preference schedule shifts at the same time that the money supply changes, none of the added money will go into idle balances, so that the increase in money supply will simply raise wages and prices. Similarly, an increase in liquidity preference will simply draw more money into idle balances at a fixed interest rate, leaving less in active balances and lowering the price level. Since all the important variables are determined independently of monetary considerations, changes in the purely monetary variables--money supply and liquidity preference--are incapable of affecting them.[16]

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[15] But, again, note the qualifications below.

[16] If the demand for money to hold is a demand for dollar balances rather than real balances (equation (3'), n. 13), nothing fundamental is changed--money supply and liquidity preference still merely determine the price level. However,

The supposed working of such a system may be illustrated by an example. Suppose that we start from a position of equilibrium and consider the effect of a fall in the marginal efficiency of investment schedule. The drop in investment will doubtless result in a reduction in output and employment to start with. This would tend to set the familiar multiplier process in operation. However, if wages are flexible, they will begin to fall when unemployment has appeared. The fall in wages reduces both costs and monetary demand so that prices fall with wages. The fall in wages and prices releases money from transactions balances into idle balances and thus lowers the interest rate. As the interest rate falls, investment expands (moving along the new lower marginal efficiency schedule), and saving may contract if the saving schedule is interest elastic. The process goes on until full employment is restored. When the new equilibrium is reached output, employment, and the real wage

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if the "money illusion" spreads to the consumption and investment functions (see equations (1'), (2'), and (3'), n. 13), the influence of monetary factors is somewhat increased. In this case, money supply and liquidity preference have a hand (along with savings and investment) in determining the interest rate. Output, employment, and the real wage are still determined independently of monetary factors, but money supply and liquidity preference through their effect on the interest rate can influence the distribution of output between consumption and investment. The same is true (but, of course, to a different degree) if there is a money illusion in either the consumption function or the investment function but not in both (i.e., if the system contains either (1') or (2')).

will be back at their original levels.[17] The interest rate, savings and investment, and money wages and prices will presumably all be lower.[18] The new interest rate will be such as to equate saving and investment at full employment under the changed circumstances. It is to be noted that, while the monetary mechanism is the device through which the reduction in the interest rate is brought about, it has no influence on the new equilibrium interest rate that is eventually reached. On the other hand, the extent of the necessary fall in wages and prices depends entirely on the monetary variables. Prices and wages must fall enough to release from active balances as much money as is required to satisfy the increased demand for idle balances at the new lower equilibrium interest rate (which is determined by saving and investment). In fact, with a given supply of money, the extent to which wages and prices must fall is determined entirely by the elasticity of the liquidity preference function. The more elastic is liquidity preference, the more must wages and prices fall.[19]

It is apparent that there is a self-adjusting mechanism tending to maintain or restore full employment in a market

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17/ We are disregarding the effects of changes in population (labor force) and stock of capital which occur during the equilibration process.

18/ If saving is inelastic to the interest rate, savings and investment will be unchanged.

19/ In the above discussion, we have followed essentially the line of argument pursued in Modigliani, op. cit.

economy characterized by flexible wages and prices. Moreover, we have seen that to the extent that this mechanism operates, the interest rate (at least in equilibrium) is determined by "real" factors (savings and investment) and is not influenced by monetary considerations.

While an economic system with flexible wages and prices does contain the self-adjusting mechanism we have been discussing, there are many points at which it may break down. As Klein has pointed out, "More must be done than merely to count equations and variables. We must consider the shapes of our functions."[20/] There are at least three situations in which the shapes of the schedules may be such as to prevent the self-adjusting mechanism from operating effectively.

(1) It is conceivable (though perhaps unlikely) that the supply of labor might exceed the demand at all levels of real wages--or that a negative wage would be necessary to attain full employment. This possibility we will not consider, however.

(2) The investment schedule may shift in such a way as to result in an excess of full-employment saving over full-employment investment at all positive rates of interest.[21/] This would mean that the interest rate would have to be negative to restore full employment, and this is obviously

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20/ Klein, The Keynesian Revolution, p. 84.

21/ Ibid., pp. 84-86.

impossible.[22] This is especially likely to be true if saving and investment are very inelastic to the interest rate. It is now generally agreed that saving is little influenced by the interest rate, being influenced mainly by the level of income and perhaps secondarily by rate of change of income, highest past income, the stock of wealth or of liquid assets, etc. Moreover, both empirical study[23] and theoretical considerations[24] have led economists to believe that investment

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[22] The rate of interest in real terms can, of course, be negative--i.e., the real value of the amount repaid to cover principal and interest may be less than the real value of the amount originally loaned due to a rise in prices. However, the rate of interest in money terms could hardly be negative (except for very special reasons and for a short time) because there would presumably be an infinitely great demand for loan funds at any negative rate.

[23] See J. E. Meade and P. W. S. Andrews, "Summary of Replies to Questions on Effects of Interest Rates," Oxford Economic Papers, No. 1 (1938), pp. 14-31; P. W. S. Andrews, "A Further Inquiry into the Effects of Rates of Interest," Oxford Economic Papers, No. 3 (1940), pp. 33-73. These studies present the results of surveys of the opinion of British businessmen. On the interpretation of the results of these two studies see H. D. Henderson, "The Significance of the Rate of Interest," Oxford Economic Papers, No. 1 (1938), pp. 1-13, and R. S. Sayers, "Business Men and the Terms of Borrowing," Oxford Economic Papers, No. 3 (1940), pp. 23-31. For a bit of evidence on the situation in the United States, cf. J. F. Ebersole, "The Influence of Interest Rates upon Entrepreneurial Decisions in Business--a Case Study," Harvard Business Review, XVII (1938), 35-39.

[24] On the theoretical explanation of the interest inelasticity of the marginal efficiency of investment schedule, see the excellent article by G. L. S. Shackle, "Interest Rates and the Pace of Investment," Economic Journal, LVI (March, 1946), 1-17. See also F. A. Lutz, "The Interest Rate and Investment in a Dynamic Economy," American Economic Review, XXXV (December, 1945), 811-830. Harrod, on the other hand, has argued that in the longer run, given time enough to "sink

is also quite inelastic to the interest rate, especially when income is falling and risks are increasing.

(3) If, as Keynes argued, the liquidity preference schedule becomes perfectly elastic at some level of interest rates (above zero), it may be that the interest rate which would equate saving and investment at full employment, while above zero, is below this floor set by institutional and expectational factors.

If the economic situation was of the type indicated by (2) or (3) (disregarding dynamic factors), wages and prices would fall indefinitely, and the interest rate would approach zero (in Case (2)) or the floor set by liquidity preference (in Case (3)). Investment, income, and employment would remain at the level determined by that interest rate. Of course, this could not be called a situation of underemployment equilibrium, since wages and prices are falling. Underemployment equilibrium requires some rigidity in the money wage structure.

Pigou[25] and Haberler[26] have pointed out another[27]

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in," a fall in interest rates may have a substantial effect on investment, although the precise reason for this is not indicated. R. F. Harrod, Towards a Dynamic Economics (London: Macmillan and Co., Ltd., 1949), p. 132.

25/ A. C. Pigou, Employment and Equilibrium (London: Macmillan and Co., Ltd., 1941), pp. 118-130; "The Classical Stationary State," Economic Journal, LIII (December, 1943), 343-351; "Economic Progress in a Stable Environment," Economica, XIV, New Series (August, 1947), 180-188.

26/ Haberler, op. cit., pp. 491-503.

27/ A number of other routes by which changes in money wages may affect the level of employment have been pointed out

channel through which flexible wages and prices may operate to eliminate unemployment. They have argued that as prices fall, the real value of that part of consumers' wealth[28] which is fixed in terms of money will increase and that this will raise the consumption function (shift the saving schedule to the left). If the price decline went far enough it could supposedly raise the consumption function enough to make saving equal to investment at a full employment level of income with the interest rate above zero (in Case (2) above) or above any institutional or psychological floor set by perfect elasticity of liquidity preference (in Case (3) above).

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by various writers. They include such factors as money illusions on the part of consumers, changes in the distribution of income, substitution effects due to rigid prices of factors of production other than labor, and so on. The general consensus seems to be that they may work toward either increased or decreased employment, and that they are not likely to be very important in any case. See J. Tobin, "Money Wage Rates and Employment," The New Economics, ed. by S. E. Harris, pp. 572-587; A. H. Hansen, Monetary Theory and Fiscal Policy, chap. 8. Two recent discussions of the effect of money wage changes on employment are R. C. O. Matthews, "The Effect of Wage-Cuts on Employment," and T. Mayer, "The Effects of a Wage Change upon Prices, Profits, and Employment," both in Economic Journal, LXI (September, 1951), 505-517 and 518-530, respectively.

28/ The Pigou-Haberler argument is applicable only to that part of fixed consumers' claims not offset by private debt. A statistical representation of this might be "net claims of the non-bank public," defined in U. S. monetary parlance as the sum of gold stock, Treasury currency, and the federal debt minus Treasury cash and bank balances. On this problem, cf. D. Patinkin, "Price Flexibility and Full Employment," American Economic Review, XXXVIII (September, 1948), 551; also R. N. McKean, "Liquidity and a National Balance Sheet," Journal of Political Economy, LVII (December, 1949), 506-522.

Thus, if this so-called "Pigou effect" is operative, it restores the tendency toward self-adjustment at full employment to the "generalized classical system" we have been discussing.[29]

It should be understood that the notion that the consumption function is raised as a result of an increase in the real value of consumers' assets brought about by a fall in prices--commonly called the "Pigou effect"--is merely a hypothesis.[30] In the absence of empirical study, the extent of the effect is unknown and even its direction might be doubted. However, if we accept Pigou's argument, the "Pigou effect" introduced into the system of relationships we have been considering above will make the economic system self-adjusting at full employment regardless of the shapes of the other functions.

However, even if we grant that a fall in the price level will raise consumption through its effect on the value of consumers' assets, a number of weighty objections can be raised against the employment of the argument in some contexts in which it has been applied and against reliance on price flexibility as cure for unemployment.

(1) Pigou himself confined his discussion of the effect of changes in the stock of consumer wealth brought about by

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[29] Except on the unlikely contingency of Case (1) above--supply of labor in excess of demand at all positive levels of real wages.

[30] Its justification in terms of the theory of consumer behavior is discussed by Pigou in Employment and Equilibrium, pp. 128-129.

changes in the price level to the consideration of long run problems, and, in particular, to the classical stationary state. Keynes[31] mentioned the possibility that the marginal efficiency of capital might in the long run[32] be driven down to zero under conditions in which saving out of full employment income would be a positive amount. If this should happen, income would fall permanently below the full employment level by an amount sufficient to reduce saving to zero.[33] Pigou introduced his "effect" to show that the stationary state would be self-adjusting at full employment. Now even if the "Pigou effect" would work as its author supposed under the (highly abstract) conditions postulated, it is doubtful whether it would work in the same way in the short run situations to which other writers have attempted to apply it.[34]

31/ Keynes, General Theory, pp. 217-220.

32/ Presumably under conditions of constant population and productive technique. Also this presumably would refer to the marginal efficiency of capital in Lerner's sense. See A. P. Lerner, Economics of Control, pp. 330-340.

33/ Keynes recognized the effect of physical accumulation of wealth on the consumption function. He indicated that the accumulation of wealth might be great enough by the time the marginal efficiency of investment reached zero to reduce the propensity to save at full employment to zero. But this would happen only by chance. See Keynes, General Theory, p. 218.

34/ Haberler, who appears to have "discovered" the effect independently discusses it in the context of short run fluctuations. Haberler, op. cit., pp. 491-503. In criticizing its probable effectiveness Patinkin is talking about its short-run operation. Patinkin, op. cit.; also "Involuntary Unemployment and the Keynesian Supply Function," Economic

Quite probably a fall in the price level that was expected to be permanent, as in the case of a stationary state, would have the effect indicated by Pigou. But it seems doubtful whether, in an economy characterized by uncertainty and cyclical fluctuations, a fall in the price level during a depression would exercise a similar influence over consumers. It is more reasonable to suppose that, in an economy in which the price level fluctuates, consumers think of the real value of their assets (in the sense in which this value exercises an influence over their savings proclivities) in terms of some "normal" price level and that they do not revise their valuations up and down with presumably temporary changes in the price level.

(2) In addition to the claims against government which are subject to the Pigou effect, consumers hold other debt claims against each other and against business firms. These are assets to some economic units and debts against others. With respect to such claims, a fall in the price level increases the value of the creditor's assets and at the same time increases the debtor's burden. These two effects might cancel each other out, or there might be a net effect in either a favorable or an unfavorable direction. However,

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Journal, LIX (September, 1949), 367-368. Others have discussed the "Pigou effect" in connection with short-run adjustments, for example, M. Friedman in "A Monetary and Fiscal Framework for Economic Stability," American Economic Review, XXXVIII (June, 1948), 259.

since a debtor is under compulsion, when either the principal or the interest on his debt comes due, to pay it, there is more reason to suppose that the debtor will reduce his expenditures on goods in order to be able to make the debt payments than to suppose that the creditor will increase his expenditures. In relation to the point made above, while the creditor may be influenced by some notion of a normal price level, the debtor is likely to be under more pressure to base his actions on the existing price level. Furthermore, sharp falls in the price level may result in defaults and bankruptcies in which both debtor and creditor lose out.

(3) When dynamic considerations are brought into the picture, the Pigou effect is even less likely to be a sufficient corrective during cyclical declines. Slow responses and frictions are likely to cause the wage-price structure to sag slowly rather than to drop sharply under pressure of unemployment. This may result in a situation in which a drop in wages and prices creates the expectation of a further drop, thus bringing destabilizing speculation into operation as both consumers and investors postpone expenditures awaiting further declines.[35/] In order to prevent this reaction, it is necessary that expectations be rather inelastic so that a fall in prices will create the expectation of a later rise--that is, buyers must have in mind some concept of a normal price level

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35/ Cf. D. Patinkin, "Price Flexibility and Full Employment," op. cit., pp. 556-560.

to which they expect a return. This relates to the first point made above, since we saw that if consumers have such an idea of a normal in mind, the Pigou effect is likely not to be effective because they will not regard their assets as increasing in real value due to what they regard as a temporary fall in prices. Bringing the two considerations together, we can see that the Pigou effect is likely not to be effective during a cyclical depression for one or the other of two reasons. If expectations are elastic, consumers may regard the real value of their assets as having increased but they probably will, if anything, reduce their expenditures in anticipation of still lower prices. On the other hand, if their expectations are inelastic, they will expect the price decline to be temporary and will not regard the real value of their assets as having increased.

It is apparent that if the Pigou effect is a significant factor in the economy, it introduces complications into the determination of the rate of interest. The quantity of money influences savings, thus providing another channel by which it may affect the interest rate.[36/] However, we are interested mainly in a moderately short-run theory of interest in an economy subject to change and uncertainty. Since, as we have seen, the Pigou effect is not likely to be important

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36/ See L. A. Metzler, "Wealth, Saving, and the Rate of Interest," Journal of Political Economy, LIX (April, 1951), 93-116, where an attempt is made, under quite restrictive assumptions, to explore the possibilities.

under these circumstances, we will not attempt to explore its influence on the rate of interest.

Loanable funds theory.--We now consider the determination of the rate of interest under the loanable funds theory when wages are flexible. This problem can be dealt with, again, by reference to a model which includes the real part of the economy. The equations are as follows.

$$\frac{I}{p} = f(y, r) \qquad (12)$$

$$\frac{C}{p} = \varphi(y, r) \qquad (13)$$

$$\frac{\Delta M}{p} = X(r) \qquad (14)$$

$$Y = C + I \qquad (15)$$

$$Y = py \qquad (16)$$

$$y = \chi(N) \qquad (17)$$

$$\frac{w}{p} = \chi'(N) \qquad (18)$$

$$\frac{w}{p} = F(N) \qquad (19)$$

$$Y = M_1 \qquad (20)$$

We have nine equations and nine unknowns: Y, y, C, I, N, p, w, r, and M_1. In this case, we assume that ΔM, the change in money supply is an exogenous variable determined by the monetary authority.

All the equations except (14) are the same as the equations in our previous model. Equation (14) expresses our present hypothesis that investors want to add to the real

value of their cash balances a certain amount per period which is a function of the rate of interest. We are at present concerned only with equilibrium positions. Since savings and investment are equal in equilibrium, our money market equation,

$$I_t + \Delta M_{2,t} = S_t + \Delta M,$$

tells us that $\Delta M_{2,t} = \Delta M$. We can therefore substitute ΔM for $\Delta M_{2,t}$ in the demand for asset money

$$\frac{\Delta M_{2,t}}{p} = X(r_t),$$

and drop the time subscripts, thus obtaining

$$\frac{\Delta M}{p} = X(r).$$

The solution to this system can be treated piecemeal like that of our previous model. Equations (17), (18), and (19),

$$y = \chi(N) \qquad (17)$$

$$\frac{w}{p} = \chi'(N) \qquad (18)$$

$$\frac{w}{p} = F(N) \qquad (19)$$

determine real income, employment, and the real wage at a full employment level. Given full employment real income, $\bar{y}$, equations (12), (13), and (15) (rewritten in real terms),

$$\frac{I}{p} = f(\bar{y}, r)$$

$$\frac{C}{p} = Q(\bar{y}, r)$$

$$\bar{y} = \frac{C}{p} + \frac{I}{p}$$

determine real consumption, real investment, and the rate of interest. Given the equilibrium rate of interest, $\bar{r}$, equation (14)

$$\frac{\Delta M}{p} = X(\bar{r}), \qquad (14)$$

determines the price level.

In other words, equilibrium is a situation in which the price level is such as to make the real value of the (given) increment to the money supply each period equal to the amount that investors want to add to their cash balances at the interest rate which equates savings and investment at the full employment level of income.

Equation (20) must be satisfied, since there must be enough money in the transactions sphere to handle the full employment volume of business valued at the equilibrium price level. There is not, however, a unique total amount of money, M, associated with equilibrium--i.e., equilibrium is associated with a growing rather than a constant amount of money. A given rate of change of the money stock rather than a given total money stock is associated with equilibrium.

In a system with flexible wages and prices and the loanable funds theory of interest, the equilibrium interest rate is determined by saving and investment and is not influenced by monetary factors. The same three possibilities of inconsistency that we noted in connection with the liquidity preference theory exist here, however.

(1) The supply of labor may exceed the demand at all levels of real wages above zero.

(2) Full employment saving may exceed full employment investment at all positive interest rates.

(3) The demand for money to hold (demand for increments to idle balances in this case) may become perfectly elastic at some low level of the interest rate. This rate may be above the rate which would equate full employment savings and investment. No fall in the price level would be sufficient to raise the value of the increments to the money stock high enough to satisfy the demand at an interest rate low enough to produce full employment.

If one of these situations should arise, the result would be continuous deflation of prices and wages and underemployment disequilibrium. Underemployment equilibrium requires some rigidity in the structure of prices and wages.

The conclusion reached as a result of our discussion of the determination of the interest rate under conditions of flexible wages and prices is that whether the liquidity preference or loanable funds theory is appropriate, the interest rate in equilibrium is determined by saving and investment (barring the possibilities of inconsistency). Our discussion of interest rate determination elsewhere in this paper is therefore applicable only under conditions in which there is some rigidity in the structure of money wages.

Monetary and Fiscal Policies

So far we have worked entirely with models which have made no allowance for government expenditures and taxation. It is a relatively simple matter to expand the scope of our models to take account of at least the more basic aspects of these matters. Moreover, it is relevant to the question of interest rate determination, since governments usually finance their deficits by selling securities and employ any surplus funds acquired through taxation to retire debt. These government operations are an increasingly important factor in the securities markets, and it would be useful to be able to take account of their effects.

We will now discuss some of the essentials of government fiscal operations with special reference to their impact on interest rates and the securities market and try to bring out the relations between fiscal and monetary policy. For the most part, we will confine ourselves to a discussion of equilibrium positions with only incidental comments on the dynamics. We will, however, start out with dynamic models, and it would not be very difficult to carry through the dynamic part of the analysis.

Our procedure, as usual, will be to take up the problems separately in connection with the liquidity preference and the loanable funds theories, since one of our main purposes will be to show that the two theories have different implications with respect to the relations between monetary and fiscal policy.

Liquidity preference theory.--In discussing fiscal policy in relation to the liquidity preference theory, we will use the following model.

$$C_t = \alpha(Y_{t-1} = T_t) + \beta \qquad (1)$$

$$I_t = aR_t + bY_{t-1} + c \qquad (2)$$

$$M_{2,t} = dR_t + eR' \qquad (3)$$

$$T_t = mY_{t-1} + n \qquad (4)$$

$$Y_t = C_t + I_t + G \qquad (5)$$

$$M_{1,t} = kY_t \qquad (6)$$

$$M = M_{1,t} + M_{2,t} \qquad (7)$$

The new variables introduced here are G, government expenditures on goods and services, and T, total taxes minus government transfer payments and subsidies.[37] G will be treated as an exogenous variable determined by political decisions and subject to change. Equation (4), the tax equation, shows taxes as a linear function of (lagged) income.[38] The parameters, m and n, are presumed to be determined by political

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[37] The income concept on which consumption is assumed to depend is not the usual "disposable income" but what might be called "gross privately available income." Y stands for gross national product, and Y - T represents gross national product minus "net" taxes (all taxes minus transfer payments and subsidies). The difference between "gross privately available income" (Y - T) and consumption expenditures is gross savings: personal savings plus undistributed corporate profits plus capital consumption allowances.

[38] The tax system will be progressive if $n<0$, proportional if $n = 0$, and regressive if $n>0$.

decisions and subject to change. We are now assuming that all the "flow" variables, such as income, consumption, and investment, are expressed as annual rates. This necessitates the introduction of the parameter k,[39] which is equal to the length of the production-planning period expressed as a fraction of a year--if the production-planning period is four months, k is one third.

The above system of equations produces the following difference equation,

$$Y_t - \frac{\alpha(1 - m) + b}{1 + \frac{ka}{d}} Y_{t-1} - \frac{\frac{a}{d}(M - eR') - \alpha n + \beta + c + G}{1 + \frac{ka}{d}} = 0,$$

for which the equilibrium solution is

$$\bar{Y} = \frac{G - \alpha n + \beta + c}{1 - \alpha(1 - m) - b + \frac{ka}{d}} + \frac{\frac{a}{d}(M - eR')}{1 - \alpha(1 - m) - b + \frac{ka}{d}}.$$

The condition for stability of this system is[40]

$$\alpha(1 - m) + b < 1 + \frac{ka}{d}.$$

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[39] See n. 17, p. 48, supra.

[40] The only important difference between this and the condition of stability for our early system (see p. 50) is the presence of m, the marginal tax rate, which adds to the stability. The presence of the ka in the inequality in place of a is only an apparent difference, being traceable only to the difference in the measurement of income. Under the same conditions, a in our present system (on an annual rate basis) will be equal to the reciprocal of k times a in the other system. That is, if the production-planning period is three months, k will be 1/4, and a on an annual rate basis will be four times the a which refers to actual amounts of investment per production-planning period. This is simply because, for example, a given drop in the interest rate will induce four times as much additional investment in a year as it will in one production-planning period.

The condition for stability for an ordinary Keynesian type expenditure model containing a tax function but without the monetary variables is

$$\alpha(1 - m) + b < 1.$$

For our present model, the stability condition is less restrictive than for a model which does not contain monetary variables. This is true because both a and d will normally be negative, and $\frac{ka}{d}$ will, therefore, be positive. Hence the sum of the propensities to spend adjusted for the effect of induced tax changes, $\alpha(1 - m)$ and b, can be somewhat greater than one, and the system will still be stable. The only exceptions to this would be the cases in which a = 0 (changes in the interest rate have no effect on investment) or b is infinitely large (liquidity preference is perfectly elastic). In all other cases, rising interest rates will tend to check expansions and falling interest rates will tend to check contractions, provided, of course, the money supply is inelastic. For example, during a period of expansion, even if the sum of the propensities to spend on consumption and investment is greater than one, rising interest rates may check investment enough to produce a stable equilibrium.

This comparison between our present model and the usual multiplier model applies to both static and dynamic stability--both to the existence of an equilibrium and the stability of the equilibrium. That is, in both cases, if the stated condition is fulfilled, not only does an equilibrium

solution exist, but the system will tend to return to this equilibrium position if it is displaced from it.

From the equilibrium solution given above, it is easy to derive a number of multipliers applicable to different types of policy.

(1) Change in government expenditures on goods and services.

$$\Delta\bar{Y} = \frac{1}{1 - \alpha(1 - m) - b + \frac{ka}{d}}\Delta G$$

(2) Change in the money stock.

$$\Delta\bar{Y} = \frac{\frac{a}{d}}{1 - \alpha(1 - m) - b + \frac{ka}{d}}\Delta M$$

(3) Shift in the tax schedule.

$$\Delta\bar{Y} = \frac{-\alpha}{1 - \alpha(1 - m) - b + \frac{ka}{d}}\Delta n$$

(4) Autonomous shift of the consumption function.

$$\Delta\bar{Y} = \frac{1}{1 - \alpha(1 - m) - b + \frac{ka}{d}}\Delta\beta$$

(5) Autonomous shift of the marginal efficiency of investment.

$$\Delta\bar{Y} = \frac{1}{1 - \alpha(1 - m) - b + \frac{ka}{d}}\Delta c$$

(6) Change in liquidity preference due to a change in investors' ideas about the "normal" level of interest rates.

$$\Delta\bar{Y} = \frac{-\frac{ae}{d}}{1 - \alpha(1 - m) - b + \frac{ka}{d}}\Delta R'$$

(7) Equal changes in government expenditures on goods and services and in the tax schedule.

$$\Delta\bar{Y} = \frac{1 - \alpha}{1 - \alpha(1 - m) - b + \frac{ka}{d}}\Delta B,$$

where

$$\Delta B = \Delta G = \Delta n.$$

Multipliers (1), (3), (4), (5), and (7) are similar to the usual multiplier formulas for various types of fiscal policy and for autonomous shifts in the consumption and investment schedules, except that, in each case, an extra monetary term is included in the denominator. The effect of this term will usually be to reduce the size of the multiplier. By comparing these formulas with the "standard" formulas, we can see what assumptions about monetary theory or monetary policy underlie the standard multipliers. There are two possibilities in each case.

(1) There may be an assumption that could be regarded as lying in the field of monetary theory--an assumption about the sensitivity of the economic system to monetary changes. Strictly speaking, this means the assumption that either $a = 0$ or that d is infinitely large. Under these conditions, for example, the multiplier for changes in government expenditures becomes

$$\Delta\bar{Y} = \frac{1}{1 - \alpha(1 - m) + b}\Delta G,$$

which is the standard multiplier formula. That is, if the marginal efficiency of investment is completely inelastic to

the interest rate, any upward pressure on interest rates brought about by government borrowing to finance deficit spending can be neglected. Or if liquidity preference is perfectly elastic, the government borrowing can be carried out without causing any rise in interest rates. Of course, one may be justified in disregarding the monetary repercussions even though these conditions are not strictly fulfilled, provided he thinks, for example, that the elasticity of the marginal efficiency of investment schedule, while not equal to zero, is nevertheless very small.

(2) A second possible assumption underlying the standard multiplier formulas lies in the realm of monetary policy. That is, it may be assumed that appropriate monetary policy accompanies the fiscal policy or other changes so as to keep the interest rate constant. It is possible to deduce the size of the change in the money supply that is required for this purpose. For example, it is easy to show that for a rise in government expenditures to raise the level of income according to the multiplier

$$\Delta Y = \frac{1}{1 - \alpha(1 - m) - b}\Delta G$$

the money supply must be expanded by an amount given by

$$\Delta M = \frac{k}{1 - \alpha(1 - m) - b}\Delta G$$

As another example, consider the so-called "balanced budget principle"--that a change in government expenditures on goods and services accompanied by an equal lump-sum change

in taxes will change the level of income by approximately the amount of the change in expenditures and taxes. The multiplier for such changes is said to be approximately unity. Induced investment and induced tax changes are neglected here, so b and m become zero, and our formula (7) becomes

$$\Delta Y = \frac{1 - \alpha}{1 - \alpha + \frac{ka}{d}} \Delta B.$$

This multiplier is somewhat smaller than unity due to the factor $\frac{ka}{d}$ in the denominator. In order for the multiplier to be equal to unity, the fiscal policy must be accompanied by a change in the money supply according to the formula

$$\Delta M = k\Delta B.$$

To generalize, the usual multiplier formulas imply that monetary change accompanies the fiscal policy (or shift in the marginal efficiency of investment or the consumption function), the extent of the monetary change required being equal to the factor k times the ultimate change in the level of income. This means that enough new money is supplied to meet transactions requirements at the new level of income so that no change in the level of interest rates is called for.

Some generalizations about the relative effectiveness of monetary and fiscal policy under different conditions can be set down on the basis of the above multiplier formulas.

(1) If a is very large or d is very small, we can see from formulas (1), (3), and (7) that fiscal policies alone (unaccompanied by monetary policy) are relatively ineffective.

That is, if the marginal efficiency of investment is very elastic to the interest rate, government borrowing to finance a deficit, for example, which raises interest rates will reduce private investment enough to offset most of the effects of the increased government expenditure. Or if the liquidity preference schedule is very inelastic, the increased government borrowing may cause such a sharp rise in interest rates as to reduce private investment significantly even though the marginal efficiency of investment schedule is relatively inelastic. The limiting case in this respect is that in which either d = 0 (perfectly inelastic liquidity preference) or a is infinitely large (perfectly elastic marginal efficiency of investment). Under these conditions, all the fiscal policy multipliers are equal to zero, and fiscal policy unaccompanied by monetary measures is totally ineffective as a means of influencing the level of income.

(2) The very conditions (elastic marginal efficiency of investment and/or inelastic liquidity preference) which make fiscal policy relatively ineffective suffice to make monetary policy highly effective. If we consider it a part of the technique of monetary policy for the central bank to try to influence the liquidity preference schedule by trying to influence the "normal" interest rate expectations of banks and other investors, we can include changes in R' and therefore formula (6) in our concept of monetary policy. Low values of d and high values of a will make the multipliers for monetary

policy (formulas (2) and (6)) large. If the marginal efficiency of investment is very elastic, for example, an increase in the money supply, by lowering the rate of interest even a little, may cause a large increase in investment and an accompanying rise in the level of income. Or, if the liquidity preference schedule is very inelastic, an increase in the money supply will lower the interest rate sharply, and may cause a large increase in investment and income even if the marginal efficiency of investment is rather inelastic to the interest rate. One special case is of interest--that in which d = 0, or the liquidity preference schedule is totally inelastic. If this is true, formula (2) reduces to

$$\Delta\bar{Y} = \frac{1}{k}\Delta M,$$

or the multiplier for increases in the money stock becomes 1/k or v. Under these conditions, the level of income rises <u>immediately</u> by the full amount of any increase in the money stock and remains at the new higher level. This is the situation implied by the crude version of the quantity theory of money, and it is probably a tendency to think in terms of this special case which caused some economists to confuse the multiplier with the circuit velocity of money.[41]

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[41] It should be noted, however, that in this particular case, the size of the multiplier depends upon the time unit that is used to measure the "flow" magnitudes (Y, C, I, etc.). For instance, if the magnitudes represent actual amounts per production planning period (rather than annual rates, as above), the multiplier becomes 1 instead of v. In fact, the size of multiplier (2) depends, in the general case, upon the time unit employed in measuring flows. That is, a

(3) Under some circumstances, fiscal policies are especially effective, even without supporting monetary policies. These are the cases, mentioned above, in which a is very small and/or d is very large, so that the monetary element in the fiscal policy multipliers becomes very small. If the marginal efficiency of investment is very inelastic, any rise in the rate of interest brought about by borrowing for deficit spending will have little effect upon private investment, while if liquidity preference is very elastic, the borrowing can be done without appreciable effect on interest rates. The limiting case of this, already mentioned, is that in which a = 0 (completely inelastic marginal efficiency of investment) or d is infinitely large (perfectly elastic liquidity preference), so that fiscal policies involve no monetary repercussions at all.

(4) The circumstances which make fiscal policies effective also make monetary policy relatively ineffective. This is the familiar case of deadlock in monetary policy due to inelastic marginal efficiency of investment and/or elastic liquidity preference. The limiting case is that in which a = 0 or d is infinitely large, making monetary policy totally ineffective (and unneeded as a supplement to fiscal policy).

Loanable funds theory.--The model we will use in

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given change in the money stock will raise the level of income per annum, for instance, four times as much as it will raise the level of income per quarter.

discussing monetary and fiscal policy in connection with the loanable funds theory is as follows.

$$C_t = \alpha(Y_{t-1} - T_t) + \beta \qquad (8)$$

$$I_t = aR_t + bY_{t-1} + c \qquad (9)$$

$$\Delta M_{2,t} = dR_t + eR' \qquad (10)$$

$$T_t = mY_{t-1} + n \qquad (11)$$

$$Y_t = C_t + I_t + G \qquad (12)$$

$$S_t = Y_{t-1} - T_t - C_t \qquad (13)$$

$$\Delta M_{2,t} + I_t + (G - T_t) = S_t + \Delta M \qquad (14)$$

This model is similar to our earlier loanable funds model, except that consumption depends upon income after taxes (equation (8)),[42/] taxes depend upon income (equation (11)), savings is defined as income after taxes minus consumption expenditures (equation (13)), and government borrowing has been introduced as an additional factor influencing the interest rate. This last change is accomplished by introducing the term G - T into equation (14), the market equation for loanable funds. The reason for this term is that the government is assumed to enter the market to borrow funds to the extent of any deficit (G - T). This adds to the demand for loan funds, and hence should be included in the demand side of equation (14). The component (G - T) will, of course, be

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[42/] See n. 37, supra.

negative if the Treasury operates at a surplus and retires debt.[43/]

The equilibrium level of income for this system is given by the expression,

$$\bar{Y} = \frac{G - \alpha n + \beta + c}{1 - \alpha(1 - m) - b} + \frac{\frac{a}{d}(\Delta M - eR')}{1 - \alpha(1 - m) - b}$$

The conditions necessary for stability of the system are essentially the same as those for our simpler system,[44/] namely,

$$\alpha(1 - m) + b < 1.$$

That is, for stability, the sum of the propensities to consume and invest (adjusted for induced taxes) must be less than unity.

This indicates the first point of contrast between our present model and the liquidity preference model embodying fiscal variables,[45/] namely, that the presence of monetary variables in the system adds nothing to its stability. Whereas,

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[43/] It is assumed that the Treasury keeps the amount of its cash and bank balances constant and that it does not finance expenditures by the issuance of additional Treasury currency. In other words, the Treasury borrows in the market to the extent of the current period's deficit or retires debt to the extent of the current period's surplus.

[44/] See p. 98, *supra*.

[45/] Cf. pp. 155-157, *supra*.

in the liquidity preference model, it was possible for the sum of the propensities to be somewhat larger than unity and still have a stable system due to monetary reactions, in the present system monetary reactions have no effect on the system's stability.

For purposes of comparison with the liquidity preference model, we list below the multipliers applicable to different events and policies.

(1) Change in government expenditures on goods and services.

$$\Delta\bar{Y} = \frac{1}{1 - \alpha(1 - m) - b}\Delta G$$

(2) Change in rate of flow of new money into the system.

$$\Delta\bar{Y} = \frac{\frac{a}{d}}{1 - \alpha(1 - m) - b}\Delta(\Delta M)$$

(3) Change in taxes minus transfer payments.

$$\Delta\bar{Y} = -\frac{\alpha}{1 - \alpha(1 - m) - b}\Delta n$$

(4) Autonomous shift of the consumption function.

$$\Delta\bar{Y} = \frac{1}{1 - \alpha(1 - m) - b}\Delta\beta$$

(5) Autonomous shift of the marginal efficiency of investment.

$$\Delta\bar{Y} = \frac{1}{1 - \alpha(1 - m) - b}\Delta c$$

(6) Change in liquidity preference due to a change in investors' ideas about the "normal" level of interest rates.

$$\Delta\bar{Y} = -\frac{\frac{ae}{d}}{1 - \alpha(1 - m) - b}\Delta R'$$

(7) Equal changes in government expenditures on goods and services and in the tax schedule.

$$\Delta\bar{Y} = \frac{1 - \alpha}{1 - \alpha(1 - m) - b}\Delta B,$$

where

$$\Delta B = \Delta G = \Delta n.$$

Multipliers (1), (3), (4), (5), and (7) are identical with the usual multiplier formulas for fiscal policies and autonomous changes in consumption and investment. In contrast with our earlier model, in which the results of fiscal policies typically depended partly on the elasticities of the marginal efficiency of investment and liquidity preference schedules, in our present system, the equilibrium levels of income that will tend to be produced by autonomous changes in consumption, private investment, and government expenditures are entirely independent of these factors. If, for example, there is increased deficit-financed expenditure by the government, the level of income will tend eventually to rise enough to produce additional voluntary savings of sufficient amount to finance the deficit. If no other autonomous changes occur in the interim while equilibrium is being approached, the interest rate will rise enough to produce sufficient dishoarding and reduction in private investment to bring balance in the capital market. However, if the system is stable, the growth of income will cause saving to increase faster than investment, and the new equilibrium when it is reached will show the interest rate back at its old level--that is, at the level required

to induce investors to add to their idle balances just the amount of new money that is being created in each period.

Of course, the effects of autonomous changes in private or public spending are not entirely independent of monetary reactions. The elasticities of the marginal efficiency of investment schedule and of the liquidity preference schedule will affect the path by which the new equilibrium is approached or reached. For instance, the immediate effect of increased deficit spending will be a rise in interest rates. If marginal efficiency of investment is relatively inelastic and liquidity preference is quite elastic, the effect on private spending will be small--a small rise in the rate of interest will produce a large amount of dishoarding, and, at the same time, private investment will be little affected by the rise in the interest rate. In this case, income will approach its equilibrium level quite rapidly. On the other hand, when the marginal efficiency of investment is elastic and liquidity preference inelastic, private spending will be cut sharply, because most of the funds needed to finance the increased public investment will be obtained at the expense of private investment. If this is the situation, income will approach its new equilibrium position slowly. However, the equilibrium position itself is independent of these factors.

The above discussion of monetary and fiscal policies in connection with the two theories of interest has taken no account of differential effects on the public's net asset

holdings. The public's net asset position may have important repercussions on its propensities to consume and invest, although the magnitude of such effects is unknown and it may be doubted whether it would be very great over a short period of time. The percentage change in the public's net stock of assets that could, as a practical matter, be brought about within a period of a year or two (except perhaps under wartime conditions) is likely to be quite small. Nevertheless, it is well to note in a general way the difference in asset effects as between monetary and fiscal policies. Fiscal policy, operating either through changes in government expenditures or changes in taxes always alters the net claims of the nonbank public in such a way as to accentuate the direct effects of the policy on total expenditure.[46/] For example, an expansionary fiscal policy implemented by a reduction in taxes with no change in government expenditures will necessarily mean that the government will have to borrow more or retire less debt than would have been the case in the absence of the tax reduction or else will have to spend out of its accumulated cash or bank balances. As a result, the public is bound to wind up with more claims, either in the form of money or government securities than it would have held if taxes had not been cut. This is true whether the government borrows from the public directly or from the banking system--the only

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[46/] The only exception to this is the "balanced budget principle," which has no asset effects.

difference this makes is that in the one case the public will hold more government securities, while in the other it will hold more money. Moreover, it will be an increase in net claims, because the public will not owe amounts to the banking system to offset it. Monetary policy, when carried out by the usual central banking techniques,[47] does not have these asset effects. An expansionary monetary policy will result in a bigger money supply held by the public, but the increased money holdings by some persons will be offset by increased debts owed to the commercial banking system by others, leaving no net increase in claims held by the public. In evaluating the relative merits of monetary and fiscal policies, especially in the long run, their differences in this respect need to be taken into account.[48]

Note Concerning the Banking System

In all of our analysis, we have consistently assumed that commercial banks always expand their earning assets and deposits to the limit permitted by the supply of available reserves. That is to say, commercial banks always keep their

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[47] If the government prints money and spends it, there will be asset as well as income effects. However, this is better regarded as a kind of fiscal rather than monetary policy.

[48] For a complete discussion of the asset effects of different types of monetary and fiscal policies, see R. A. Musgrave, "Money, Liquidity, and the Valuation of Assets," in Money, Trade, and Economic Growth: In Honor of John Henry Williams (New York: The Macmillan Co., 1951), pp. 231-237.

actual reserve ratios at the legally required level.[49/] This assumption seems realistic enough during reasonably normal times, but we know from our experience during the 'thirties that commercial banks may sometimes hold very large excess reserves. We should, therefore, make room in our analysis for this possibility.

The motives which prompt banks to hold cash reserves are essentially the same as those which cause other types of investors to hold money. They hold some cash to meet day-to-day cash and inter-bank drains resulting from the use of funds by their depositors. This corresponds to the transactions motive of other investors. It should be comparatively simple for a bank to determine, on the basis of past experience, what proportion of its deposits it should hold in the form of cash for this purpose. The proportion should be high enough to cover normal drains with some margin. To deal with abnormal losses of cash that may result from loss of confidence by depositors, the bank can rely on its ability to borrow at the central bank. It will presumably not try to protect itself against such situations by holding cash itself, because, as our banking system is now organized, it can always borrow at the central bank in emergencies, and because it could not protect itself except by holding prohibitively high (nearly 100%) reserves.

[49/] More accurately, they keep the proportion between their actual and required ratios constant.

Banks, like other investors, also hold cash for precautionary and speculative reasons. To the extent that they do hold money to meet unusual demands on the part of depositors, these funds should be classified as precautionary holdings. But, as pointed out above, they probably do not hold much cash for this reason, since they have an open line of credit at the central bank. They may hold some funds which could be classified as precautionary during periods of uncertainty while waiting to see the turn of the market. More important, however, is the fact that banks may hold cash for speculative reasons. This demand, like that of other investors, is a function of the rate of interest. The lower the rate of interest, the greater will be the banks' demand for cash for speculative reasons.[50/]

Under reasonably normal conditions, the legal reserve requirements will be so high that banks will be forced to hold more cash than they want to hold for the reasons mentioned, and it is safe to assume that, when the central bank supplies them with more reserves, they will expand their earning assets to the fullest possible extent. But when interest rates are very low, this may not be the case, and when the central bank

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50/ The argument is complicated but not essentially changed when allowance is made for the fact that debts of different maturities are available. When short-term securities without risk of default (Treasury bills and bonds near to maturity) are available, banks are not likely to hold large amounts of excess reserves until the interest rates on these securities have been driven to a very low level, as in the 'thirties.

supplies additional reserves, some of these may be retained in cash. In fact, when rates are low enough, the banks' demand for cash may be perfectly elastic so that all new reserves are held idle for speculative reasons. Under such circumstances, the power of central bank policy to stimulate expansion by using its usual quantitative weapons is seriously curtailed (in the extreme case, almost completely destroyed), even though the public's liquidity preference be inelastic and the marginal efficiency of investment elastic.

There are two ways in which the behavior pattern of the commercial banking system could be introduced into our models. The simplest way would be to include the banks' demand for idle balances in our liquidity preference function, along with the demand of all other investors. We would then define money for purposes of our models as the potential amount of money that could be created on the basis of the existing supply of bank reserves, in view of legal and customary working reserve requirements and the public's desired ratio of currency to bank deposits. That is, the stock of money would be the existing amount of bank reserves times the coefficient of expansion of the commercial banking system, and the change in the money stock (as used in the loanable funds theory) would be the change in the amount of bank reserves times this same coefficient. Idle balances would include the actual idle cash holdings of the public plus the excess reserves of the banking system multiplied by the

coefficient of expansion.

The second way of dealing with the problem would be to treat the supply of money as a function of both the interest rate and central bank policy. The elasticity of the money supply curve would then depend upon the liquidity preference of the banking system, with an elastic supply corresponding to elastic liquidity preference. The location of the money supply curve would depend upon central bank policy.

Of these two alternative approaches, the second is probably the better, since it separates the liquidity preference of banks from that of other investors whose patterns of behavior may differ considerably from those of banks. However, either approach will bring out the fact that elastic bank liquidity preference may reduce (or completely eliminate) the effectiveness of monetary measures even when other conditions (inelastic liquidity preference of the non-bank public and elastic marginal efficiency of investment) are compatible with effective monetary policy.

It is apparent that, if conditions appeared to warrant it, we could quite easily introduce the liquidity preference of the banking system into both our liquidity preference and loanable funds models. However, having mentioned this refinement, we will not attempt to carry the matter further since it would introduce no new principle into our analysis and would make no material difference in our results.

CHAPTER V

FUNDS VERSUS FLOWS IN MONETARY INTEREST THEORY

Introduction

The question as to whether stock or flow analysis should be employed in monetary theory does not appear to have been adequately considered by economists. The reason for the lack of attention to this problem seems to be that there has been a widespread feeling that the two approaches are not essentially different and that they yield substantially identical results. We have demonstrated in the three preceding chapters that this is incorrect, that the two approaches are quite different. We must now attempt to evaluate their relative merits.

Before we begin our own analysis, we will consider an argument for the use of stock analysis that has been advanced by Scitovszky.[1] He argues that stock analysis is called for in studying any market in which the size of stocks is large in relation to current production of the commodity in question. His reason is that, in such a case, the responses of present holders of the commodity to changes in the price are likely to have important effects which are not taken

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[1] T. de Scitovszky, "A Study of Interest and Capital," Economica, VII, New Series (August, 1940), 293-317.

account of if stocks are neglected. To illustrate the nature of the possible effects, he considers the case of a shift of demand away from wheat, a commodity of which there are large existing stocks, and toward some other commodity. If there is speculation in wheat based on the assumption of a "normal" price, deviations from which are believed to be temporary, the activity of speculators will tend to stabilize the price of wheat. As the price of wheat falls, speculators will enter the market to buy in anticipation of a later rise in the price, and by so doing they will check the fall in the current price and also check the tendency for production to be reduced. If this tendency is important, it may be that the wheat market will not be equilibrated by a fall in the price but rather by a completely different process, namely, by a rise in the level of income, incident upon the increased production of other commodities, which will raise the demand for wheat. Or, to adapt the illustration to the money and securities markets, a rise in the marginal efficiency of investment schedule, instead of merely causing interest rates to rise enough to equate saving and investment, may result in holders of idle money rushing into the breach to buy securities in the expectation of a later fall in interest rates (rise in security prices). If this happens, saving and investment are equated not by a rise in interest rates but rather by a rise in the level of income sufficient to generate enough additional saving to balance the increased

investment and thus equilibrate the securities market. Money and securities being examples *par excellence* of "commodities" whose existing stocks are large in relation to current production, he argues that here is a case in which stock analysis is especially necessary.

The considerations stressed by Scitovszky are of great importance in any discussion of interest and money. But they do not necessitate the formulation of the analysis in terms of stocks rather than flows. All that is necessary is that flows of funds out of existing stocks of idle money (dishoarding) and flows of "old" securities into the market be explicitly taken into account. In a flow analysis, it is quite possible to allow for the fact that, when the interest rate rises, some holders of present idle balances will use them to buy securities and that, when the interest rate falls, holders of old securities may sell them and hold money. Both of these possibilities were, in fact, allowed for in setting up the flow models we employed in Chapter III. It is done automatically when either hoarding or the stock of idle balances is regarded as a function of the interest rate. Since both stock and flow models which include some concept of the demand for idle balances as a function of the interest rate satisfy Scitovszky's requirement, this requirement cannot serve as a basis for preferring one over the other.

It is true that, in any realistic analysis, stocks of money and securities could not be entirely overlooked

because they may set limits to the process not taken into account in our formal models. For instance, dishoarding cannot continue beyond the point where the whole stock of money has passed into active circulation.[2] And the central bank might not be able to continue forever to sell securities in the open market because it might exhaust its supply of securities.[3] However, these are merely limiting cases and would not prevent the use of flow analysis under ordinary circumstances.

The choice between a stock theory and a flow theory should be made on the basis of the behavior of investors. Do households and business firms actually adjust the stocks of idle money and securities they hold to the interest rate, or do they adjust the rate of change of their stocks? This is the question that needs to be answered, and we will address ourselves to some aspects of it now.

Stocks versus Flows: General Considerations

There would seem to be a *prima facie* case for developing monetary theory in terms of flows, because demand and supply in other branches of economics are usually treated as flow concepts. We say that the supply of wheat is a schedule

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[2] But there may be some elasticity to this limit. Cf. p. 183, *infra*.

[3] This limit on the open market powers of the central bank is institutional rather than inherent. It could be avoided by giving the bank power to issue and sell its own debentures.

showing the time rates at which wheat will flow into the market at various prices and that the demand for wheat is a schedule showing the time rates at which it will be taken off the market at those prices. It is true that if we confine our analysis to one period, the absolute quantity supplied equals the absolute quantity demanded and that, in a free market, price moves to bring this about, thus implying a momentary stock equilibrium. But in the next period, a fresh supply and a fresh demand appear in the market. The demand for wheat is inherently a flow. To see what characteristics a good must possess in order that the demand for it shall be a flow concept, let us consider a (theoretically) completely indestructible commodity--old masters' paintings, an old standby of textbook illustrations, will serve our purposes. Suppose them to be entirely indestructible, with a fixed stock, and a zero supply (in the usual flow sense). The price would have to be such as to induce people to hold the stock of the paintings that was available. This price would presumably vary with consumers' tastes and incomes, but if tastes and incomes remained unchanged, we might expect the price to remain constant. Now suppose that, with constant tastes and incomes, additional paintings of similar quality and acceptability[4/] began to be produced at a certain

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4/ Actually, new paintings, even of equal quality, would not possess the same prestige value as old paintings and, therefore, would not be entirely acceptable substitutes, at least for some people. But, for purposes of our illustration, it will be all right to assume that new and old paintings are equally desirable and acceptable.

rate per period. What would happen to the price of paintings? Would the price fall to a new stable position to equate the supply (flow) with the demand (flow). The answer is, presumably, that it would not. It would continue to fall until it reached zero or the production of paintings stopped entirely. The reason is that the demand for such paintings cannot be thought of as a flow in the usual sense if they are completely indestructible. The demand for the <u>services</u> of the paintings--the pleasure of looking at them and so on--is a flow concept. But if paintings are indestructible, a stable flow of paintings means a constantly increasing flow of the services of paintings. With constant incomes and tastes, presumably consumers will buy additional units of these services (which the paintings themselves represent) only at constantly falling prices. The demand for paintings is thus, at least as far as we have pursued the matter, in the nature of a stock. Equilibrium in the market must, therefore, be a stock equilibrium, and equilibrium (with constant incomes and tastes) requires a constant stock or zero supply. In a dynamic sense, however, with growing incomes and perhaps tastes, a stable price can be compatible with a supply (flow) greater than zero. That is, if supply (flow) equals rate of increase in demand (in the relevant sense), price can be constant. Our argument is modified still more when we consider the fact that people are constantly saving and accumulating wealth. Even with constant incomes and tastes, it may be that

investors will desire to hold more paintings as their wealth increases and that for this reason a constant flow of new paintings will be consistent with a stable price. As we will see later, this "wealth effect" on demand is probably very important in the case of money.

To generalize what we have been saying, suppose we consider now a commodity that is not completely indestructible but that has a very long life--say 100 years. Now the condition for stability of the price with stable demand is that current production must equal 1% of the existing stock. If it exceeds 1%, the stock will increase and the price will fall. If it falls below 1%, the stock will decrease and the price will rise. If demand is increasing at 1% per year at the existing price, production can be 2% of stock without causing a price change--1% for replacement and 1% to meet the new demand. We can say that the condition for stability in the price of a good over time when demand is stable is

$$S = \frac{1}{n}K,$$

where S = annual production, n = number of years in the life of the good, K = the initial (and constant) stock. The indestructible good is seen to be a special case of this when $n = \infty$ and $S = 0$.

Very much the same reasoning can be applied to producers' goods. If demand for the goods they are used to produce remains constant, technology doesn't change, etc.,

the demand for new units is confined to the replacement demand.

The Demand for Money

Now we must consider the demand for money with a view to deciding whether it should be regarded as a stock or as a flow concept. We will take up the demand for money successively under the three headings used by Keynes and other writers: (1) transactions demand, (2) precautionary demand, and (3) speculative demand.

Transactions Demand.--On the subject of the transactions demand for money, not a great deal needs to be said. Angell and Ellis[5/] in their work on the theory of velocity have elucidated the factors which determine the transactions cash requirements of households and firms. These requirements depend, according to Ellis, on such factors as the frequency of receipts, frequency of payments, degree of overlapping between receipts and payments, and the degree of integration of industry. Since these are factors which presumably would not be subject to sudden violent changes, it seems reasonable that the amount of money held for transactions purposes would be approximately proportional to the level of money income, the proportion being the reciprocal of the circuit velocity

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5/ J. W. Angell, "The Components of the Circular Velocity of Money," Quarterly Journal of Economics, LI (February, 1937), 224-273; H. S. Ellis, "Some Fundamentals in the Theory of Velocity," Quarterly Journal of Economics, LII (May, 1938), 431-472.

of active money. Hansen[6/] has pointed out that the demand for money for transactions purposes may have some, but probably not much, elasticity with respect to the interest rate. That is, in periods of high interest rates, some money that would normally be held by firms and households for transactions purposes may be made available on the loan market for short intervals of time when it is not in use. For example, the holder of a life insurance policy who pays his premiums quarterly and sets aside one-twelfth of the annual premium out of each month's salary, may simply let the funds accumulate in cash at ordinary levels of interest rates simply because the cost and effort of investment and disinvestment for a short period are too great to make it worth while. But when interest rates are exceptionally high, he may find such investment and disinvestment to be worth the effort. This example indicates that the line between cash held for transactions purposes and that held for precautionary purposes is not very sharp--the difference being that cash accumulated in advance to make a payment that one knows he will have to make is part of transactions demand, while cash accumulated in advance to fulfill a need that is more or less uncertain is a part of precautionary demand. Since most payments that are very far distant in time are subject to some uncertainty, the two appear to shade in together. However, for analytical

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6/ Hansen, Monetary Theory and Fiscal Policy, pp. 66-68.

purposes, it appears to be wise to maintain a sharp distinction. It seems reasonable to assume that the amount of money that will be held for transactions purposes is proportional to the level of income.[7]

Returning to our problem of stock and flow analysis, it is clear that the demand for money for transactions purposes is a stock concept. That is, a certain level of income requires the holding of a certain stock of money for transactions purposes, and when income is stable a constant stock of money will suffice for this purpose, in the absence of changes in payment patterns, institutional factors, and so on, which we can consider as exogenous variables for purposes of our analysis.

The transactions demand for money is, to all intents and purposes, a stock concept in the models we have constructed to represent <u>both</u> the liquidity preference and the loanable funds theories. In our liquidity preference models, the volume of active money in any production-planning period is equal to the level of income for that period.[8] When income reaches equilibrium, the stock of active money remains constant. In the loanable funds model,[9] the change in the

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[7] Keynes held the view that for short periods the circuit velocity of active money is nearly constant, hence that money held for transactions purposes is approximately proportional to income. Cf. <u>General Theory</u>, p. 201.

[8] Cf. equation (4), p. 44, <u>supra</u>.

[9] Cf. Table III, p. 100, <u>supra</u>.

amount of active money equals the change in the level of income. Since

$$\Delta M = \Delta M_1 + \Delta M_2,$$

the change in the amount of active money, ΔM_1, is given by

$$\Delta M_1 = \Delta M - \Delta M_2.$$

If we take, for example, Period 3 (in the table),

$$\Delta M_1 = 15.00 - 12.90 = 2.10,$$

which is the same as the rise in the level of income from Period 2 to Period 3. In fact, the amount of active money must presumably **equal** the level of income in any production-planning period, since money becomes active by being spent on consumption and investment.[10/] Furthermore, in equilibrium, with income stable, the stock of active money is constant (and presumably equal to income per period), since net hoarding (dishoarding) is just sufficient to absorb the increase (decrease) in the stock of money.

Since we have decided that the demand for active money is inherently a stock concept, and since it is so handled in both the models we have developed, either model is satisfactory with respect to the way active money is handled, and there is no basis for preferring one or the other on this score. We must look elsewhere for differences.

10/ It is necessary to say "presumably" since the model itself, being set up entirely in terms of flows, says nothing at all about the stock of money. But the sense of the scheme it is supposed to represent would imply that the stock of active money is equal to the level of income in any production-planning period.

Precautionary Demand.--Next, we will consider the precautionary demand for money. Here we are on much more uncertain ground. Following Hart, we may define precautionary balances as balances held "to cushion the ill effects of possible unexpected outlays or failures of receipts, and to safeguard financial respectability."[11] This is similar to Keynes' definition: "To provide for contingencies requiring sudden expenditure and for unforeseen opportunities of advantageous purchases, and also to hold an asset of which the value is fixed in terms of money to meet a subsequent liability fixed in terms of money....."[12]

There is no very clear-cut agreement as to the determinants of precautionary demand for cash. Keynes throws it in with transactions demand as a component in his M_1, the demand for which he regards as dependent primarily on the level of income.[13] At the same time, he recognized that the amount of cash held for precautionary purposes may also depend upon other factors. "The strength of [the precautionary] motive will partly depend on the cheapness and the reliability of methods of obtaining cash, when it is required, by some form of temporary borrowing, in particular by overdraft or its equivalent. For there is no necessity to hold idle cash to

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11/ A. G. Hart, Money, Debt, and Economic Activity (New York: Prentice-Hall, Inc., 1948), p. 196.

12/ Keynes, General Theory, p. 196.

13/ Ibid., p. 199.

bridge over intervals if it can be obtained without difficulty at the moment when it is actually required. [Its] strength will also depend on what we may term the relative cost of holding cash. If the cash can only be retained by forgoing the purchase of a profitable asset, this increases the cost and thus weakens the motive towards holding a given amount of cash..... It may be, however, that this is likely to be a minor factor except where large changes in the cost of holding cash are in question."[14/] In other words, Keynes recognizes that the demand for money for precautionary purposes is a function of the availability of borrowing facilities and of the rate of interest, but thinks these factors are relatively unimportant compared with the level of income.

Hart, in his acute analysis of the precautionary motive (which he calls the "margin-of safety" motive), brings out two important points. First, he introduces what he calls the "principle of linkage of risks,"[15/] by which he means the possibility that lack of liquidity on the part of firms or households may cause chains of misfortune resulting in serious losses. This intensifies the motive for holding precautionary balances and turns them into important income-yielding (loss-avoiding) assets. Second, he points out that in many cases the precautionary motive may be satisfied by holding liquid

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[14/] Ibid., p. 196.

[15/] Hart, op. cit., pp. 198-201.

assets other than cash,[16] including savings deposits (which we do not include in the money supply), redeemable or marketable securities (especially safe short-term securities, such as Treasury bills or government bonds near to maturity), etc.

Fellner[17] regards precautionary (or contingency) balances as balances held as a protection against risk. He defines speculative and precautionary balances in the following passage: "The speculative money stock is that part of the idle (i.e., nonworking) balances which the public would continue to hold even if it were certain that its 'most probable' expectations concerning future receipts from the sale of, and concerning future expenditures on the purchase of, commodities and services will come true; the remainder of the money hoards (i.e., of the nonworking balances) consists of contingency (or 'precautionary') money."[18] Moreover, Fellner regards precautionary hoarding as a more important phenomenon than hoarding for speculative reasons. He thinks that the demand for (a stock of) precautionary balances is very inelastic to the interest rate and may, in fact, have a positive elasticity because rising interest rates mean higher risks associated with investment and these higher risks may

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16/ Ibid., pp. 200-201.

17/ W. Fellner, Monetary Policies and Full Employment (Berkeley: University of California Press, 1946), pp. 146-171.

18/ Ibid., pp. 147-148. (Italics in original.)

more than offset the effects of the higher opportunity cost, thus causing business firms to hold larger precautionary balances at high than at low interest rates. Furthermore, he explains the rigidity of interest rates in a downward direction in a way fundamentally different from Keynes. He maintains that, when the marginal efficiency of investment schedule shifts to the left, safety margins on investment (defined as the difference between the most probable expected outcome and the outcome which would barely avoid loss to the firm) are reduced for each volume of investment. When this happens, the firm will typically react partly by reducing investment and partly by reducing safety margins. The reduced safety margins reduce the firm's chance of being able to rely on the credit market. To protect itself, the firm will hold larger precautionary balances. Thus, shifts to the left of the marginal efficiency of investment schedule are accompanied by corresponding shifts to the right of the demand for precautionary balances which tend to keep the interest rate from falling.[19/]

It would seem that another factor in addition to those discussed by the aforementioned writers is likely to influence the holding of precautionary balances. If precautionary balances are interpreted to include balances held by reason of the convenience that attaches to having surplus cash available, it seems probable that the total wealth holdings of an

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19/ Ibid., pp. 156-159.

investor would influence his holdings of precautionary cash. As wealth increases, with income, rate of interest, and degree of uncertainty remaining constant, it seems reasonable that an investor would hold some of the increase in his wealth in the form of cash simply because of the return in convenience which it yields. The significance of this point in connection with the choice of the appropriate interest rate theory will be discussed later after we have considered speculative balances.

Accepting the suggestions of the various writers as to the determinants of the amount of money held for precautionary purposes and adding one of our own, we will adopt for purposes of the present discussion the hypothesis that these determinants are the level of income, the rate of interest, the degree of uncertainty, and the stock of wealth. The level of income represents, at least roughly, the size of commitments made by firms and households. The rate of interest represents the cost of holding cash, and we may accept the suggestion of Keynes and Fellner that its effects are not likely to be great. The degree of uncertainty we will take to be an exogenous variable, changes in which we will not attempt to explain or even take account of. The stock of wealth reflects the extent to which households and firms feel that they can afford the convenience of holding idle balances.

In order to avoid having to introduce a new set of

determinants, we are going to handle the demand for precautionary balances by dividing it into two parts--one dependent upon the level of income and the other dependent on the rate of interest and the stock of wealth. The first category we can then include with transactions balances which are also dependent upon the level of income. The second we can lump with speculative balances, which we are going to regard as dependent upon the rate of interest and the stock of wealth also.

Speculative Demand.--We will now consider the demand for money for speculative, or investment, purposes. To simplify matters and get at the essentials of the subject and also to keep the analysis moving along the lines followed in earlier chapters, we will confine our analysis to the situation in which investors have only two forms available in which to hold their wealth, cash and consols. As a further simplification, we will express interest rates on the basis of our production-planning period--i.e., a 4% rate means 4% per period rather than 4% per annum.

We start with a situation in which there is perfect knowledge about future interest rates and no costs of investment. With no investment costs, investors will prefer consols to cash at any positive return. The rate of return for any period is equal to the interest earned plus any capital gain or minus any capital loss. The actual rate of return on investment in consols for one period is

$$R = r_1 + \frac{r_1}{r_2} - 1,$$

where r_1 is the interest rate on consols in Period 1, and r_2 is the rate in Period 2. If $r_2 < r_1$, there will be a capital gain, and R will exceed r_1; if $r_2 > r_1$, there will be a capital loss and R will be less than r_1. If $r_1 = r_2$, the interest rate (price of consols) is unchanged, and $R = r_1$. The condition necessary for the rate of return to be negative is that the rate rise enough so that the capital loss will exceed the interest received during the period. This can be developed as follows,

$$R = r_1 + \frac{r_1}{r_2} - 1 < 0$$

if

$$r_2 > \frac{r_1}{1 - r_1}.$$

If the rate rises by an absolute amount just a little greater (for reasonably low rates) than its own square, this rise will wipe out the interest and leave no net return.

$$\Delta r = r_2 - r_1 = r_1 r_2 = r_1(r_1 + \Delta r).$$

$$\Delta r(1 - r_1) = r_1^2.$$

$$\Delta r = \frac{r_1^2}{1 - r_1}. \qquad (1)$$

For example, if the interest rate in Period 1 is 4%, a rise to 4.1667% in Period 2 will result in a capital loss that will just offset the interest so that the net return earned by buying a consol in Period 1 and selling it in Period 2

will be zero.

$$\Delta r = \frac{.0016}{.96} = .001667.$$

If the rate in Period 2 is more than 4.1667%, the return obtained by holding the security during Period 1 would be negative. A rise in the rate of more than $r_1^2/1 - r_1$ would be inconsistent with rational behavior and perfect foresight, since investors would sell consols now and plan to buy at the end of the period, thus pushing up the current rate and depressing the future rate until the differential was no bigger than $r_1^2/1 - r_1$. Similarly, the expected increase in rates between the beginning of Period n and the beginning of Period n + 1 could not exceed $r_n^2/1 - r_n$. If investment and disinvestment involved some cost in money or inconvenience, the possible rise in the rate would be still further limited. The differential could not exceed an amount such that the interest return exceeded the capital loss by the cost of investment.

There is no similar limit operating in the case of a fall in the interest rate. Here the interest return in a given period is augmented by the capital gain resulting from the fall in the rate.

We will now abandon the condition of perfect foresight, but we will do it in two stages. First, we will allow for differences of opinion among individuals. Suppose everyone held a definite, precise, certain opinion about future interest

rates, but that the opinions differed from one person to another. Of course, most persons' opinions would be bound to turn out incorrect. Now we no longer have perfect foresight, and some people might expect rates to rise by more than the limiting amounts indicated above, while others could expect them to rise by less or even to fall. In this case, anyone who thought rates would rise by more than the amount which would result in a capital loss sufficient to wipe out the interest would hoard all his current savings in cash and sell all his current holdings of consols to avoid the expected losses.[20/] Anyone who expected rates to rise by less than this amount or to fall would invest all his current savings and accumulated wealth in consols. We may call the hoarders Group I people and the security-buyers Group II people.

Now we must allow for the fact that there is uncertainty about the expectations. People differ in their expectations and also in the degree of confidence they have in these expectations. Uncertainty would cause an investor to divide his available resources between cash and consols--in its absence, he would put all his resources in one or the other depending upon his expectations. Thus a person who

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20/ A qualification is called for at this point. An investor who thought the rate would fall below its present level at some time within his horizon of expectations or at some time before he expected to need to realize cash on his investment might hold onto his securities awaiting a more favorable time to sell. Or if the security is selling below par and it is due to mature before he expects to need the cash, he may hold it until maturity.

expects the rate to fall or to rise by less than enough to wipe out the interest, but who is quite uncertain about it, may put part of his resources into consols, but, as a hedge, in order not to subject all his savings to the risk of loss, may also hold part of them in cash. On the other hand, if he expects the rate to rise sharply, he may hold mostly cash, but put something into consols in order to earn some return in case his expectation turns out to be wrong.

Now we have most of the ingredients of speculative liquidity preference. One more element is needed--the concept of a normal interest rate. Every investor probably has at least some notion of a normal interest rate--or at least some range of rates within which things seem normal. This normal rate is influenced by past experience, but also by future expectations. It differs for different investors, with probably some clustering around some particular level. As rates fall they successively pass through the normal rates of different investors. The customary way of looking at liquidity preference implies that whenever the rate is below the normal of a certain investor, that investor will expect the rate to rise. On this assumption, there are three separate elements that tend to cause hoarding to increase as the rate falls.

(1) The lower the rate, the less in absolute or relative terms it has to rise for the capital loss to wipe out the interest. For example, at 4% it can rise about 0.16%

in one period, while at 2% it can rise only about 0.04%. This follows from formula (1) above.[21] This means that the lower the interest rate, the less (in absolute or relative terms) an investor need expect it to rise in order to have an incentive to hold cash.

(2) The lower the rate, the larger the number of people in Group I (those who expect the rate to rise). As the rate falls, it passes below the normal rates of more and more investors, thus shifting them from Group II to Group I.

(3) The lower the rate, the more certain will be the people in Group I and the more uncertain will be the constantly dwindling number in Group II that their expectations are correct.

Now, in the context of this theory, people hold cash as an investment because they expect it to earn a return through appreciating in value in terms of securities. If a person's income, tastes, expectations, and degree of uncertainty remain unchanged and if he is doing some saving out of income period after period, he will presumably not be content to hold the same speculative balance from period to period. His current savings will go partly into cash and partly into securities--probably, although not necessarily, in roughly the proportions of his original holdings of the two. The situation can be depicted by a simple indifference

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21/ Cf. Keynes, General Theory, p. 202, where this approximation is referred to.

curve analysis, as in Figure IX.

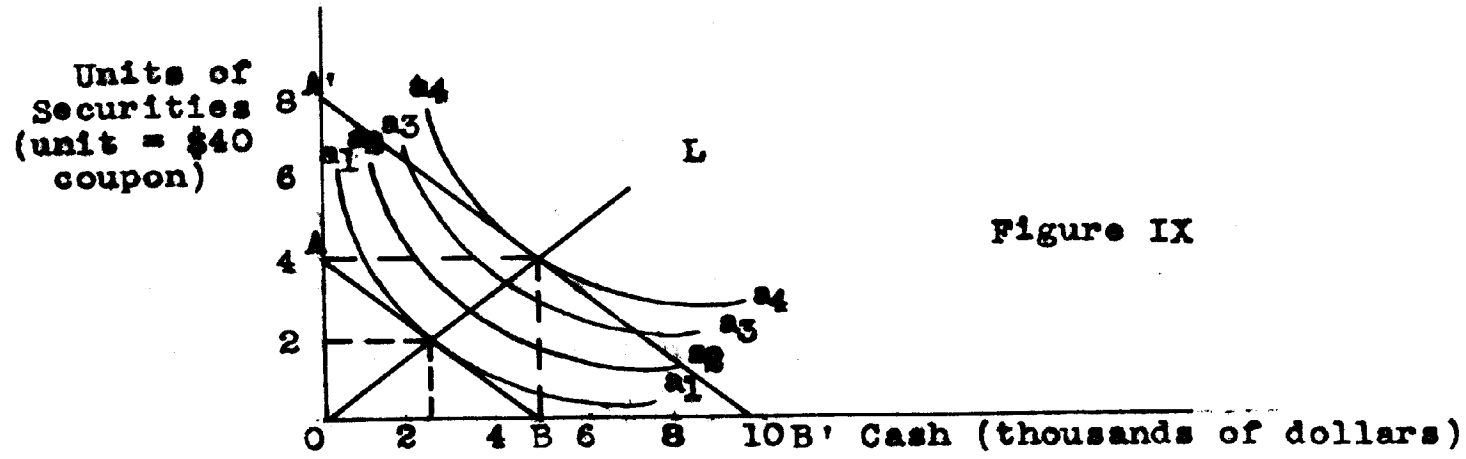


Figure IX

Lines AB and A'B' represent the possible combinations of cash and securities that can be attained with $5,000 and $10,000, respectively, when the interest rate is 5%. For example, if he invests all his funds in securities when his wealth is $5,000, he can obtain four securities (paying $40 per period each), while, at the other extreme, he can, of course, hold $5,000 in cash. What combination he will select depends upon his preferences as shown by the indifference curves (a_1, a_2, a_3, a_4, ...). This individual will hold about $2,500 and two securities when his wealth is $5,000 and the interest rate is 5%. If his wealth increases to $10,000, he will hold about $5,000 and four securities. All the factors affecting his relative desire for cash as against securities are impounded in the system of indifference curves. Thus any changes in his expectations or degree of uncertainty that occur <u>for reasons unconnected with a change in the interest rate</u> will be reflected in a shifting or distortion of the

indifference curves. But differences in expectations and uncertainty simply associated with changes in the interest rate are reflected in the shape and position of the existing indifference curves. By drawing investment opportunity lines for different interest rates fanning out from B, we could derive a demand for cash (or securities) as a function of the interest rate, when total wealth was $5,000. At very high interest rates, he might hold no cash at all (for speculative purposes), and, at very low interest rates, he might hold all his wealth in cash. The demand schedule obtained in this way would be the liquidity preference schedule for this individual at that level of wealth. The magnitudes would be in the nature of stocks rather than flows since as long as his wealth remained unchanged and the general outlook did not change (i.e., his indifference pattern remained stable), he would not add to his cash or securities. The only change he might make would be to redistribute his wealth between cash and securities if interest rates changed.

However, if the individual is accumulating wealth through saving, his investment opportunity line is shifting outward, and he will be adding to his holdings of both cash and securities, moving along a path indicated by line OL. The slope of this line, OA/OB, is his preferred asset ratio, which in this particular case, does not change with the volume of his accumulated wealth, although it does change with the

rate of interest.[22] The line OL would not have to be a straight line, but could take on many different shapes. However, a straight line seems reasonably plausible in the case we are considering. This means that as a person accumulates wealth, other things remaining constant, he maintains the proportions between securities and asset money constant. The notion that the speculative demand for money can be regarded as a stock concept under conditions in which wealth is increasing involves a special assumption about OL--that after some point it becomes vertical. That is after a certain level of wealth has been reached, speculative balances are left unchanged. This is illustrated in Figure X.

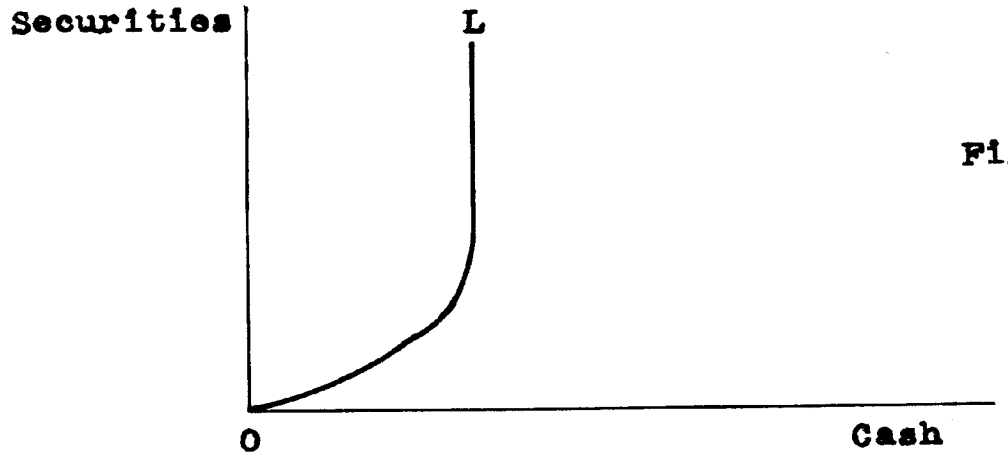


Figure X

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[22] The "preferred asset ratio" as used here is expressed in "real" terms--the number of units of securities divided by the number of units of cash. Frequently it is used in a different sense--the number of dollars invested in securities (market value) divided by the number of dollars of cash. A special assumption about investor behavior, which we will employ later, would be that this latter ratio did not change with the interest rate.

This assumption does not appear to be at all reasonable when we bear in mind that investment in both cash and securities is made for the purpose of earning some kind of return.

Actually, the adjustment in asset portfolios that is made when interest rates change is an adjustment in the proportion of cash to securities. In dealing with a problem in which it is legitimate to assume the stock of wealth as constant throughout the analysis, it is appropriate to assume that the stock of cash is adjusted when interest rates change. This is what Keynes does in his liquidity preference theory of interest. However, under conditions in which wealth is assumed to grow during the period covered by the analysis, this is not, in general, legitimate. Under these conditions, the proportion of cash to securities, or of cash to total wealth, rather than the absolute amount of cash should be included in the liquidity preference function.

A Model Involving the Stock of Wealth

Before we consider whether it is legitimate in monetary analysis to assume that the stock of wealth is constant, as Keynes did, we will attempt to see how things are affected when we allow for the growth of wealth in our models. We will now construct a simple aggregative model in which we assume that the proportion of cash to securities held depends upon the interest rate. We will assume that all variables except

the interest rate are measured in real terms (deflated with an index of the general price level). We will not make any allowance for the effect of the increase in the stock of capital on the productive capacity of the economy--in this, we will follow Keynes. However, we will allow for the fact that the stock of assets available for investors to hold is increasing. Furthermore, we will make the simple assumption that investors always desire to keep a constant proportion between cash and the market value of perpetuities, which are the only assets available to them. Firms raise new capital by selling perpetuities to investors. Investment is assumed to depend only on the interest rate.

We can express this model by means of a system of equations, as follows.

$$C_t = \alpha Y_{t-1} + \beta \tag{2}$$

$$I_t = aR_t + b \tag{3}$$

$$Y_t = C_t + I_t \tag{4}$$

$$\frac{M_{2,t}}{\sum_{i=1}^{t} R_i I_i / R_t} = c \tag{5}$$

$$Y_t = M_{1,t} \tag{6}$$

$$M_{1,t} + M_{2,t} = M \tag{7}$$

If we take M to be given, we have six equations in six unknowns: C, Y, I, R, M_2, and M_1. Equation (4) is constructed as follows: $\sum_{i=1}^{t} R_i I_i$ is the total coupon bill on

all outstanding perpetuities. When this is discounted at the current interest rate, R_t, the market value of all outstanding perpetuities is obtained. The ratio of asset money to the value of outstanding perpetuities is the constant, c.[23/]

A general solution of this dynamic system of equations would be difficult to obtain, since equation (4) is nonlinear and involves the summation, $\sum_{i=1}^{t} R_i I_i$. However, we can bring out some important features of the equilibrium (stationary) solution without solving the dynamic system, and this will suffice for our purposes. Since we want to explore the equilibrium solution, we will be dealing with a situation in which $Y_t = Y_{t-1} = \bar{Y}$ and $R_t = R_{t-1} = \bar{R}$. We can difference equation (5) to get

$$\frac{\Delta M_{2,t}}{\Delta(\sum_{i=1}^{t} R_i I_i / R_t)} = c.$$

Now

$$\sum_{i=1}^{t} R_i I_i / R_t = \sum_{i=1}^{t-1} R_i I_i \bar{R} + \overline{RI}/\bar{R}$$

$$\Delta(\sum_{i=1}^{t} R_i I_i / R_t) = \bar{I}$$

$$\frac{\overline{\Delta M_2}}{\bar{I}} = c$$

$$\overline{\Delta M_2} = c\bar{I} \qquad (8)$$

[23/] For an explanation of the other equations in this model, see pp. 44-48, supra.

Again, we can difference equation (7)

$$\Delta M_{1,t} + \Delta M_{2,t} = \Delta M$$

$$\overline{\Delta M}_1 = Y_t - Y_{t-1} = \bar{Y} - \bar{Y} = 0$$

$$\Delta M = \overline{\Delta M}_2 \qquad (9)$$

Substituting from (9) into (8), we obtain

$$\bar{I} = \frac{\Delta M}{c} \qquad (10)$$

Substituting from (2) into (4), we obtain

$$Y_t = \alpha Y_{t-1} + \beta + I_t,$$

which, in equilibrium, becomes

$$\bar{Y} = \alpha \bar{Y} + \beta + \bar{I}. \qquad (11)$$

Substituting from (10) into (11), we get

$$\bar{Y} = \alpha \bar{Y} + \beta + \frac{\Delta M}{c}$$

or

$$\bar{Y} = \frac{\beta + \frac{\Delta M}{c}}{1 - \alpha} \qquad (12)$$

The important feature of this result is that if $\Delta M = 0$--if the money supply is constant--the only equilibrium possible will be at the point where $Y = C$ and $I = 0$. If we start out with investment occurring but money supply constant, the increasing stock of wealth resulting from investment will call for constant adjustments to preserve the required proportion of money to debt, c. This proportion will be preserved in each period by the following adjustment: Money will be drawn out of idle balances, which will tend to reduce the ratio below c. To preserve the equilibrium, investors will sell

securities, thus forcing up the interest rate. However, the rise in the interest rate will reduce investment. This process will continue period after period until the interest rate has been driven up enough to reduce investment to zero. With investment at zero, the stock of real wealth is constant, and the stock of idle balances can remain constant at a constant interest rate. Here we have a stationary state which is brought about by the mere fact that the money supply is inelastic. However, this could not very well be a true long-run equilibrium, since in true long-run equilibrium with a permanently stable interest rate, there would obviously be no incentive to hold money for speculative reasons. Hence the proportion of wealth held in money form, c, would presumably gradually decline, gradually lowering the interest rate. This process might continue until c was reduced to zero and there were no idle balances, with the interest rate reaching the level corresponding to zero savings (i.e., just high enough to provide incentive to keep existing capital invested).[24/] However, since we are concerned with a shorter-run

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24/ Schumpeter has contended that, in a "circular flow" economy (similar to the above illustration), the interest rate will be zero, since with constant incomes over time, investors have no rational reason for preferring present income to future income. It would not therefore be necessary to pay them any interest to induce them to keep their capital invested. J. A. Schumpeter, The Theory of Economic Development (Cambridge: Harvard University Press, 1934), chap. V; P. A. Samuelson, "Dynamics, Statics, and the Stationary State," Review of Economic Statistics, XXV (February, 1943), 58-68.

employment equilibrium of the Keynesian type, it seems legitimate for us to assume that the proportion c remains unchanged.

To illustrate further the nature of this system, suppose we start from a given equilibrium position with a given money stock, $I = 0$ and $Y = \frac{\beta}{1-\alpha}$. Now a single increment of money is injected into the economic system. This will force down the interest rate, as investors buy securities to restore the proportion c. The fall in the interest rate will produce a burst of investment activity, which will continue on a constantly diminishing scale until the stock of wealth has been built up to the point where the addition to income from wealth when capitalized at the equilibrium interest rate, $\bar{R}$ (which is still the rate at which $I = 0$) will bear the appropriate relation to the addition to the money supply that started the burst of activity. When the expansion is concluded, Y and R will be back at their old levels, and all that will have happened will be that wealth has been somewhat expanded. All the new increment of money will be in idle balances.[25/]

We could allow for a wealth effect on consumption by making our consumption function into

$$C_t = \alpha Y_{t-1} + \gamma W_{t-1},$$

25/ There will presumably be a reduction in the level of employment (unless prices fall in proportion to rising labor productivity, thus permitting an expansion of output) because, with the increased stock of capital, the same output can be produced with less labor.

where W_t is total wealth at time t. Then

$$W_t = M_{2,t} + \frac{\sum_{i=1}^{t} R_i I_i}{R_t} = (1 + c)\frac{\sum_{i=1}^{t} R_i I_i}{R_t}.$$

$$C_t = \alpha Y_{t-1} + \gamma(1 + c)\frac{\sum_{i=1}^{t} R_i I_i}{R_t}$$

This represents what has been called the "Keynes effect"[26/] -- the temporary fall in the rate of interest results in a deepening of capital which increases the stock of consumers' wealth and raises the propensity to consume. When this effect is introduced, it permits the single injection of money to raise equilibrium income. What it amounts to is an increase of β in the equation

$$C_t = \alpha Y_{t-1} + \beta$$

to a higher level β' corresponding to the larger accumulation of wealth. So the new equilibrium level of income $Y' = \frac{\beta'}{1-\alpha}$ instead of $\frac{\beta}{1-\alpha}$. But nevertheless R will be back at its old level, and investment will again be zero when the new equilibrium is reached.

There is a striking similarity between our present models, in which the ratio of money to debt is included in the liquidity preference function, and the loanable funds

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26/ G. Ackley, "The Wealth-Saving Relationship," Journal of Political Economy, LIX (April, 1951), 154-161; also Keynes, General Theory, p. 218, where a recognition of the possible effect of wealth on consumption is indicated.

models developed in Chapter III. In both cases, it is the flow rather than the stock of money which plays a part in determining the equilibrium level of income. In both cases, a single increment to the stock of money will raise income only temporarily, with income subsequently falling back to its original level. Furthermore, while our present models make the special assumption about the form of the asset preference function that the ratio of desired money holdings to the market value of debt is a constant, it seems reasonably clear that systems in which the ratio of money to debt is a function of the interest rate would behave in somewhat the same way. As long as debt is increasing, the money supply must be increasing if the interest rate is to remain constant. Consequently, the permissible rate of interest and rate of investment and, therefore, level of income depend upon the rate of increase of the money supply.

We have attempted in this chapter, first, to argue that, while the demand for active money is by nature a stock concept, the amount desired for this purpose being unchanged when income is stable, the demand for money for both precautionary and speculative (investment) purposes grows as the stock of wealth possessed by society increases, and, second, to show that, if we treat the liquidity preference function as a relation between the ratio of money to debt and the interest rate, we get a system which behaves very much like our loanable funds models in Chapter III. We may draw the

conclusion from this that the loanable funds type of interest theory is superior to the liquidity preference theory as an approximation of the correct theory. Since it is very difficult in most cases to include the stock of wealth as a variable, we desire to have a theory in which we do not have to include it but which behaves as much as possible like one that takes it into account.

Importance of Changes in the Stock of Wealth

The notion that the amount of money that people want to hold is somehow related to their total asset holdings traces back at least as far in the history of economic thought as Marshall, who referred to it in an oft-quoted passage in his Money, Credit and Commerce: "Let us suppose that the inhabitants of a country, taken one with another (and including therefore all varieties of character and of occupation) find it just worth their while to keep by them on the average ready purchasing power to the extent of a tenth part of their annual income, together with a fiftieth part of their property."[27] Hansen makes reference to this aspect of Marshall's analysis in his Monetary Theory and Fiscal Policy, noting with approval Marshall's inclusion of total assets,[28] but then, before he

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[27] A. Marshall, Money, Credit and Commerce (London: Macmillan & Co., Ltd., 1923), p. 44. (Italics added.)

[28] A. H. Hansen, Monetary Theory and Fiscal Policy, pp. 2, 55-57.

really starts his own analysis, he drops the stock of assets out of the picture, with the remark, "In short-run analysis [it] may be neglected on the ground that it can be changed only by a small amount compared to the total stock."[29] Hansen seems to feel that, since one of the factors which determines the aggregate value of assets is the rate of interest, the chief significance of Marshall's inclusion of total assets in the demand for money equation is that it represents a step in the direction of the Keynesian recognition of the interest rate per se as a determinant of the demand for money. This appears to be reading too much into Marshall, since the context of Marshall's discussion seems to indicate that he was referring in a general way to the fact that persons with large wealth usually do more business and can also afford more of the convenience provided by money. Moreover, Marshall's discussion suffers from the weakness that he did not include bank deposits as money--money to him meant currency.[30]

It is very easy to assume that the stock of assets is constant in a static model and to drop them completely out of the analysis. In fact, it is impossible to allow for growth of assets in a satisfactory way except in a dynamic formulation, because accumulation is by its very nature a dynamic process. It also sounds reasonable that the accumulation

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29/ Ibid., p. 57.

30/ See Marshall, op. cit., p. 45, where he refers to the fact that "the very rich who pay all their tradesmen by cheques use relatively little [money]."

of wealth can be neglected in short-run analysis because the increments are so small in relation to the pre-existing total. However, it should be remembered that what we are interested in determining is income, not wealth, and the increments in wealth (assets) in the United States in most years are by no means negligible when compared with income. For example, in 1950, net private domestic investment by business firms (gross private domestic investment less capital consumption allowances) was $27.7 billion, according to Department of Commerce figures.[31] This is certainly not negligible in comparison with a gross national product of $282.6 billion. In addition, there is in most years a sizeable increase in the stock of consumer durable goods and some increase in net claims against foreign countries resulting from an export surplus. Finally, in many recent years there have been large changes in the public's stock of claims resulting from the surpluses or deficits of the Federal government. It is clear that the change in the public's net assets, including all the items mentioned, may possibly be large enough in a year to exert a potent influence on interest rates if the demand for money is much influenced by changes in wealth.

Of course, if short-run analysis of the Keynesian variety involved a period of only a month or two, changes of

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31/ National Income Supplement to the Survey of Current Business, 1951 Edition (Washington: U. S. Government Printing Office, 1951), pp. 148-149.

such magnitudes (per annum) could perhaps be ignored without very serious consequences. But the theory of income determination involves much longer time periods. The unit time period (production-planning period) may typically be as long as six months, to take a rough guess. Moreover, to get a substantial fraction of the total effects indicated by the multiplier almost always requires a number of such periods.[32] The calendar time to be taken into account would always be a year or two at the very least.[33] And, in such a time interval, the growth of wealth can be large enough to exert an important effect on the demand for money.

The same arguments mentioned in the previous paragraph against failing to take account of the effect of the stock of wealth on liquidity preference could, of course, also be directed against Keynes' failure to take account of the growth of the stock of productive capital and changes in technique on the level of income and employment.[34] It is quite clear

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[32] To illustrate: In simple multiplier analysis, five periods are required to get 90% of the ultimate effect when the multiplier is 2.5, 11 periods when the multiplier is 5, and 22 periods when the multiplier is 10. In general, the larger the multiplier, the longer (in periods) is the time required to get a given fraction of the total effect.

[33] For a more extended discussion of these matters, see pp. 79-86, *supra*.

[34] Cf. A. Smithies, "Effective Demand and Employment," *The New Economics*, pp. 564-565, where the assumption of constant technique is especially criticized as dangerous in analysis of the American economy.

that an analysis covering a time period of a year or two might go seriously astray through failure to take account of capital accumulation and changes in technique. Keynes' analysis was entirely static, and it is clear from the whole tenor of the General Theory that he considered it to be much more "short-run" than it really is. However, it is not our task to consider this aspect of Keynesian economics at length, but merely to point out its relation to the problem we are considering. Actually Keynes' failure to take account of the stock of wealth in his liquidity preference function is merely a reflection of his failure to allow for the growth of the capital stock.

However, there is nothing logically wrong with the assumption that the capital stock is fixed. Doubtless, allowing for its growth would merely complicate the analysis without basically changing it. On the other hand, if our analysis above is correct, failure to make any allowance for the effects of growing wealth on the demand for money introduces a positive analytical error into the theory. The monetary variable is incorrectly handled. The stock of money is treated as a factor which influences the level of income, when the rate of change of the money stock or the flow of money into or out of the system is really the thing which influences income.

If the loanable funds theory is used instead of the liquidity preference theory, the results are quite similar to those which would be obtained by making allowance for

changes in the stock of wealth. Moreover, as we have seen, the loanable funds theory can be incorporated quite easily and effectively into income-determination models of the Keynesian type. Use of the loanable funds theory provides us with a method of making at least rough allowance for the growth of wealth without greatly complicating the analysis.

The Structure of Interest Rates

What we have been saying in this chapter is merely that it is normal and natural for people to increase their money holdings as their wealth increases. Money is an attractive form in which to hold wealth because of its superior convenience. As wealth grows, the scale and complexity of financial operations and commitments increases also, thus presumably increasing the marginal return in the form of convenience from a given amount of money. At a given cost in terms of income foregone, investors will almost certainly increase their precautionary money holdings as their wealth increases, although probably not in proportion to the increase in their wealth. At the same time, the amount of money held for this reason will almost surely be at least somewhat responsive to changes in the level of interest rates. At lower interest rates, the cost of added units of convenience in the form of money holdings will be reduced. Thus we might expect that at given interest rates investors would add to their money holdings at a certain rate as their wealth

increased, and that this rate would be greater at low than at high interest rates. Moreover, investors hold money also as a temporary investment because they expect it to appreciate in value relative to securities. We can relax our assumptions in a general way and allow for the fact that there are many different types of securities with different interest rates. As interest rates rise, there is a tendency for investors to shift their current holdings of wealth out of cash and short-term securities into longer-term securities and also to invest a larger portion of current increments to their wealth in longer-term securities. The reason for this is that they want to take maximum advantage of the presumably temporary high rates and also perhaps make capital gains by reselling long-term securities later when rates have fallen. This line of reasoning, of course, assumes that investors' thinking about interest rates is influenced by their notion about a normal level of interest rates, so that the higher interest rates rise the more general becomes the feeling that they are going to fall,[35] and, on the other hand, the lower they fall

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[35] It may be that, in the early stages of a period of rising interest rates, the dominant expectation among investors, at least for a short period ahead, will be that interest rates will rise still more. In these circumstances, those investors who have short investment periods (expect to have to realize cash on their investments within a short time) may shift from long-term securities into short-term securities and cash. If this happens, the early stages of a period of rising interest rates may be characterized by a greater rise in long-term than in short-term rates. In fact, short-term rates might even fall if investors shift primarily from long-terms into short-terms rather than from long-terms into cash. However, this

the more widespread becomes the opinion that they are going to rise. Of course, according to the same line of reasoning, when interest rates fall, investors will tend to shift out of longer-term securities and into cash and short-term securities to subject themselves to the low rates for as short a time as possible and to avoid the capital losses that are foreseen on long-term securities when interest rates rise again as they are expected to.

The kind of investor behavior described in the last paragraph would lead one to expect certain systematic variations in the maturity structure of interest rates as the level of interest rates rises and falls. When interest rates in general are relatively high, short-term rates should be above long-term rates, and when rates are generally low, short-term rates should be below long-term rates. This means that short-term rates should fluctuate over a wider range than long-term rates. Empirical evidence concerning the structure of interest rates corresponds closely with our expectations based upon this theory. We do find rates following this pattern.[36] In

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tendency will presumably end when the "weak" holders (those with short investment periods) have adjusted their portfolios to the situation, and, moreover, while it lasts it will merely speed up the process of pushing interest rates up to the point where most investors expect them to fall.

[36] Cf. F. A. Lutz, "The Structure of Interest Rates," Quarterly Journal of Economics, LV (November, 1940), 36-63, especially Fig. II, p. 58; D. Durand, Basic Yields of Corporate Bonds, 1900-1942 (National Bureau of Economic Research, Technical Paper 3, 1942), pp. 16-19, especially Chart 4, p. 17.

fact, empirical evidence permits us to make a fairly precise guess concerning the nature of investors' interest rate expectations. Not only do we find short-term interest rates varying more than long-term interest rates, but we also find long-term security prices varying more than short-term security prices. This implies that the elasticity of investors' interest rate expectations is positive and between zero and unity.[37] If the elasticity of expectations were zero, meaning that a fall in the current long-term rate does not cause the expected future long-term rate to change, we should expect that short-term rates would fall much more than the long-term rate but that the prices of long-term and of short-term securities (of the same degree of risk) would rise in equal proportion. On the other hand, if the elasticity of expectations were unity, so that a fall in the current long-term rate would cause an equal fall in the future expected long-term rate, we should expect to find the short-term rate falling by only about the same amount as the long-term rate, while the prices of short-term securities would hardly be affected at all and the prices of long-term securities would fall sharply. Since the actual pattern typically found in the market is intermediate between these two extremes (elasticity of zero and elasticity of unity), we are able to deduce

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[37] The elasticity of interest rate expectations may be defined as the percentage change in the expected future interest rates which is caused by a given percentage change in the current rate, divided by the percentage change in the current rate.

that the elasticity of expectations is typically between zero and unity.[38] Now the empirical evidence about interest rates and security prices, by implying that the elasticity of expectations is positive but less than one, lends support to the thesis that investors are influenced by some concept of a normal level of interest rates. It indicates that when current interest rates fall, investors typically expect them to rise again in the not too distant future although not all the way back to their original level.

The holding of cash for speculative reasons is a little harder to explain when there are short-term securities available for investors to hold. However, there are two reasons why investors may shift into cash when rates fall and into securities when rates rise, even though there are both short-term and long-term securities available. First, many investors are not acquainted with short-term riskless securities (such as Treasury bills) or with the markets in which they are sold. Such investors will tend to shift back and forth between cash and long-term securities as rates change. Second, as short-term rates fall, investors with relatively small amounts of funds to invest find that the costs of investment and disinvestment (including both money costs and the inconvenience involved) are so great as not to make the

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[38] On the relation between the elasticity of expectations and the structure of interest rates and security prices, see de Scitovszky, op. cit., especially pp. 304-305; also Modigliani, op. cit.

holding of short-term securities worth while. These costs vary much less than in proportion to the amount of funds to be invested, and, as interest rates fall, the volume of funds that must be invested to make the return seem worth while gets larger and larger. Hence, as short-term rates fall, one might expect to find larger and larger investors forced out of the short-term market by the cost factor.[39/]

It is apparent that, when we take account of the existence of securities of different maturities, our earlier reasoning about the demand for money does not need to be altered very much. It still appears to be reasonable that the amount of money that investors will want to hold for speculative reasons will vary inversely with the interest rate level. Moreover, it seems correct to assume that at a given interest rate they will put part of the current additions to their wealth that arise through saving into money. Hence it still seems appropriate to treat the speculative demand for money as a flow concept. Of course, if the interest rate remains stable at a high level (in relation to recent experience), it will gradually lead to an upward adjustment in investors' ideas about the normal level of interest rates (a rise in R'). For example, this might result in

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39/ This line of reasoning seems to be the best explanation of the vast holdings of excess reserves by commercial banks in the late 1930's. As time went on, the rate on Treasury bills was driven down so low that even banks, with large amounts of surplus funds available, did not find investment in bills attractive, presumably because of the costs.

some investors revising their expectations in the direction of rising rates and an increased pace of hoarding as time went on. But it seems reasonable in analysis covering fairly short periods of time and as a first approximation to leave this out of account.

Transition Periods

It might seem at first that we could take R' (the expected normal level of rates) as representing a precise index of the community's concept of the normal rate and postulate that when the market rate is below R' there will be hoarding and that when the market rate is above R' there will be dishoarding. Thus our hoarding function would be of the following type

$$\Delta M_{2,t} = F(R_t - R'), \text{ where } F(0) = 0,$$

or, as a linear approximation,

$$\Delta M_{2,t} = d(R_t - R').$$

However, this formulation collides directly with our basic contention about hoarding. We have been arguing that hoarding is normal behavior, which implies that dishoarding is abnormal. Different investors have different notions about the normal level of interest rates, and, within a wide range of rates, some investors will find the current rate below their idea of what is normal. These investors will be hoarding. Actual dishoarding will occur as a stock adjustment, presumably, only during times of rising interest rates. It

will presumably occur only during times of transition. The chief weakness of the loanable funds model as a substitute for a model explicitly containing the ratio of money to wealth as a variable is that the loanable funds model fails to take account of these stock adjustments. For ordinary purposes, this is not likely to be too serious a weakness.

In one respect, the loanable funds model seems, at first, to be peculiar and unrealistic. An autonomous increase in investment will cause a sharp increase in interest rates in the first period in which it occurs. If the higher rate of autonomous investment is maintained in successive future periods, however, the interest rate will gradually fall back toward its original level, provided the economic system is stable. That is, if the sum of the marginal propensity to consume and the marginal propensity to invest is less than unity (or the marginal propensity to save exceeds the marginal propensity to invest), savings will increase faster than investment, thus tending gradually to depress the interest rate. This is directly contrary to the actual behavior of interest rates during periods of expansion. The result yielded by the liquidity preference theory seems much more realistic--the rising level of investment and income draws money out of idle balances into active circulation and pushes up the interest rate. To get the same result under the loanable funds theory, all that is necessary is to assume that the economy is temporarily unstable. If the sum of the

marginal propensity to consume and the marginal propensity to invest is greater than unity (marginal propensity to invest greater than marginal propensity to save), investment rises faster than savings, the demand for loan funds rises faster than the supply, and the interest rate rises continuously. Since it seems reasonable that rising income during a buoyant period would have a strong tendency to induce additional investment, it seems not unreasonable that the economy would be temporarily unstable during such a period due to an abnormally high marginal propensity to invest. Exactly the same line of reasoning can be applied during a period of falling income to produce a falling interest rate level.

Conclusion

In this chapter, we have tried to show that the demand for asset money (precautionary and speculative motives) is partly a function of the stock of wealth. Ideally, we would employ a model in which the ratio of asset money to total wealth (or to total debt) is included as a function of the interest rate. Examination of such a model seemed to indicate, however, that results are quite similar to those obtained through the use of the loanable funds theory. We conclude, therefore, that the loanable funds theory is a more satisfactory approximation to the correct theory of interest than is the liquidity preference theory.

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