APPENDIX: A SYNTHESIS OF MONETARY ANALYSIS AND INCOME ANALYSIS

The modern theory of income determination is a lineal descendant of earlier theoretical systems. Money played a large role in these systems, which usually went under the name of *monetary theory*. It will be useful to glance at some earlier ideas about money before considering its role in modern income analysis.

The Fisher Equation

Until quite recently, economists thought of full employment as the normal condition of the economy and of any deviation from full employment as temporary and self-correcting. Monetary forces, it was believed, reflected themselves mainly in movements of the *price level*: and attention was consequently focused on the relation between money and prices.

One line of reasoning was as follows: for every sale made in the economy, the number of dollars changing hands must equal the value of the goods sold. Thus the total amount of money spent in the country during a year must equal the total value of goods and services exchanged during that period.

Total spending may be thought of as the amount of money in existence, M, multiplied by the average number of times each dollar changes hands during the year. This second quantity, usually designated as V, is termed the *transactions velocity of money*. Total spending during the year, then, is MV.

The value of the goods and services exchanged may be thought of as the quantity of each good, T, multiplied by its price, P. Thus the total value of transactions during a year is PT, where P is an index of average prices of and T represents the physical quantity of goods exchanged.

Now total spending must equal the value of goods sold. They are simply different ways of looking at the same transactions, one from the standpoint of the buyers and the other from that of the sellers. It follows that

$$MV \equiv PT .$$

This is the famous *quantity equation* or *equation of exchange*, often identified with Professor Irving Fisher of Yale.

On its face the equation is simply a truism. It resembles the $S = I$ formula in that it is true by definition for any past period. It does not necessarily say anything about causal relations in the economy.

With a few embellishments, however, the quantity *equation* can be turned into a quantity *theory* of money and prices. The velocity of money, it can be argued, depends on banking institutions and people's

money-holding habits. These are reasonably stable over short periods, and so V can be taken as roughly constant. Moreover, if one regards full employment as the normal state of affairs, production cannot change much over short periods, and T can also be taken as constant.

With V and T constant, and only M and P left to vary, the outcome is clear. An increase in M will produce a proportionate change in P. Double the quantity of money, and the price level will also double. Cut the quantity of money and prices will fall.

The simplicity of this theory, and the sweeping conclusions which could apparently be drawn from it, attracted a wide following. Most economists have gradually become convinced, however, that the theory is too good to be true. V turns out not to be very stable in the short run, tending to rise during business upswings and fall during downswings. More serious, T moves up and down over the course of the cycle. Indeed, it is these fluctuations in output in which we are mainly interested; but the quantity theory is not oriented toward fluctuations in T and does little to explain them.

The flexibility of V means that it is possible for spending to rise or fall with no change in the quantity of money. Moveover, under sellers' inflation the impetus to price increases comes from the cost side rather than the demand side. So one cannot regard money as the only prime mover in the economy. The quantity theory fails to highlight the forces behind the spending decisions on which total demand depends.

The Cambridge Equation

A different form of the quantity equation stems from the work of Professor Alfred Marshall of Cambridge, and is hence usually termed the *Cambridge equation*. It starts from the proposition that the quantity of money people wish to hold in cash or checking accounts is related to the size of their incomes. The fraction of their incomes which people choose to hold in money was designated by Marshall as k. Then the money holdings of any individual or business will be $m = ky$. EXAMPLE: I have an income of $500 a month, and keep on the average $250 in my pocket and my checking account. Thus my k is 0.5, and my money holdings satisfy the condition

$$250 = 0.5\ (500) .$$

Since all the money in existence at a particular time must be held by somebody, we can sum up for the economy as a whole and conclude that

$$M = kY$$

where M is the average money stock over a certain period, Y is total money income during the period, and k is the ratio of money holdings to income

Marshall's k is the same kind of creature as Fisher's V. Marshall thought that k could be regarded as roughly constant over short periods. He also supposed the economy to be fully employed, so that output does not change. Suppose now that the quantity of money increases. What will happen? People find that their money holdings are above the level, k, to which they are accustomed. They will try to get rid of the excess by spending it. Since output cannot rise, increased spending serves only to raise the price level. As prices rise, people's money incomes also rise. This expansion of income will continue until the ratio of money holdings to income has fallen to the normal level k. At this point, people are once more willing to hold the enlarged money supply, and the system is in equilibrium.

A little calculation shows that this occurs when the price level has risen by the same percentage as the original increase in money supply. Thus we reach Fisher's conclusion by a different route: a change in the quantity of money leads to an equal proportionate change in the price level.

Marshall's system is subject to some of the same criticisms as Fisher's system. K does not remain constant over time, any more than V does. Nor does output remain constant over time. The Cambridge equation was, nevertheless, a substantial improvement. It focused attention on people's reasons for holding money balances and on the relation of this to spending plans. It was a step toward the thoroughgoing analysis of spending which characterizes the modern approach.

Money and Interest in Modern Dress

Modern monetary theory starts from the observation that there are several reasons for holding money rather than just one reason, and that the amount of money held is related to the rate of interest as well as the level of income.

The demand for money may be divided into three parts:

1. Transactions demand. It is convenient to keep something in one's pocket and one's checking account to pay for current purchases. Given a certain income, the amount carried depends on personal habits and business practices. One could get by with a very small balance by buying entirely on credit and paying all bills by check on the first of the month. But most people pay bills intermittently over the month and also make cash purchases, which requires a sizable average balance. Business concerns also carry substantial cash balances to pay for current purchases.

These practices can be assumed to remain stable over short periods.

income.[5] A larger national income means a proportionate increase in the transactions demand for money.

Transactions demand is probably little influenced by interest over the normal range of interest rates. If the interest rate becomes very high, however, people may try to economize on their cash balances so that they can put more into securities or savings accounts.

Transactions Demand for Money Depends on Interest and Income

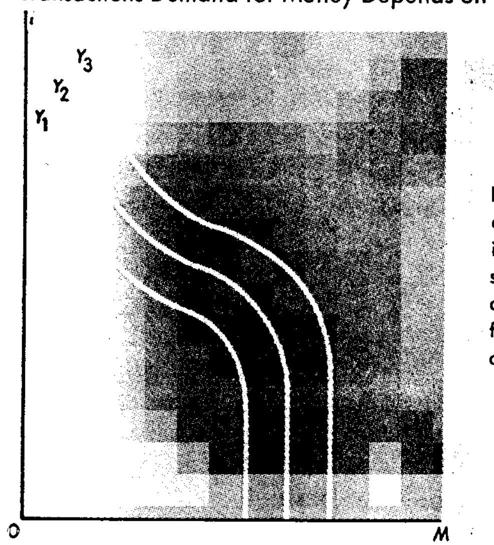

FIGURE 1a. A separate demand curve must be drawn for each level of income. Y_1, Y_2, and Y_3 show demand at successively higher income levels. A diagram of the *precautionary* demand for money would look similar to this one.

These suppositions are shown graphically in Figure 1*a*. The rate of interest is shown on the vertical axis, the quantity of money on the horizontal axis. Each Y line shows the transactions demand for money at a certain level of national income. It is completely unresponsive to the rate of interest over most of its length. If the interest rate becomes very high, however, people become willing to get along with less money for transactions purposes, so the demand curve bends to the left.

The demand curve Y_1 assumes a specified level of national income. Suppose instead that there is a higher income level. Then the transactions demand for money will be higher, say at Y_2, which lies to the right of Y_1. A still larger income will move the money demand rightward to Y_3 and so on.

2. Precautionary demand. If future receipts and expenditures were completely certain, the money carried for transactions purposes would cover all one's needs. But the future is never completely certain. A check which is supposed to arrive at a certain time may not arrive. I may have to make a business trip out of town on short notice. Before the

[5] In this Appendix, as in earlier chapters, we shall continue to use the term

invention of the credit card, this might have meant paying for the trip first and collecting from the boss later. A car accident or a sudden illness in the family may lead to unforeseen needs for cash.

Most people, therefore, will not be content to hold the bare minimum of cash needed to cover normal transactions. They will want a "rainy day" reserve in addition. This precautionary demand, like transactions demand, probably depends mainly on the size of incomes. As a man's income rises, he buys more safety as well as more of everything else.

The precautionary demand for money thus resembles the transactions demand curves shown in Figure 1*a*. There will be a different demand curve for each level of national income, and these curves will be unresponsive to interest except at very high rates. Because of this similarity, it has not seemed necessary to draw a separate diagram for precautionary demand.

3. Speculative demand. This type of demand affects investors, including business concerns as well as better-off individuals. While these people are a minority of the population, they hold large money balances; and the size of their holdings is related to the state of the securities markets.

Since speculative demand for money is a phenomenon of the securities markets, it has no direct connection with the level of production. Thus we have only one demand curve instead of a separate curve for each level of national income. What does this demand curve look like? In particular, how is the speculative demand for money related to the rate of interest?

It is helpful to recall that the rate of interest moves in the *opposite* direction from the price of bonds and other fixed-interest securities. To say that the interest rate is *rising* is the same as saying that security prices are *falling*; and vice versa. Now as security prices fall, more and more people will conclude that prices are "too low," i.e., below their normal or long-run level, and that they will rise back toward this level at some later point. In an effort to "buy at the bottom," they will shift out of cash and into securities. Speculative holdings of money decline. Conversely, as security prices rise (= the interest rate falls), more and more people will conclude that prices are now "too high," and will shift out of securities into cash. The speculative demand for cash increases.

This produces the kind of demand curve shown in Figure 1*b*. *The speculative demand for money varies inversely with the rate of interest.* This amounts to saying that people will be more willing to hold securities the lower their prices.

Note one important feature of Figure 1*b*. At the interest rate i_0, the speculative demand curve for money becomes infinitely elastic. What does this mean? It means that at this level the yield on securities is so

all. If additional money is pumped into the system, they will simply hold it in idle balances. This is usually termed the *liquidity trap*. The practical consequence is that *the monetary authorities cannot force the interest rate below* i_0. This limits the power of the central bank to take useful corrective action during a depression.

4. Total demand. The total demand for money, obtained by adding these three types of demand, will look as shown in Figure 1*c*. There is an infinite number of demand curves, each corresponding to a different level of national income, of which only three are shown here. Each curve slopes downward in response to lower interest rates until it reaches the critical minimum i_0, at which point it becomes infinitely elastic.

Speculative Demand for Money

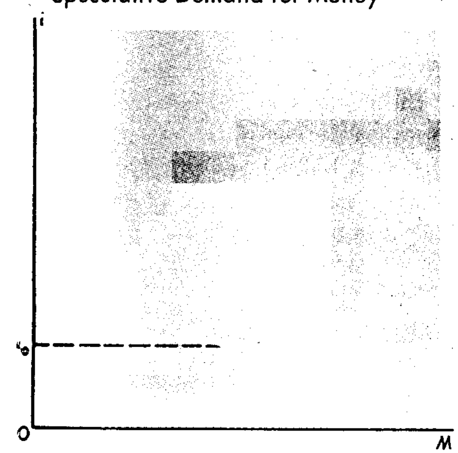

FIGURE 1b. As the rate of interest falls (= securities prices rise), people will hold less securities and more money. At some minimum rate, i_0, any additional money will be held idle.

Total Demand for Money and the Rate of Interest

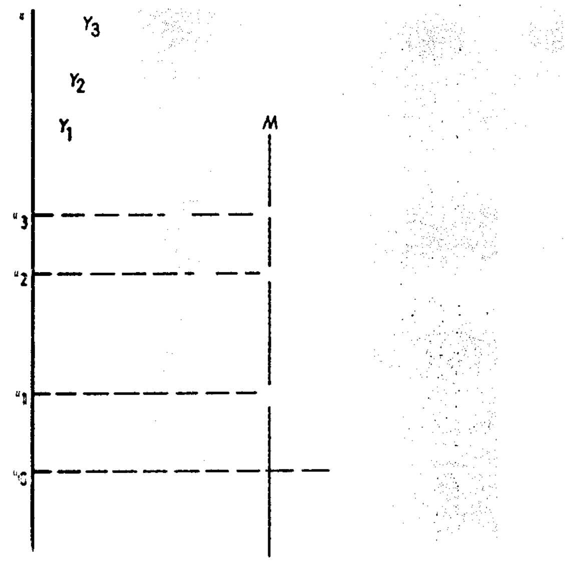

FIGURE 1c. The total demand curves Y_1, Y_2, and Y_3 are a composite of the underlying demand curves in Figures 1a and 1b. Given such a demand curve, and given the supply of money, one can determine the rate of interest. Thus if demand is Y_1, and money supply is OM, the interest rate will be i_1.

If we know the supply of money as well as the demand, we can determine the rate of interest. Suppose *OM* is the quantity of money in existence, so that *MM* is the money supply curve. And suppose that at the present level of income the demand curve for money is Y_1. Supply and demand must be equal, since all the money in existence at a particular time must be held by somebody. Thus the rate of interest must be i_1, determined by the intersection of Y_1 and *MM*.

A higher national income Y_2, with the same quantity of money, will produce a higher interest rate i_2, defined by the intersection of Y_2 and *MM*. A still higher income Y_3 will result in the interest rate i_3, and so on. Thus we conclude that, given the money supply, *the interest rate varies directly with the level of national income.*

Suppose now that we take national income as fixed, say at Y_1, and make money supply the variable factor. Move *MM* to the left, indicating a smaller supply. The equilibrium rate of interest will be higher. Enlarge the money supply by moving *MM* to the right. The interest rate will be lower. This leads to a second proposition: *The interest rate varies inversely with the quantity of money.* (This holds good *until* one strikes the horizontal section of the demand curve, when the interest rate becomes unresponsive to further increases in money supply.)

Income Determination in a Monetary Economy

We seem to have made a considerable step forward. In Chapter 20 we said that, in order to draw a consumption or investment schedule, one must assume some rate of interest. But this rate was pulled out of the air. Now we have shown how the interest rate itself is determined by the operation of the system.

But wait a moment. Are we as far ahead as we thought? All we have shown is that we can determine the rate of interest provided we know the supply of money *and the level of national income.* But in practice, of course, the level of national income is the great unknown. This is what we really want to determine in the end. So we seem to be going around in a circle.

The difficulty is that, having brought money into the picture, we have two equilibrium conditions to satisfy instead of one. These are:

1. Equilibrium in product markets. Total spending on goods and services must equal the cost of goods and services produced. We saw in Chapter 20 that this condition is satisfied when

$$S = I + (G - T)$$

or in the simplified no-government case,

$$S = I .$$

2. Equilibrium in the money market. This requires that the amount of money people want to hold must equal the amount of money

in existence. If we designate the former as *L*, and the latter as *M*, the condition is

$$L = M .$$

Suppose we know the quantity of money in existence. (We have to take *something* as fixed in order to get anywhere at all!) But both national income (*Y*) and the rate of interest (*i*) are left free to vary. *Problem:* To find a combination of *Y* and *i* which will satisfy *both* of the equilibrium conditions simultaneously. If we can do this, we shall have a stable equilibrium for the economy, in which money supply, interest rate, and the total expenditure schedule will be mutually consistent.

Is this a soluble problem? Yes, it is. The solution can be shown in several different ways. The one chosen here requires effort to grasp; but it ties up a lot of things in a neat way.

Since we are now trying to determine *Y* and *i* simultaneously, our diagrams from here on will show *Y* on the horizontal axis and *i* on the vertical axis. The eventual solution, then, will be a *point* on this sort of diagram, a satisfactory pair of values for the two variables.

Start with the first condition of equilibrium, $S = I$, and look at

Product Market Equilibrium

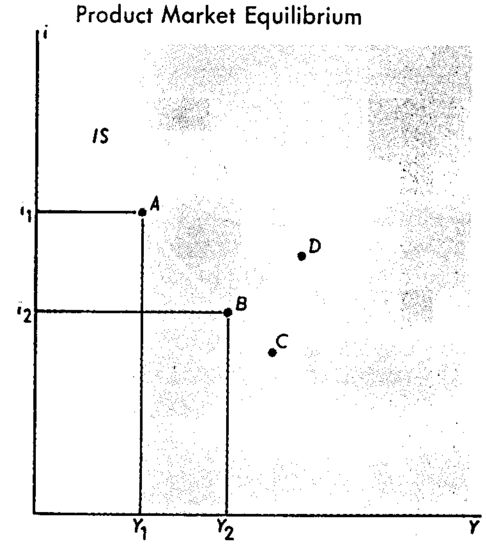

FIGURE 2. *IS* contains all combinations of national income (*Y*) and interest rate (*i*) which satisfy the conditions $S = I$. Thus *A*, *B*, and *C* are possible equilibrium positions for the economy, while *D* is not.

Figure 2. Choose any rate of interest, i_1. Now, for this rate of interest there must be some level of national income which will make *S* equal to *I*. The rate of interest determines a certain amount of investment, so we must find a level of income at which people will choose to save just this amount. Suppose this turns out to be Y_1. Then point *A* on the diagram, with coordinates i_1, Y_1, is one point at which the $S = I$ condition is fulfilled.

But there are obviously many more such points. Choose a lower rate of interest, i_2. With lower interest, there will be a larger volume of investment. If the saving-investment equality is to hold, there must be more saving, and this will happen only at a higher level of income. The required level of income turns out to be Y_2. This gives us another point, B, which meets the $S = I$ condition. By repeating the same process we discover a third point, C; and so on.

By linking together all such points, we derive the curve *IS*. This is the *locus of all combinations of* i *and* Y *which satisfy the* S = I *condition.* Wherever the economy may settle, then, it must be at some point along this line. Point D, for example, cannot be an equilibrium point because it does not satisfy one of the basic conditions.

Money Market Equilibrium

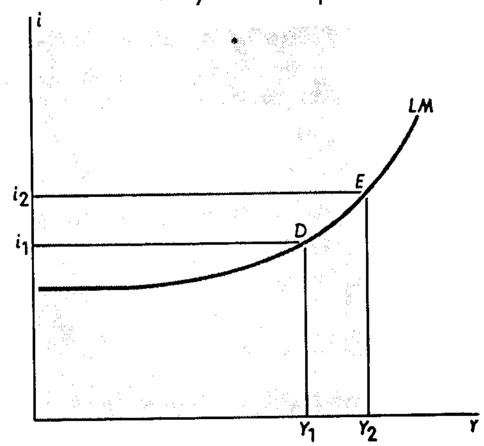

FIGURE 3. *LM* contains all combinations of *Y* and *i* which satisfy the condition $L = M$. Only points on this line, such as *D* and *E*, are possible equilibrium positions for the economy.

Turn now to the second condition, $L = M$, and look at Figure 3. We proceed as before. Choose any rate of interest, i_1. Given this rate, the amount of money people wish to hold depends solely on the level of income (refer back, if you need to, to Figure 1c). But the quantity of money in existence is fixed. Thus we can find some income level at which people are just willing to hold this fixed amount of money. Suppose this turns out to be Y_1. Then point D gives us one combination of i and Y which satisfies the $L = M$ condition.

Choose another rate of interest, i_2. At this rate, it will take a different income level, Y_2, to equate L and M. This gives us a second point E. By discovering more and more such points and joining them up, we obtain the *LM* curve in Figure 3. This is *the locus of all combinations of* i *and* Y *which satisfy the* L = M *condition.*

Why does *LM* slope upward to the right? As we move to the right, we are moving toward higher levels of income. People will thus want to hold larger money balances for transactions and precautionary purposes. But the amount of money in existence is fixed. So the larger transactions-precautionary demand can be satisfied only by persuading people to h...

smaller balances for speculative purposes. This requires a rise in the rate of interest, since speculative balances vary inversely with interest. The rate of interest must rise enough to reduce the speculative demand for money by the same amount that the higher level of income has raised the transactions-precautionary demand. Only in this way can the $L = M$ condition continue to be satisfied with a fixed amount of money.

Note, however, that the early section of *LM* has been drawn as a horizontal line. This corresponds to the horizontal section of the money demand curve in Figure 1c. This portion of Figure 1c, it will be remembered, indicates that at some (low) level of interest rates people will accumulate idle balances indefinitely instead of buying securities.

General Equilibrium: Simultaneous Determination of Interest Rate and National Income

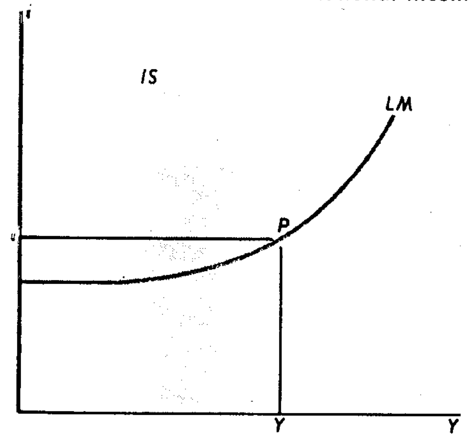

FIGURE 4. Any equilibrium position for the economy must lie on both *IS* and *LM*. The only point of which this is true is the intersection point *P*. Hence the level of income will be *Y* and the interest rate *i*.

This is the region of the liquidity trap. Starting from such a situation, as income rises the increased transactions-precautionary demand for money can be met for awhile by drawing off idle balances with no need for a rise in the interest rate. Eventually, however, the economy reaches a point at which further balances will be released only at a higher rate of interest. At this point *LM* turns upward.

Once the construction of the *IS* and *LM* curves has been grasped, the solution of our problem becomes simple. Look at Figure 4, where the two are brought together. Each curve shows a basic condition of equilibrium. For the economy to be in equilibrium, *both* conditions must be satisfied at once. The equilibrium combination of interest rate and national income *must* lie on *both IS* and *LM*. But this can happen only where the two curves intersect. The intersection at P, then, defines the general equilibrium of the system. The interest rate will settle at i and the level of national income at Y. And this will be a stable position so long as the underlying conditions—the expenditure schedule, the money demand ... and the quantity of money ... remain unchanged.

Changes in the Level of National Income

In practice, the underlying conditions never do stay unchanged for long. The chief usefulness of the $IS - LM$ diagram is as a tool for exploring the reactions which will be set up by any change in the basic conditions. Two examples will make the point.

An Increase in the Expenditure Schedule

Suppose first that the *IS* curve shifts rightward to $(IS)_1$ (Figure 5). This means that, at each rate of interest, people are now willing to spend more than before. We need not ask why. An increase in planned spending by consumers, business concerns, or government might be responsible.

A Change in the Expenditure Schedule

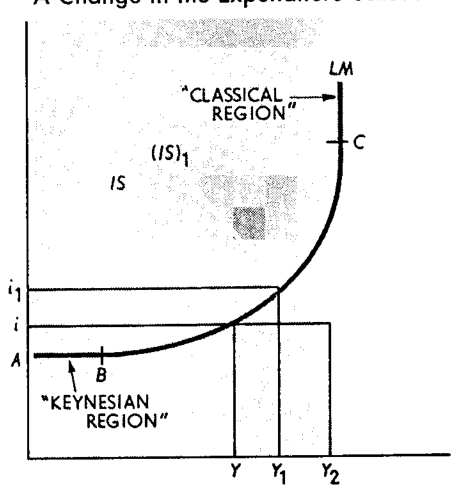

FIGURE 5. Over the upward-sloping region *BC*, a shift of *IS* will change both the interest rate and the level of income. Below *B*, the effect will be entirely on income; above *C*, it will be entirely on the rate of interest.

What reactions will be set up by this shift? The answer depends on the shape of *LM*. Three cases may be distinguished:

1. Suppose that $(IS)_1$ intersects *LM* somewhere in the range *BC*, over which *LM* slopes upward to the right. (This is probably the commonest case, and is the one illustrated in Figure 5.) Then equilibrium will be reestablished at the intersection of $(IS)_1$ and *LM*. The rate of interest will rise from i to i_1, and national income will rise from Y to Y_1. The increase in spending will raise *both* national income and the rate of interest.

Note, however, that national income rises less than it did in the simple multiplier analysis of Chapter 21. The reason is that in Chapter 21 we assumed the interest rate to be unaffected by any shift in total demand. If this were so, and if the rise from *IS* to $(IS)_1$ left the interest

rise. This acts as a brake on expansion and limits the rise in national income to Y_1.

2. There is a case, however, in which the simple multiplier analysis yields correct results. Suppose that both *IS* and $(IS)_1$ intersect *LM* in the range *AB*, i.e., the region of excess speculative balances. Then the rise in spending will not raise the rate of interest. Without the interest brake, the multiplier will be left to work out its full effect in terms of higher income.

This has been labeled the "Keynesian region" in Figure 5, because Lord Keynes called attention to this possibility and thought it was important in practice. In the abnormally depressed conditions of the 1930's, interest rates may have reached the irreducible minimum which Keynes visualized, but this possibility has been of little practical importance since 1940.

3. A third possibility is indicated by the vertical section from *C* upward in Figure 5. At *C* the rate of interest is so high (security prices are so low) as to produce a general conviction that the movement will be reversed. Everyone has shifted into securities, and speculative holdings of money have fallen to zero. All the money in existence is being held for transactions and precautionary purposes. But we have assumed that these holdings are a constant proportion of income. Thus if the money supply is fixed, national income is fixed, and we can move no farther to the right on the diagram. The *LM* curve becomes vertical.

Suppose that the *IS* curve intersects *LM* at or above *C*. If *IS* rises still higher, the new intersection point will be immediately above the previous one. The only effect will be a rise in the interest rate, and there will be no effect on national income. This has been labeled the "classical region" in Figure 5, because these results correspond to those often assumed in economic theory before 1930.

"Real-life economies" are probably moving most of the time within the range *BC*, and the results which hold within that range are most likely to be of practical importance.

An Increase in Money Supply

Consider now the effects of a change in the money market (Figure 6). The banks, influenced by Federal Reserve policy, have become willing to lend more than before at the same rate of interest. Thus *LM* moves rightward to the position $(LM)_1$. What will happen? The *IS* curve now intersects the monetary curve farther to the right, so that there is a new equilibrium level of interest and national income. But note that these variables change in opposite directions. National income *rises* from Y to Y_1. The rate of interest *falls* from i to i_1. Moreover, a quick pencil test reveals that these results hold even if *IS* intersects *LM* in its vertical or

A Change in the Supply of Money

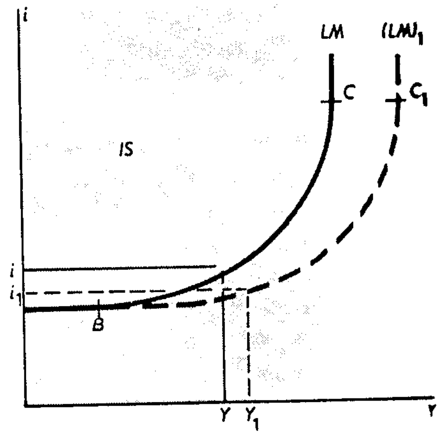

FIGURE 6. An increase in the supply of money shifts *LM* rightward, say to $(LM)_1$. The normal result will be a *rise* in national income and a *fall* in the rate of interest. But if *IS* intersects *LM* in the Keynesian region to the left of *B*, the increase in money supply will be ineffective.

Suppose *IS* is very steep, i.e., savings and investment decisions are little affected by changes in the rate of interest. Then an increase in money supply will mean a marked drop in the rate of interest, but only a small increase in national income. A very flat *IS* curve will lead to opposite results. The flatter the shape of *IS*, the greater the impact of an increase in money supply on national income.

This analysis helps to illustrate why equally good economists may reach different conclusions about the effects of monetary change, and thus come out with different policy recommendations. Such disagreements can often be put in the form of differences of opinion about the shape and location of the *IS* and *LM* functions. These are questions of fact. As continuing research throws more light upon them, the range for legitimate difference of opinion should gradually narrow.