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The IS-LM Model and the Liquidity Trap Concept: From Hicks to Krugman

Mauro Boianovsky

The General Theory of Employment is the Economics of Depression.
—John Hicks, "Mr. Keynes and the 'Classics': A Suggested Interpretation" (1937)

Depression economics is back.
—Paul Krugman, *The Return of Depression Economics* (2000)

One main feature of John Hicks's 1937 "Mr. Keynes and the 'Classics'" is the identification of the assumption that there is a floor to the rate of interest on the left part of the LM curve as the central difference between John Maynard Keynes's 1936 *General Theory* and "classical" economics, a judgment that Hicks repeated on other occasions ([1939] 1946, 1950, 1957). The notion of a "liquidity trap"—a phrase coined by Dennis Robertson (1936, 1940), albeit in a different context, as discussed below—was conspicuous in macroeconomic textbooks of the 1950s and 1960s (see, e.g., Hansen 1953, Ackley 1961, and Bailey 1962), but it gradually receded into the background until it came to the fore again in the recent literature triggered by the Japanese depression and the experience of low inflation and low nominal interest rates in the United States and Europe in the late 1990s (see, e.g., McKinnon and Ohno 1997, chap. 5; Fuhrer and Madigan 1997; Krugman 1998, [1999] 2000; special

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issues of the *Journal of Money, Credit, and Banking*, November 2000, and of the *Journal of the Japanese and International Economies*, December 2000; Benhabib et al. 2002; Walsh 2003, chap. 10; Woodford 2003, chap. 2). The revival of interest in the notion of a liquidity trap as a constraint on the effectiveness of monetary policy is also visible in connection with references by modern textbooks to the Japanese depression (see, e.g., Gordon [1978] 2000, Froyen 2002, Gärtner 2003, Mankiw 2003, and Krugman and Obstfeld 2003).

Whereas the liquidity trap literature traditionally associated with Keynes 1936 and Hicks 1937 concerned the existence of a positive floor to the interest rate, a more recent approach investigates the possibility of a zero lower bound on interest rates. This is in part explained by the shift from Keynes's model—where the long-term interest rate is the relevant opportunity cost in money demand, and expectations about the future values of that long rate are assumed to be regressive or inelastic—to the formulation of money demand in terms of the short-term nominal interest rate, which affects the long rate through the expectations theory of the term structure of interest rates. However, it should be noted that the textbook IS-LM approach to the liquidity trap set off by Alvin Hansen (1949, 1953) is closer to Keynes's 1936 original exposition than to Hicks's 1937 reformulation, which is in some aspects similar to the modern discussion. As pointed out by Don Patinkin (1976, 113 n. 9), Hicks (1937) formulated the liquidity trap "in a notably less extreme form than that which later became the standard one of macroeconomic textbooks." Hicks based his formulation of the liquidity trap on the notion that the short-run nominal interest rate cannot be negative and that the long rate is formed by expectations about the future value of the short rate plus a risk premium. These ideas were fully developed in his 1939 classic *Value and Capital*, which Hicks was writing when he published the IS-LM article.

The purpose of the present essay is to examine how the development of the liquidity trap concept is associated with the interpretation of the IS-LM model in general and the LM curve in particular, with emphasis on the original formulation by Hicks and the new interpretation put forward by Paul Krugman and others. The 1937 article—and the liquidity trap concept in particular—is interpreted against the background of the notion of "elasticity of price expectations" developed in *Value and Capital*. Oskar Lange (1938) was the only author, besides Hicks, to stress the form of the LM curve as the dividing line between Keynes and the

"classics," but in a form quite different from Hicks. The recent literature shares with Hicks ([1939] 1946) the view that under liquidity trap conditions the central bank loses its ability to control the price level. Furthermore, the modern optimizing approach brings into the picture the notion of expectations of economic policy (with its consequences for the interpretation of the liquidity trap idea and for the IS-LM model), which Hicks ([1936] 1982, [1939] 1946, 1969) mentioned only briefly.

1. Hicks on the Rate of Interest Minimum

Hicks himself pointed out the importance of *Value and Capital* for an understanding of the framework of the 1937 IS-LM article. In correspondence with Warren Young (1987, 98), Hicks recalled that "during those years (34–38 inclusive) my thought was mainly directed to the writing of *Value and Capital* (to be published in early '39); anything else was a side-line." The IS-LM article, together with Hicks [1936] 1982, "were, from my point of view, just applications of *Value and Capital* methods."

In part 3 of *Value and Capital* Hicks introduced the method of "temporary equilibrium" in order to discuss economic dynamics. Equilibrium is defined over a period of time when supply and demand in the various markets are adjusted to price expectations held at the start of the period. It was in that context that Hicks introduced the notion of elasticity of price expectations to study the effect of actual prices on price expectations. Hicks ([1939] 1946, 205) defined the elasticity of a "person's expectations of the price of commodity X as the ratio of the proportional rise in expected future prices of X to the proportional rise in its current price." As long as elasticities of price expectations are zero, any change in current prices will bring about large substitution effects over time in markets for inputs and outputs, which will stabilize the economic system. But, if changes in current prices are expected to be permanent, there will be no opportunities left for substitution over time. As pointed out by Hicks ([1939] 1946, 251), the case of unit elasticities of expectations was at the time implicitly taken for granted by most economists, without realizing its implications for stability analysis.[1] In particular, if the expected future price level is given, an excess supply in the market for goods will cause a reduction in current prices and, by that, a fall in the

1. Knut Wicksell ([1898] 1936) advanced the association between instability and unit elasticity of price expectations. After Hicks, the assumption of unit elasticity of price expectations became widespread (see, e.g., Modigliani 1944, 45; Patinkin [1956] 1965, 61).

expected real rate of interest (since individuals expect a return to the previous price level), which will increase aggregate demand for goods and stabilize the price level. However, if elasticities of expectation are 1.0 (or higher), the expected future price level changes together with current prices, which precludes stabilization and leads to cumulative falling prices. Hicks claimed that "the proposition which we have thus established is perhaps the most important proposition in economic dynamics" (255).

Under the (provisional) assumption that nominal interest rates are given, downward instability of the price level in the case of unit elasticity of expectation can be only checked if money wages are rigid, as in Keynes's *General Theory* (until chap. 19) and in Hicks's IS-LM model. In that case, stability is achieved through unemployment and a contraction of output. However, changes in current prices (expected to be permanent) will affect the demand for money and therefore, for a given money supply, will bring about changes in the interest rate required to equilibrate the market for money. An increase of the interest rate is effective to check a rise in prices, but in the case of falling prices the interest rate mechanism may be unable to stabilize the economy because of the floor to the rate of interest. "In this case, the system does not merely suffer from imperfect stability; it is absolutely unstable. Adequate control over the money supply can always prevent prices rising indefinitely, but it cannot necessarily prevent them from falling indefinitely" (259).

Hicks's notion that the central bank cannot avoid falling prices once the interest rate hits its minimum level is based on his hypothesis that the short-term rate of interest is determined by transaction costs, that is, by the lack of general acceptability or imperfect "moneyness" of very short bills (166). Long rates are then determined by expectations about the future course of the short rate according to the theory of the term structure introduced in chapter 11 of *Value and Capital*. Hicks's theory of interest was developed as a reaction against Keynes's (1936, chap. 13) view that the current rate of interest is determined by risk and uncertainty about its future value. In a famous passage, Hicks ([1939] 1946, 164) pointed out that "to say that the rate of interest on perfectly safe securities is determined by nothing else but uncertainty of future interest rates seems to leave interest hanging by its own bootstraps." Hicks's solution is that while the current long rate depends on the expected short rates, the current short rate is not dependent on expectations but on the current supply and demand for money. Hicks's approach to the determination

of the interest rate was followed by Keynesian economists such as Nicholas Kaldor (1939, 13–14) and Michal Kalecki ([1943] 1991, 138–39).[2] Hicks concluded that securities normally stand at a discount relative to money, since the storage costs associated with money are usually negligible ([1939] 1946, 167 n. 1; 1950, 142). It is as part of that framework that Hicks's explanation of the liquidity trap in the 1937 IS-LM article should be read. According to Hicks (1937, 154), the demonstration of the interest rate minimum is "so important that I shall venture to paraphrase the proof, setting it out in a rather different way from that adopted by Mr. Keynes."

> If the costs of holding money can be neglected, it will always be profitable to hold money rather than lend it out, if the rate of interest is not greater than zero. Consequently the rate of interest must always be positive. In an extreme case, the shortest short-term rate may perhaps be nearly zero. But if so, the long-term rate must lie above it, for the long rate has to allow for the risk that the short rate may rise during the currency of the loan, and it should be observed that the short rate can only rise, it cannot fall. This does not only mean that the long rate must be a sort of average of the probable short rates over its duration, and that this average must lie above the current short rate. There is also the more important risk to be considered, that the lender on long term may desire to have cash before the agreed date of repayment, and then, if the short rate has risen meanwhile, he may be involved in a substantial capital loss. It is this last risk which provides Mr. Keynes' "speculative motive" and which ensures that the rate for loans of infinite duration (which he always has in mind as *the* rate of interest) cannot fall very near zero. (154–55; emphasis in the original)[3]

2. Modigliani (1944, 82–86) and Patinkin ([1956] 1965, 109–10) rejected Hicks's notion that the short-term nominal interest rate would become zero in the absence of transaction frictions, on the grounds that the consequence of an increased liquidity of securities is not a lowered rate of interest but a decreased use of money as a medium of exchange. See, however, Walsh 2003, chaps. 2 and 3.

3. Gottfried Haberler (1946, 220) has been one of the few commentators to notice the similarity between that passage and chapter 11 of *Value and Capital*. See also Hicks 1950, 141–42. As suggested by Patinkin ([1956] 1965, 352 n. 27), in the 1950 passage Hicks deduced the liquidity trap as the result of a "market experiment" (the effect of an increase of money supply on the rate of interest) instead of an "individual experiment" (the effect of a reduction of the interest rate on the demand for money). Patinkin claimed that the liquidity trap is a property of the market for securities, not of the money demand function (see also Grandmont and Laroque 1976).

Hicks deployed in his 1937 demonstration of the floor to the rate of interest the two main elements later developed in his theory of the term structure ([1939] 1946, chap. 11): the notion that the long rate is an average of current and expected short rates (the so-called expectations theory of the term structure); and the view that, under the assumption that speculators are averse to risk, they must be paid a liquidity or risk premium to induce them to hold long-term securities (the so-called liquidity preference theory of the term structure; see also Malkiel 1966, chap. 2). Hicks added two important footnotes to the passage quoted above. The first note (1937, 155 n. 6) argues that it is unlikely that individuals might interpret the very low short rate as permanent. Instead, they will interpret it as part of the business cycle and, therefore, be aware that it may possibly rise whether the economy improves (which would increase transactions demand for money) or gets worse (which would increase liquidity preference). Hence the size of the difference between the long and the short rates is a business cycle phenomenon in Hicks's IS-LM. The second note (155 n. 7) claims that the "speculative motive" alone cannot account for the system of interest rates, anticipating some elements of his 1939 criticism of Keynes's theory of interest. Hicks explained that "the shortest of all short rates must equal the relative valuation, at the margin, of money and such a bill." The prospective terms of rediscounting are relevant, however, for the determination of the "*difference* between short and long rates" (emphasis in the original). Hicks's comments can be read as an implicit criticism of the aggregative structure of the *General Theory*, with its simplified two-asset structure comprising "money" (representing short-term assets) and "non-money assets."

The rate of interest assumed in the IS-LM diagrams and equations is the long-term rate, as implied by Hicks at the end of that passage. In correspondence with Young, Hicks recalled that IS-LM did not appear in his Cambridge lectures in the late 1930s, which were based on *Value and Capital*. The reason is that the "heavy emphasis on the long-term rate of interest in the *General Theory* (followed by IS-LM) was not in my line. My theory of interest (in *Value and Capital*) was a theory of the structure of interest rates" (Young 1987, 99). Toward the end of the IS-LM article, Hicks (1937, 158) pointed out that the schedules express a relation between the price system and the system of interest rates, and "you cannot get that into a curve." Nevertheless, as shown by Hicks ([1939] 1946, 147–52), it is possible to reduce the system of interest rates for various maturities to a single short or long rate, which he called a "spot

economy" (i.e., with no forward trading) with short lending only or long lending only, respectively.

Hicks (1950, 142) clarified later on that "the exact position of the [interest rate] minimum depends on the method we adopt of choosing a single rate of interest to represent the whole interest-structure." Furthermore, the elasticity of the IS and LM functions is affected by the choice of the representative rate. The short rate is more sensitive to monetary changes than the long rate, but its effect on investment decisions is smaller. Hence both the IS and LM curves will appear more elastic if a long rate is used as the representative rate. The upshot is that, since the choice of a short or long rate as the single representative rate affects the IS and LM schedules in the same way, the relation between the two curves will be the same (151–52). Moreover, Keynes's use of the long rate as "the" rate of interest in the *General Theory* did not mean a representative rate but a particular rate, which would raise Hicks's (1974, 32–33) criticism.

Although Hicks's 1937 demonstration of the interest rate minimum differed from the one found in the *General Theory* (1936, 201–3), he made clear that it was an elaboration of an original idea by Keynes. The relation between Keynes's and Hicks's formulations is better appreciated with the help of the concept of "elasticity of interest-expectations" introduced in *Value and Capital* (Hicks [1939] 1946, 260). Like the concept of elasticity of price expectations, it expresses the effect of changes in current short or long rates on their expected values. Two cases must be distinguished, depending on whether interest expectations mean expectations of short rates or long rates. In the first case, if interest expectations are rigidly inelastic, a change in the short rate will have almost no effect on the long rate. Hence the whole adjustment must be made through major changes in the short rate, and "it becomes very easily conceivable that downward adjustments may be necessary on a scale which would involve a negative rate of interest, if interest changes are to restore equilibrium" (Hicks [1939] 1946, 260). Hicks also made the argument in terms of expectations of long rates, which is closer to Keynes (261). If these expectations are inelastic—that is, if individuals interpret a fall in the long rate as temporary—the current long rate can be reduced only very slightly, since it cannot fall by more than the expected value (at the end of the period) of the long rate multiplied by itself.[4] The

4. This comes from Hicks's ([1939] 1946, 149, 261 n. 2) formula that the net yield obtainable by investing in long-term securities for a given period is $R + (R/R') - 1$, where R is

general conclusion is that a large fall in the demand for money (caused by falling money income) will be effective in reducing short rates as far as they can be reduced, but long rates will be affected significantly only if interest expectations are elastic enough.

As pointed out by Kaldor (1939, 15) in a critical comment on Keynes (1936, 218–19), it is the inelasticity of interest expectations, not the uncertainty concerning future interest rates, that explains why the demand for liquid funds is highly elastic with respect to the long-term rate, making the long rate stable relative to the short rate. As mentioned above, Hicks (1937, 155 n. 6) assumed implicitly inelastic interest expectations in his demonstration of a positive floor to the long-term rate, above the near zero floor to the short rate. The main reason for the inelasticity of the interest expectations assumption is that the long rate is governed mainly by "fairly long-run prospects; by the danger of credit restriction in the future rather than by current credit policy," so that if individuals do not believe that the decline is permanent, the long rate will not come down significantly (Hicks [1939] 1946, 282).

2. Keynes versus the "Classics"

The main reason why Hicks was so careful in his discussion of the existence of a floor to the rate of interest was that he considered it to be "the most important thing in Mr. Keynes' book" (Hicks 1937, 254), a judgment that he repeated in *Value and Capital* (259) as part of his treatment of absolute instability downward when prices are falling continuously. Hicks (1950, 141) was convinced that the nearly horizontal stretch at the left of the LM curve was "an essential part of Keynes's argument." He later reaffirmed that the individuality of Keynes's theory vis-à-vis "classical" economics is based on the assumption that there are conditions in which "the interest-mechanism will not work" (Hicks 1957, 279). The IS-LM diagram, according to Hicks (1979, 990), shows that Keynes and the "classics" are "both of them special cases of something *more* general. . . . Keynes's model, though an extreme case of the *general* IS-LM model, is an extreme case that is outstandingly important."

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the current long-term rate and R' stands for the rate expected to rule at the end of the period. Since that expression is necessarily positive, R must be higher than $R'(1 + R')$, or approximately, $R > R'(1 - R')$, which gives the maximum possible fall in the current long rate. It corresponds to Keynes's (1936, 202) well-known proposition that a liquidity trap will occur if investors expect long-term rates to rise by more than the square of the current long interest rate.

Hicks (1957) realized that such a judgment depends a great deal on how one describes "classical" economics. As is well known, Hicks's IS-LM is a short-run model built under the assumptions of a fixed amount of capital and given money wages (1937, 148, 158; 1957, 280). The assumption of given money wages was applied in the 1937 article to both Keynes and the "classics," since Hicks was concerned with a comparison between their respective approaches to short-run economic fluctuations when employment is below its full level (see Coddington 1979). The assumption about the behavior of money wages is a "special assumption that can be incorporated into any theory . . . in response to changing facts" (Hicks 1957, 281). Among pre-Keynesian economics, Hicks (1937, 152–53) distinguished between classical orthodox and the "revised and qualified Marshallian" theories—the former corresponds to the Cambridge quantity theory of money with a given proportion k between money and nominal income, while the latter acknowledges that the demand for money depends on the rate of interest (see also Laidler 1999, 310–13). The relevant comparison, according to Hicks, should be between Keynes and the revised theory of later Marshallians that prevailed when the *General Theory* was written, not between Keynes and the orthodox quantity theory of money. "Mr. Keynes in 1936 is not the first Cambridge economist to have a temperate faith in Public Works" (Hicks 1937, 154).

Hicks's suggested clarification of the difference between Keynes and the qualified classical theory is based on an analysis of the shape of his (Hicks's) LL curve (renamed LM by Hansen [1949]). The curve will tend to be "nearly horizontal" on the left (because of the floor to the rate of interest) and "nearly vertical" on the right, because there is an upper limit to the velocity of money (Hicks 1937, 154). This is illustrated in figure 1, where, as pointed out by Hicks, the LL curve approaches these limits asymptotically. Keynes's theory becomes relevant if, because of a weak inducement to invest or a high propensity to save, equilibrium lies on the left of the LL curve, since, on the one hand, the rate of interest is not influenced by real factors, and, on the other, income is not affected by changes in money supply. As stressed by Hicks, an increase in money supply cannot bring the interest rate down any further—the LL curve shifts to the right, but "the horizontal parts are almost the same" (155), as shown in figure 1. Therefore Keynes's theory is the "Economics of Depression" (155), a judgment that Hicks would repeat on other occasions: "The *General Theory* . . . is the book of the Great Depression

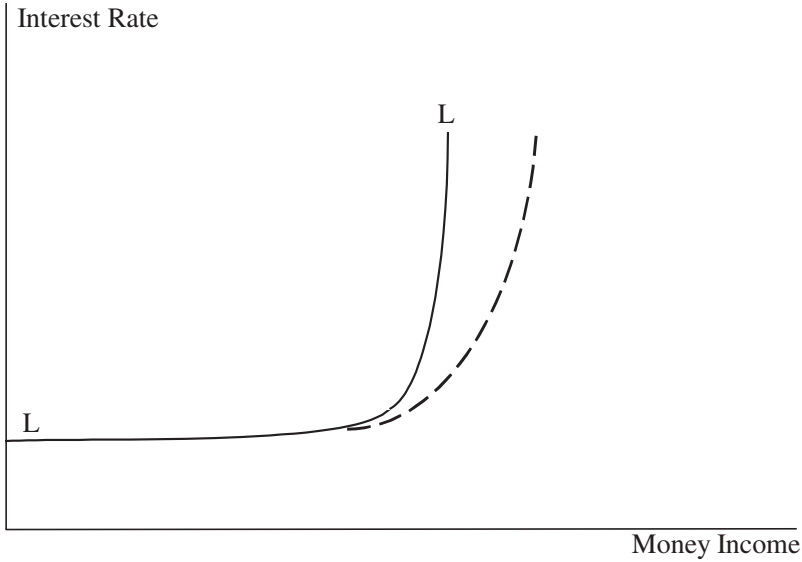

Figure 1 Hicks's LL curve with exogenous money supply (Hicks 1937, 153)

of the nineteen-thirties. . . . [Keynes's] practical problem was emergence from Depression; he looked at the world from a Depression point of view" (Hicks 1967a, 156, 169).[5]

Hicks's description of the *General Theory* in terms of the left section of the LL curve was motivated not only by the ineffectiveness of monetary policy in the Depression but also by his attempt to discuss Keynes's "startling conclusion" that an increase in the inducement to invest will not affect the rate of interest, but only employment (Hicks 1937, 152; cf. Keynes 1936, 165, 184). Dennis Robertson (1936, 182–83) discussed the point, arguing that Keynes's claim would be valid only if either "the liquidity schedule proper is perfectly elastic (the curve representing it a horizontal straight line)" or the monetary authority expands the money supply and holds the rate of interest down in the face of upward shifts of investment. Hicks had discussed the issue in his 1936 review of the *General Theory*, but he then focused the argument on the conditions for

5. Robert Skidelsky (1992, 440–41; 1996) argued for the notion that Keynes's *General Theory* was designed to supply a theory for the Great Depression, despite the absence of explicit references to that episode in the book.

the operation of the multiplier mechanism, which would bring about an increase in saving and, by that, in the supply of loanable funds (Hicks [1936] 1982, 90–91).[6] In the book review, he had not taken into account the increase of the interest rate caused by the effect of a higher income level on money demand, which is central to the 1937 IS-LM model.

Although Hicks finished writing his IS-LM paper in August 1936 (for presentation at the September 1936 conference of the Econometric Society; see Young 1987), before the publication of Robertson's 1936 article, he had access to preliminary drafts, as indicated by Robertson's (1936, 168) acknowledgment. Hence the shift in the argument between the 1936 review and the 1937 IS-LM article may in part reflect Robertson's influence, but Robertson's description of Keynes's argument in terms of a horizontal LM curve with perfectly elastic demand for money is much closer to Lange's (1938) later formulation than to Hicks's careful discussion of a floor to the rate of interest as the left part of the LM curve (see section 3). Furthermore, Robertson (1936, 183) decided to put aside the case of a horizontal liquidity schedule quoting a passage from the *General Theory* in which Keynes wrote that "whilst this limiting case might become practically important in the future, I know of no example of it hitherto" (207). This is in contrast with Hicks (1937, 1950, 1957), who, despite Keynes's ambiguity on the relevance of the interest rate minimum (see Patinkin 1976, 111–13; Laidler 1999, 258–59), had no doubts about its importance for Keynes's theory.

Regardless of whether Robertson had an influence on Hicks's discussion of the interest rate minimum in 1937, there is clear evidence that Hicks's description of the "qualified classical theory" was in great part a result of their correspondence about the first draft of Hicks's 1937 article (see Mizen and Presley 1998). However, Robertson did not share Hicks's implicit interpretation that the neo-Marshallians realized the full implications of the relation between money demand and interest for the analysis of the investment-saving process in general equilibrium. In particular, according to Robertson (1936, 188–90; 1940, 19, 34, 36), the pre-Keynesian literature did not take into account that an increase in the

6. Kregel (2000, 42–47) wrongly imputes to Hicks (1937) the argument that the horizontal stretch of the LM curve is based on the assumption of a high elasticity of supply of consumption goods or of money. The relation between Keynes's theory of the multiplier and the theory of interest rates was clarified by Kaldor (1939, sec. 3), who showed that the finance of long-term investment in the multiplier process depends on the stabilization of the long-term rate by speculators owing to a shortage of savings, not on the supply of cash by the banking system.

desire to save, even if it is spent on a purchase of securities, will not bring about an increase in investment in the same proportion. Pre-Keynesian economists overlooked the effect of a fall in the rate of interest (caused by an increase in the demand for securities) on money demand, which interrupts the fall in the rate of interest.

> Some part of the additional savings devoted by individuals to the purchase of securities will come to rest in the banking accounts of those who, at the higher price of securities, desire to hold an increased quantity of money. Thus the fall in the rate of interest and the stimulus to the formation of capital will be less than if the [liquidity schedule] were a vertical straight line, and the stream of money income will tend to contract. . . . Liquidity [is] a trap for savings. (Robertson 1936, 188–90)

> Thus owing to the existence of this sliding or trap, my act of thrift does not succeed, as "classical" theory asserts that it will, in creating incomes and money balances [in the capital goods sector] equal to those which it has destroyed [in the consumption goods sector]. (Robertson 1940, 19)

In terms of Hicks's 1937 model, Robertson's (1940, 34, 36) phrase "liquidity trap" describes a leftward shift of the IS curve along an upward-sloping LM schedule. Hicks (1957, 279, 285), however, was not convinced by Robertson's point that the argument about the general equilibrium effects of an increase in the propensity to save was not part of the pre-Keynesian tradition. According to Hicks, a "properly equipped 'classical' economist . . . *can* go so far" as recognizing that real shifts will have monetary effects if the interest rate elasticity of money demand is assumed.[7] In the same way—in contrast with Kaldor 1937, the first article to refer to Hicks's IS-LM diagram—Hicks (1957, 286–88) would not identify as originally Keynesian the notion that a reduction in money wages can only bring about an increase in income and employment through its effect on the position of the LM curve (cf. Keynes 1936, chap. 19).

However, Hicks would later change his interpretation of the relation between Keynesian and "classical" monetary theories. In his contribution to the *Chambers's Encyclopaedia*, Hicks (1967b, 621) pointed out that

7. It was in his review of Robertson's 1940 *Essays* that Hicks (1942, 56) used for the first time Robertson's phrase "liquidity trap for savings."

the "novelty" of the Keynesian theory of interest was that the long-term rate of interest, not just the short rate, is subjected to monetary influences. The "classical" tradition of Marshall and Hawtrey used to treat the money (or bill) market and the bond market as almost completely separate entities. Hence, although the "classics" had a theory of the short rate of a "liquidity preference type," they proposed a different theory for the long-term market as determined by real forces (see also Hicks 1989, chap. 9). Hicks's 1967 account differs from his 1937 minimization of the differences between Keynes and the neo-Marshallians, but it is not inconsistent with his discussion of the Keynesian floor to the long rate.

The notion that the short-term nominal interest rate cannot fall below zero was occasionally mentioned in the pre-Keynesian literature, usually in connection with the discussion of a deflationary process. This led "classical" authors to recognize the limitations of monetary policy in the Depression: "What if the rate of depreciation of prices is actually *greater* than the natural rate of interest? If that is so nothing that the bankers can do will make borrowing sufficiently attractive. . . . This phenomenon of stagnation will only be possible where the *expected* rate of depreciation of the prices of commodities happens to be high" (Hawtrey [1913] 1962, 186–87; emphasis in the original). The problem, then, from Ralph Hawtrey's point of view, is that the (Fisherian) expected real rate of interest is negative, but the bank rate cannot be lower than zero. Similar comments can be found in the second edition (1928) of Robertson's *Money* ([1922] 1948, 177) and in Pigou 1933, 213.

Hawtrey also introduced the related notion of a "credit deadlock." It may be impossible in a depression to expand the money supply through the banking system because of a crisis of confidence that affects both the demand and supply sides of the credit market (Hawtrey 1932, 172). Under these circumstances, open market operations are not able to increase money supply because banks are willing to hold excess reserves rather than lending. As indicated by Paul Wonnacott (1978, 193–94; see also Laidler 1999, 123, 286), the "excess reserve trap" argument advanced by Hawtrey is consistent with the quantity theory of money, since it is not about the ineffectiveness of changes in money supply (as in Hicks's 1937 liquidity trap discussion) but about the difficulty of increasing the money supply through the banking system in a depression. Despite the recognition in the pre-Keynesian literature of limits to monetary policy in a slump, those authors acknowledged that Keynes's (1936, 207) suggestion

of the possibility that "liquidity preference may become virtually absolute" at a low but positive long rate introduced a new element into the discussion. As pointed out by Hawtrey ([1937] 1952, 205), "Keynes rendered a service to economics in pointing out that [this problem] may occur at a stage when the long-term rate of interest is still some way above zero." From this point of view, Hicks's 1937 emphasis on the floor to the long-term rate as a Keynesian contribution is not contradicted by previous discussions of the zero lower bound in the "classical" literature. It does not reflect a "glut of capital" (since the capital stock is constant in the IS-LM model), but a reduction in aggregate demand. Also, in contrast with most of that literature, it is not based on the assumption of deflationary expectations.[8]

Hicks's 1937 formulation of the floor to the interest rate makes no reference to the banking system, which is also true of the basic version of his IS-LM model as a whole. Nevertheless, Hicks (1937, 157) did try to incorporate some features of a banking system by replacing the assumption of a given supply of money by a given "monetary system." As Hicks (1950, 142–43) pointed out later on, this becomes particularly important if under "money supply" one includes bank deposits, since the supply of deposits by the banking system is responsive to interest and income. The new LL curve will not feature in its right part a nearly vertical segment. The left part of the curve will remain the same, which is not clear in Hicks's (1937, 157) figure 3. Hicks (1950, 141) would provide the correct construction of the new LL curve under the assumption of endogenous money supply; it is reproduced as figure 2. If the monetary system is elastic—meaning that a rise in the rate of interest increases the supply of money—the economy will move from point P_1 on curve L to P_2' on L' (with a larger money supply) instead of P_2 on the old LL curve. The new LL curve is formed by connecting the dotted points, each one corresponding to a different money supply for a given elasticity of the monetary system (see also Bailey 1962, chap. 2). In the case of a perfectly elastic monetary system, the adjusted curve would become horizontal at the level of the interest rate minimum, corresponding to a mix of the Keynesian liquidity trap and the Wicksellian pure credit economy (cf. Hicks 1937, 158; 1957, 286).

8. The deflationary process is important, however, to explain what Hicks ([1939] 1946, 264–65) called "depression psychology," provoked by the impact of unexpected falling prices on the real value of debt.

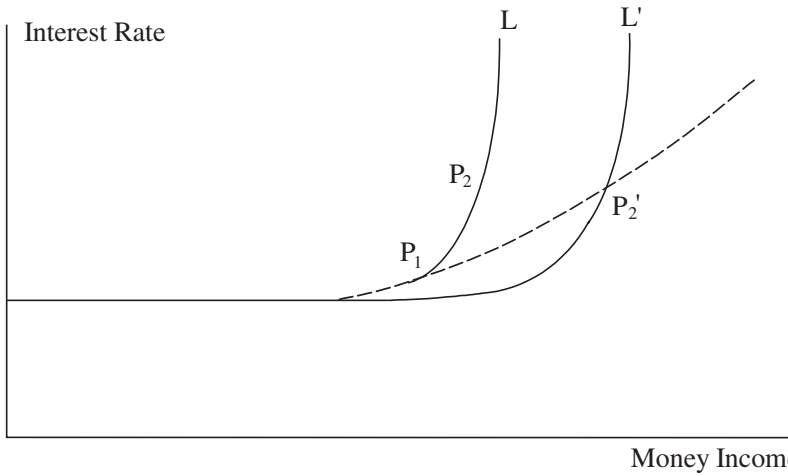

Figure 2 Hicks's LL curve with endogenous money supply (Hicks 1951, 141)

3. Hansen, Lange, and the Textbook IS-LM

Hicks's IS-LM analysis attracted the attention of the profession (Kaldor 1937; Modigliani 1944; Klein 1947; Hansen 1949, 1953) until it became the standard representation of "Keynesian economics." Before that, Oskar Lange (1938, 12 n. 1) put forward independently of Hicks (1937) an alternative diagrammatic analysis that also focused on the form of the LM function, which Lange (1938, 28) called the "isoliquidity curve." Like Hicks, Lange discussed under what conditions Keynes's claim—that the rate of interest does not react to changes in investment or saving—holds. Lange argued that Keynes "obviously . . . must have in mind" the limiting case when the "interest-elasticity of the demand for liquidity is infinite," and the isoliquidity curve "degenerates into a horizontal straight line"(19, 28, 31). The other special case is the traditional quantity theory of money, with a corresponding vertical isoliquidity curve.

Despite apparent similarities with Hicks (1937), their respective treatments are quite different. In Lange the issue is not the logical existence of a floor to the rate of interest created by a nearly zero short-term rate, but the empirical matter of the value of the interest elasticity of the demand for money, without any mention of the speculative demand for

money (or of the term structure of interest rates, for that matter). In Hicks's approach, money and securities necessarily become perfect substitutes when the short-term rate hits its lower bound. Accordingly, while Lange described Keynes's case as a completely horizontal LM curve, Hicks distinguished between the different parts of the LM curve. As shown in section 2, Hicks's LM can become completely horizontal only if the monetary system is perfectly elastic. Lange's approach has been adopted by several textbooks, especially when a linear formulation of the IS-LM model is deployed (see, e.g., Dornbusch and Fischer 1978, Gordon 2000, and Hall and Taylor 1986).

With Franco Modigliani (1944), the Keynes versus "classics" issue changed from the discussion of the specification of the money demand function to the determination of money wages in the labor market (see De Vroey 2000).[9] Modigliani used the long-period version of the general classical model with perfectly flexible wages as a benchmark for comparison with Keynes. The floor to the rate of interest is still relevant, but only if the assumption of rigid money wages is removed from Keynesian theory—as shown by Modigliani (1944, 74–75), if the interest rate is at its minimum level, a reduction of money wages will affect only the price level, with no effect on employment and real wages. Modigliani's (59) LL curve has the same shape as Hicks's original LL, with horizontal and vertical stretches on its left and right parts. He followed Hicks's *Value and Capital* closely in the explanation of the lower bound to the rate of interest by transaction costs (Modigliani 1944, 50–53, 83; but see note 2 above). Although Modigliani subscribed to Hicks's theory of the term structure, he did not apply it to the determination of a floor to the long-term rate of interest above the lower bound of the short rate (56).

Lawrence Klein (1947) moved the discussion to an econometric level. Instead of resorting to Keynes's hypothesis of infinite elasticity for money at some low interest rate (for which there was "not sufficient evidence"), Klein (1947, 72, 85) claimed that the data indicated that the saving and investment functions are interest inelastic. Accordingly, from Klein's point of view, the core of Keynesian economics is the proposition that there is no positive value of the rate of interest able to equilibrate saving and investment at full-employment income. This is illustrated in

9. David Champernowne (1936) anticipated Modigliani's (1944) emphasis on the labor market as the dividing line between Keynes and the classics (see Boianovsky 2005). Instead of Hicks's general equilibrium with simultaneous equations, Champernowne stressed the distinct causality structures of Keynes's and classical theories.

figure 3, which shows the saving and investment schedules (continuous lines) at full-employment income Y_0. Excess saving will be eliminated by a reduction of income to Y_1. Klein did not claim that the assumption of interest inelasticity of the investment function could be found in the *General Theory*—it pertained to Keynesian economics, not necessarily to the economics of Keynes. Klein (1947, 88) next argued that wage flexibility does not bring the economy to full employment if the IS function is very steep and the LM schedule features a horizontal stretch. Klein's discussion, however, was marred by his imprecise interpretation that a reduction in money wages shifts the whole LM schedule down, including its horizontal stretch. Although Klein distinguished sharply between the interest inelasticity and the liquidity trap arguments, it is clear enough that they are not entirely disconnected, since, as first stressed by James Tobin (1947, 127–28), the inconsistency between saving and investment arises from the impossibility of reducing the nominal rate of interest below its zero bound (see also Smith [1956] 1966, 42; Ackley 1961, 194–95; Bailey 1962, 48–49).

Klein's notion of a steep IS function was adapted by Hansen (1949, 79), with the suggestion that it becomes interest inelastic at low income levels only.[10] As shown in figure 4 (where income levels, as in Klein, are expressed in real, not nominal, terms; this makes no difference for the diagrammatic representation of a liquidity trap), the shape of Hansen's LM is very similar to Hicks's original LL (see also Hansen 1953, 146). At the point of intersection of the IS_1 curve and the LM_0 curve "monetary policy is ineffective" (Hansen 1949, 80). However, Hansen's explanation of the floor to the rate of interest differs from Hicks's (1937), as well as from Modigliani's (1944). According to Hansen (1949, 64–65; 78; 1953, 152), the floor to the rate of interest is explained by the fact that the compensation for bearing the risk of a change in (long-term) interest rates approaches zero as the interest rate declines.

Hansen's 1949 interpretation of the liquidity trap was not based on Keynes's (1936, 201) analysis of the behavior of speculators when the current long-term rate is below what they consider its normal, or "safe," value. Instead, Hansen built on another element mentioned by Keynes (1936, 169, 202), that is, the notion that every fall in the interest rate reduces the "insurance premium to offset the risk of loss on capital

10. Hansen (1949, 79–80) sometimes associated the interest inelasticity of the IS curve in a depression to capital saturation, but this is imprecise, since the capital stock is constant in the IS-LM model.

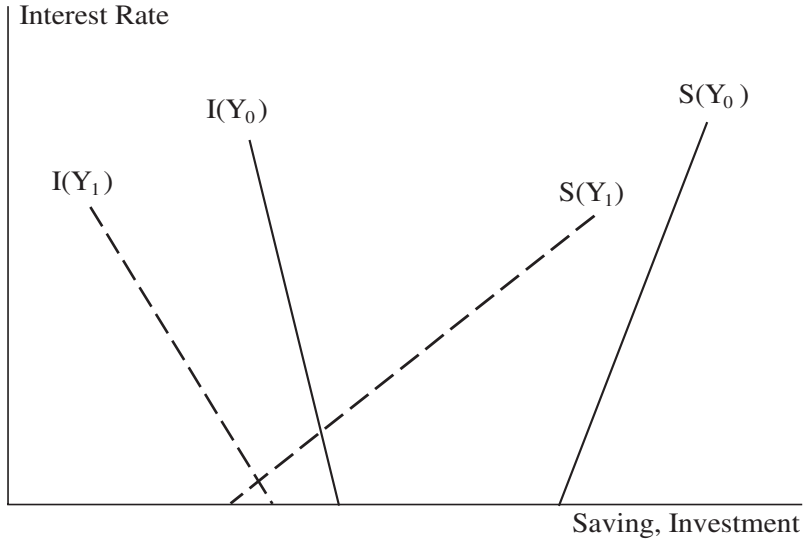

Figure 3 Klein's saving-investment inconsistency (Klein 1947, 85)

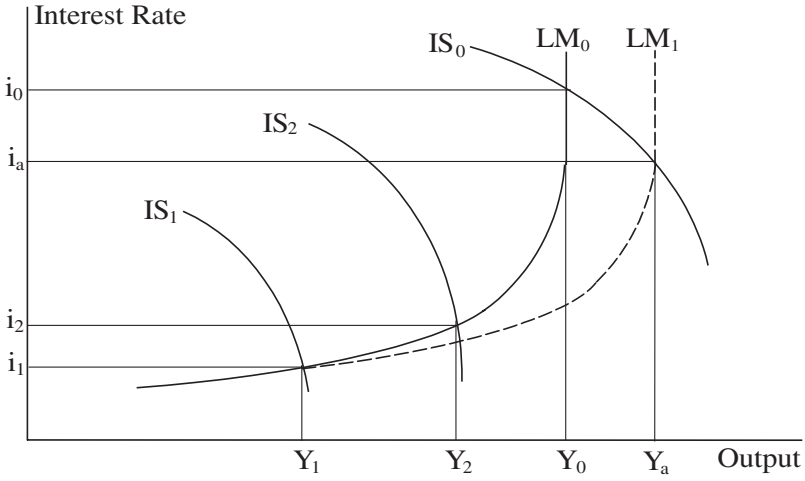

Figure 4 Hansen's IS-LM (Hansen 1949, 79)

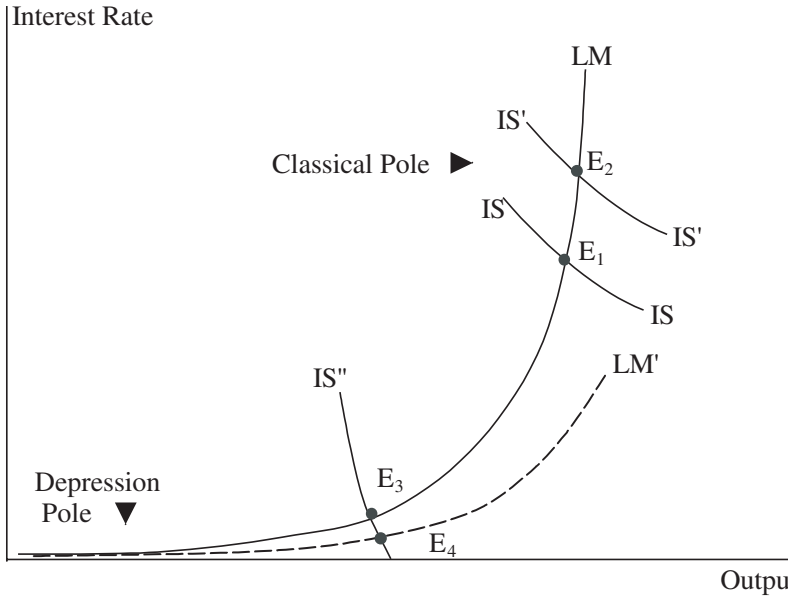

Figure 5 Samuelson's classical and depression poles (Samuelson 1967, 331)

account." Hansen's discussion is consistent with the argument developed by Tobin ([1958] 1966, 191) that, under the assumption of risk aversion, the interest elasticity of the demand for money increases as the rate approaches zero. Hicks ([1936] 1982, 96) had used the same argument in his review of the *General Theory*. Paul Samuelson reproduced Hansen's diagram in the seventh edition of his *Economics* (1967, 331; it was first introduced in the third edition [1955], without the "depression" and "classical" poles; see Pearce and Hoover 1995), with the difference that the left stretch of the LM curve approaches zero, instead of a positive interest rate. Samuelson probably had in mind a short-term rate, as suggested by his explanation that an increase in money supply (M) "by open-market purchases which involved swapping a close-money substitute Treasury bill for M itself" would leave the horizontal part of the LM curve "virtually unchanged."

Both Hansen and Samuelson dismissed the association of Keynesian economics with a liquidity trap, though. The notion that the IS-LM model (not just the liquidity trap region) represents "Keynesian economics" as

a whole is quite clear in Hansen's (1953, 147–48) assessment that Hicks provided the correct general equilibrium formulation by putting together Keynes and Robertson in the IS-LM model. The question remained, however, whether money wage flexibility could bring the economy to its full-employment output. It was in that context that the liquidity trap concept continued to attract attention in macroeconomic textbooks.

Gardner Ackley (1961, chap. 9) provided a careful textbook discussion of the speculative demand for money and of the liquidity trap as an obstacle to full employment. Although Ackley (1961, 363) used the Hicks-Hansen IS-LM model, his presentation of the liquidity trap was based on Keynes's hypothesis of regressive expectations, instead of Hicks's (1937) term structure formulation or Hansen's (1949) risk aversion argument. Ackley was probably influenced by Joan Robinson's ([1951] 1952) and Tobin's ([1958] 1966) reexamination of Keynes's theory of liquidity preference. Keynes's (1936, chap. 15) discussion of the circumstances in which liquidity preference becomes "virtually absolute" was marred by his tendency to interpret that phenomenon as a generalization of his speculative demand for money because of uncertainty as to the future of the rate of interest. As explained by Kaldor (1939) and by Robinson ([1951] 1952), Keynes's argument about the floor to the long rate of interest does not depend on uncertainty, since it is the very confidence with which speculators believe in the normal price of bonds that makes it difficult to reduce the rate of interest. "In the limit, if the market confidently believes that from tomorrow the rate of interest will be at its past average value, the long and the short rate will be equal to that value today. In this case liquidity preference in Keynes' sense is absolute" (Robinson [1951] 1952, 17–18).

Keynes's model of regressive interest expectations, as elaborated by Robinson, does not lead to a gap between the short and long rates of interest in the liquidity trap, in contrast with Hicks's 1937 formulation. Furthermore, the "normal" rate is not a constant magnitude, but it falls if the current long rate is continuously lower than the expected rate and if bear speculators are convinced that "the new low rate has come to stay," which may shift downward the whole LM curve over time (Robinson [1951] 1952, 30; Ackley 1961, 198–201).[11]

11. Hicks (1967a, 96–97) explained the fall in the long-term interest rate in Great Britain in the mid-1930s along similar lines. According to Hicks, "the basic thing that was needed was a continuation of monetary ease, and an expectation that this ease would go on. . . . So long as the pattern of expectations remained as I have been describing it, a 2 per cent Bank rate was bound to press down the long-term rate, even to fairly low levels." As pointed out by Hicks, in the

By 1957, when Hicks reexamined his IS-LM framework, he added another factor that could also prevent the working of the interest mechanism: interest inelasticity of the IS curve à la Klein (Hicks 1957, 288). Hicks's (1937, 153) original IS schedule was drawn as an elastic curve, to represent Keynes's view that the effect of changes in the long rate on investment "was of major importance" (Hicks 1967a, 54). Furthermore, Hicks (1967a, 57–58) criticized Keynes for confusing two different issues that should be kept apart: the short-period question about the effectiveness of monetary policy in the Depression and the ability of the financial system to adjust to a condition in which the marginal productivity of capital has fallen permanently (cf. Friedman 1970, 212–15; and Laidler 1999, 263–65). Hicks's 1937 IS-LM discussion of the liquidity trap applied to a cyclical, not permanent, change of the marginal productivity of capital. "The long-period question, I now hold, is rather different. While one can understand that large balances may be held idle for considerable periods, for a speculative motive, it is harder to grant that they can be so held indefinitely" (Hicks 1967a, 58). Hicks suggested that the idea of a floor to the long-term rate of interest in long-period equilibrium could still be used, but it should be interpreted as a result of the fact that even if the rate set by the central bank is reduced to zero, the marginal cost of capital to industry will not be so reduced because of costs of financial intermediation associated with information problems and risk evaluation of potential borrowers—a supply side phenomenon, instead of the usual short-period liquidity trap.

4. The Recent Approach to the Liquidity Trap

The Keynesian liquidity trap argument gradually receded into the background in the macroeconomic literature of the 1970s and 1980s.[12] The increasing attention devoted to the microfoundations of price and wage rigidity was one reason behind the relative marginalization of IS-LM analysis (see Dixon and Gerrard 2000). Hicks himself was part of that shift with his contributions to the fixprice literature (see his 1979 account

mid-1930s the Bank of England started to target the interest rate instead of the exchange rate. See also Roberts 1995 for a discussion of the relation between the gold standard and Keynes's treatment of the liquidity trap.

12. Tobin 1980, 5, was an exception. Tobin then explained a liquidity trap along Hicksian lines, that is, by the fact that "the absolute floor for nominal interest rates is zero," together with the notion that "long term rates . . . would be held above zero by expectations . . . that short rates will rise from rock bottom in future."

of how he moved beyond "IS-LM Keynesianism" after the late 1950s). Another reason was the long experience with significant inflation rates in Europe, Japan, and the United States, accompanied by high nominal interest rates. Hicks (1979, 994) remarked that "one can see why [the liquidity trap] appeared, in the thirties, to be such an important matter; in the inflationary conditions to which we have now become accustomed, it is irrelevant." Hicks's (1982, 263; 1989, 79) discussion in the 1980s of the determination of the interest rate indicates that inflation had moved the old liquidity trap idea out of his research agenda, which helps explain why the floor to the rate of interest is absent from his 1980–81 "explanation" of IS-LM.

Furthermore, the traditional notion of a liquidity trap suffered from the growing criticism of the concept of a speculative demand for money—whether in its Keynesian or Tobinian formulations—and from Patinkin's ([1956] 1965, 1959) real balance effect. Already in the second edition of his *Value and Capital* ([1939] 1946, 335), Hicks realized that his demonstration of the absolute instability of the economy, under the assumption of unit elasticity of price expectations and a floor to the rate of interest, was valid only if the "income effect" of price changes was disregarded. However, in his 1957 review of Patinkin, Hicks wrongly interpreted the real balance effect as shifting the LM curve only, which led to Patinkin's (1959) critical reaction. The lack of empirical support for a liquidity trap (in the Hansen-Tobin sense) in econometric studies of the demand for money carried out in the 1960s also contributed to the criticism of that concept (Laidler 1969, chap. 9).

The return of the liquidity trap concept to the research agenda of monetary macroeconomics in the late 1990s is not explained by new econometric evidence on the interest elasticity of money demand (Miyao 2002; Hondroyiannis, Swamy, and Tavlas 2000). Instead, it reflects changes in the economic environment, with deflationary tendencies in Japan and near price stability in the United States and Europe. Moreover, the criticism of the traditional Keynesian approach to the demand for money, as well as the focus on an economy with multiple financial assets, has brought monetary theory closer to Hicks's (1935, [1939] 1946) treatment. This was already visible in Ackley's (1978, 715–31) detailed discussion of the term structure of interest rates. The term structure is also prominent in Olivier Blanchard's (1997, chap. 9) treatment of the IS-LM model.

The new generation of optimizing IS-LM models (McCallum 1989, 102–7; Krugman 1998, 142–49; McCallum and Nelson 1999; Walsh 2003, 230–40) approaches the money demand function in terms of a model of money as a medium of exchange (money-in-the-utility-function, shopping time, or cash-in-advance models), with the general result that the (short-term) nominal interest rate is positive only if money yields liquidity services (Walsh 2003, 49, 107). This is a formalization of Hicks's insight in chapter 13 of *Value and Capital*. If money has no storage costs and there is a finite level of money balances at which there is satiation with the transaction services of money, it will be possible to reduce the nominal rate all the way to zero (McCallum 2000, 875–76). Otherwise, there will be a liquidity trap at a low positive short-term nominal interest rate. As discussed above, Hicks and his followers assumed that the lower bound to the short nominal rate was generally slightly above zero, but this makes no real difference for the analysis of a liquidity trap.

Allan Meltzer (1995, 1999) has criticized the transmission mechanism of the IS-LM model and its implications for the interpretation of a liquidity trap. According to Meltzer, the IS-LM approach does not take into account the positive effect of an increase in money supply on the price of securities and, by that, on the value of financial wealth, explained by the imperfect substitutability between alternative financial assets. Meltzer claims that monetary policy remains effective even if the short rate hits its lower bound, since the central bank may buy or sell long-term assets that are not perfect substitutes for money and do not have a zero yield. Meltzer's interpretation of the transmission mechanism is reminiscent of Hicks's (1967a, 51–53; 1974, 52–53) "liquidity pressure effect" on investment. Such a liquidity effect will be stronger the larger the proportion of reserves held in relatively "long" assets. However, in contrast with Meltzer, Hicks (1967a, 52; 1974, 53) was skeptical of the general effectiveness of a "liquidity pressure effect" in a depression, since an increase in money supply should only be able to reduce longer-term interest rates if such action is interpreted as a change in the central bank's commitment regarding the future path of short-term rates (see also Eggertsson and Woodford 2003, sec. 2; and note 11 above).

Apart from the specification of the LM curve as a function of the (short-term) nominal rate of interest, another important feature of optimizing IS-LM models is the assumption that the IS curve is a function of the expected (long-term) real interest rate. The notion that nominal rates

matter for money demand, while real rates are relevant for investment, was advanced by William Vickrey (1954, 92–93) and applied to the IS-LM model by Martin Bailey (1962, 50–51). Vickrey's essay became well known for introducing the notion of programmed inflation to counteract the limits imposed by the interest rate lower bound on the effectiveness of monetary policy. Hicks ([1939] 1946) was aware of the distinction between real and nominal interest rates, which had been introduced by Irving Fisher (1896).[13] However, in the framework of *Value and Capital*, the assumption of an elasticity of 1.0 of price-expectations was enough to yield Hicks's instability results. The crucial issue, from the perspective of the modern literature, is that expected deflation puts a floor to real interest rates and limits the effectiveness of monetary policy (see, e.g., Blanchard 1997, 573). If the central bank follows a Wicksell-Taylor interest rate feedback rule—whereby the short-term nominal rate is set as an increasing and nonnegative function of the inflation rate—it can be shown that deflationary expectations, together with a lower bound to the nominal interest rate, may lead to a self-fulfilling deflationary spiral that cannot be avoided by monetary policy (see Benhabib, Schmitt-Grohé, and Uribe 2002; Walsh 2003, 484–87).[14]

Another factor that may bring about a liquidity trap in recent discussion is the possibility that the Wicksellian "natural rate of interest" is negative (Krugman 1998, 2000a). As discussed above, Klein (1947) associated that possibility with the interest inelasticity of saving and investment. In the modern literature, the natural rate of interest, as decided by the rate of time preference à la Ramsey, will be negative if the marginal utility of consumption in the next period is greater than in the current period, which will happen if people expect their income to fall in the future (cf. Krugman 1998, 150). Alfred Marshall ([1890] 1990, 192–93) had entertained the possibility of a negative natural rate on those grounds, but did not realize that, in a monetary economy, the actual rate of interest could never be lower than zero. Krugman's scenario has some similarities with A. C. Pigou's famous 1943 article. However, while for Pigou the

13. See Hicks [1939] 1946, 119, 160. After Wicksell, Hicks called the rate of interest in terms of goods the "natural" rate. It should be noted that Hicks's proposition about zero interest rate in the absence of transaction frictions applies to the nominal, not the natural, rate.

14. The modern notion of a liquidity trap can also be applied if the usual LM curve is replaced by the assumption that the central bank follows an interest rate rule (see Romer 2000). It is worth noting that Romer's curve differs from Hicks's suggestion of an elastic LM curve, since Hicks had in mind reactions by the private banking system to changes in the interest rate, not an interest rate rule set by a central bank.

economy will eventually converge to its full-employment growth path through the effect of falling prices on shifting the saving function, Krugman argues that a fall in current prices will bring the economy back to full-employment equilibrium only if it represents an increase in the ratio between the expected future and the current price levels and, by that, a reduction in the expected real rate of interest to the level of the negative natural rate of interest.

The real balance effect is not generally part of the Euler condition used in deriving the IS function in recent optimizing IS-LM models. A real balance effect would arise if real balances entered the representative agent's utility function and this function was nonseparable with a positive cross-derivative between consumption and real balances (McCallum 2000, 882–83; Woodford 2003, 102–4). However, even if a real balance effect is present in the IS function, this effect vanishes when the short-term nominal interest rate falls to its lower bound. As pointed out by Michael Woodford (131–35), additional real balances affect the marginal utility of expenditure only to the extent they can reduce the short-term nominal rate, which indicates the value of further reduction in transaction frictions from holding more wealth in money form. Hence the real balance effect, as a liquidity effect, will not work under liquidity trap conditions (see also Rabin and Keilany 1986–87). Nevertheless, the real balance effect might still work as a wealth effect if consumption is a function of permanent income and population is growing, so that money can be treated as net wealth outside the standard representative agent framework (see Ireland 2001; Walsh 2003, 487–88).[15]

5. Krugman, Expectations, and the IS-LM Model

Krugman's (1998, 2000a) discussion of the liquidity trap concept is particularly relevant for the purposes of the present essay, since he presents it as part of an intended reformulation of Hicks's original IS-LM model (on Krugman's argument, see also Wilson 1999, Kregel 2000, Sumner

15. Before the revival of interest in the liquidity trap, the notion of a zero interest rate was usually associated in monetary economics with Milton Friedman's (1969, chap. 1) proposition that only deflationary monetary policies that generate a zero nominal interest rate will lead to satiation in money demand and, therefore, to optimality. Uhlig (2000) discussed the contrast between Friedman's framework and the depression scenario of the recent liquidity trap literature.

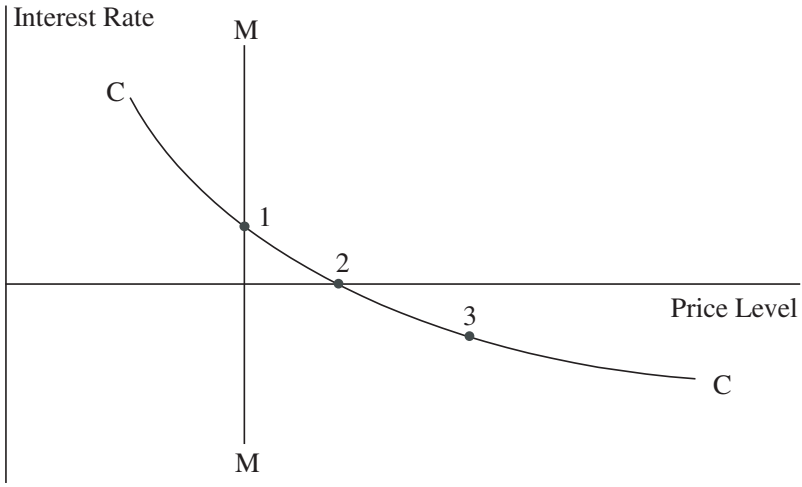

Figure 6 Krugman's IS-LM with flexible price level (Krugman 1998, 145)

2002, and Eggertsson and Woodford 2003). Krugman (1998, 138–39, 142–45; 2000a, 224–27) put forward a simple rational expectation model of a representative agent that maximizes its intertemporal utility function and demands money according to a cash-in-advance constraint in an endowment economy. Under the assumption that there is no uncertainty and that the nominal rate of interest on one-period bonds is positive, the cash-in-advance constraint is binding and the quantity theory of money applies: $P = M/y$, where y is the output level (see also Boianovsky 2002). This relationship is represented by the line MM in figure 6, which describes equilibrium in the market for money. The IS curve is obtained from the equilibrium in the market for goods, derived by Krugman from the Euler equation for consumption: $(1 + i)(P_t/P_{t+1}) = (1/D)(y_{t+1}/y_t)^{\rho}$, where D and ρ stand for the discount factor and relative risk aversion, respectively. The price level in the next period (P_{t+1}) is determined by M_{t+1} and y_{t+1}, which are assumed to be given constants. Hence a rise in the current price level generates expected deflation and a lower nominal rate of interest, for a given real (or "natural") interest rate, which explains the inverse relation illustrated by the curve CC.

Patinkin ([1956] 1965, 233) advanced the representation of equilibrium in the markets for money and for goods in a flexible price economy in (i, P) space (see also Krugman 2000b). It is implicit in chapter 22 of

Hicks's *Value and Capital*. In terms of Hicks's framework, Krugman's assumption that the future expected price level (P_{t+1}) remains constant when the current price level (P_t) changes means that the elasticity of price expectations is zero. As discussed above, this implies, according to Hicks, that the system can be stabilized through intertemporal substitution, which is exactly Krugman's conclusion.

Any increase in the current money supply—for a given long-run money supply and expected price level in future periods—past point 2 has no effect on the price level, since, at zero nominal interest rates, the cash-in-advance demand for real money balances is indeterminate because money is also held as a store of value. Money and bonds become perfect substitutes, and the cash-in-advance constraint is no longer binding at the zero lower bound. In this context, a liquidity trap arises if the economy is beset by deflationary expectations that shift the CC curve to the left or if the natural interest rate is negative because of the time preferences of individuals. Krugman (1998, [1999] 2000, 2000a) discusses mainly the last factor, which he applies to the Japanese economy in the late 1990s (see also Kuttner and Posen 2001). Under these circumstances, the current price level will fall in relation to the expected future price level, with an ensuing reduction of the Fisherian real expected rate of interest to the negative equilibrium level of the Wicksellian natural rate of interest. Again, it is Krugman's assumption that the expected price level is given—in contrast with Hicks's unit elasticity of price expectations—that is behind the equilibration mechanism that prevents a cumulative price fall in the liquidity trap. Hicks ([1939] 1946, 271, 298) mentioned that "people's sense of normal prices" might counteract the initial effects of the unit elasticity of price expectations and stabilize the economy in a depression.

Krugman next investigates the role of monetary policy in a liquidity trap under the assumption that the price level in the current period is predetermined and that the consumption good is produced. The equation for the IS curve is now given by $y = y_{t+1}(P_{t+1}/DP_t)^{1/\rho}(1 + i)^{-1/\rho}$, which is drawn as curve CC in the (i, y) space in figure 7. Once again, expansionary money supply will not be able to increase output beyond point 2. Nevertheless, in Krugman's framework, this is true only if individuals see monetary expansion as transitory, that is, if the future money supply is held constant. Even if the nominal rate of interest is zero, an increase in the money supply perceived to be permanent will raise current prices in the flexprice model, or output in the sticky price model.

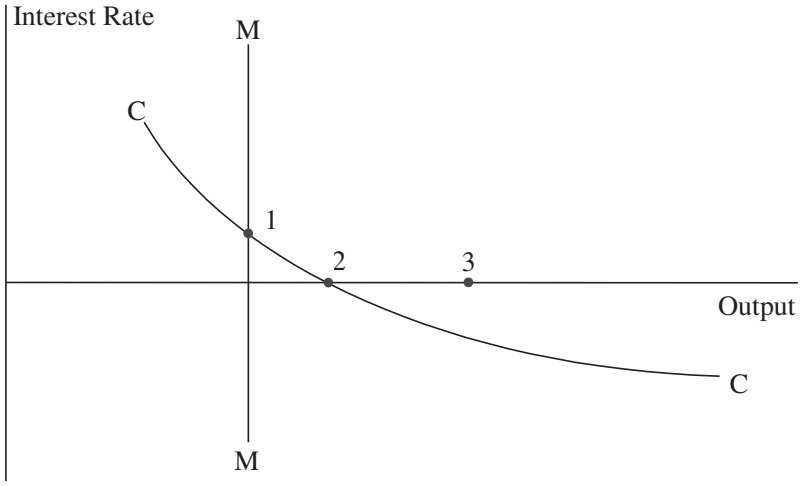

Figure 7 Krugman's IS-LM with predetermined price level (Krugman 1998, 149)

The upshot is that the liquidity trap concept now involves a "credibility problem": monetary policy is ineffective only if people do not believe that monetary expansion will be kept in the future (Krugman 1998, 142, 161).

The notion that expected inflation could provide a way out of the impasse posed by a negative natural rate of interest could be found already in Vickrey 1954 and Bailey 1962, 101. Bailey dismissed its practical relevance on the grounds that "there is nothing to assure that such expectations will develop." Krugman, though, has claimed that inflationary expectations can be generated by the perception by forward-looking consumers of the future path of money supply. The assumption of forward-looking expectations has implications not just for the liquidity trap concept but for the interpretation of the IS-LM model as a whole. Indeed, as pointed out by Axel Leijonhufvud (1983, 1987), traditional IS-LM analysis is based on the notion that disturbances that shift one of the curves will not at the same time affect the position of the other curve, which is not true under a rational expectations equilibrium. In particular, an anticipated monetary impulse will shift both IS and LM schedules, with the implication that the interest elasticity of the two curves is largely irrelevant for the monetary transmission mechanism in general and for the liquidity trap in particular (see also Christiano 2000; Krugman and

Obstfeld 1994, 392, 456, 474; Krugman and Obstfeld 2003, 499–501; Gordon 2000, 135–38; Mankiw 2003, 303).

Although Hicks ([1936] 1982, 88) hailed Keynes's notion that short-period equilibrium depends on the state of expectations, he was critical of the assumption that such expectations could be treated as given when economic policy changes. In *Value and Capital*, expectations of price are determined by autonomous changes in the state of the "news" and by the elasticity of price expectations (204). Hicks ([1939] 1946, 277–79) showed how an autonomous rise in price expectations will shift demand in favor of current commodities at the expense of securities or money, with an ensuing increase in current prices. He did not apply that to the discussion of the liquidity trap concept, though. Later on Hicks (1969, 315; see also Hicks 1989, chap. 11) would point out that "expectations of the future (entirely rational expectations) are based upon the data that are available in the present." Although that passage indicates that Hicks could be aware of some of the issues that would be raised by Leijonhufvud (1983) concerning the interdependence of the IS and LM curves under forward-looking expectations, there is no recorded reaction by Hicks (who died in 1989) to Leijonhufvud's comments and to their implications for the analysis of the liquidity trap concept.

6. Conclusion

Hicks's formulation of a long-term interest rate minimum in the 1937 IS-LM article was based on his theory of the determination of the short-term rate by the marginal value of liquidity and of the long rate by the term structure, plus the double assumption of elastic price expectations and inelastic interest expectations. The theory of interest developed in *Value and Capital* has provided the foundation for much of the modern approach to the determination of interest rates, which explains why Hicks's 1937 presentation of the liquidity trap argument is in many ways closer to the recent discussion than Keynes's or the traditional textbook version built on Hansen or Lange. Despite similarities between Hicks's original treatment and recent literature, it should be noted that Hicks's 1937 emphasis on a positive floor to the long-term rate of interest has not been shared in the theoretical discussion triggered by the Japanese depression of the late 1990s. Instead, the focus is on the lower bound to the short-term interest rate used as an instrument of monetary policy by the central bank. Accordingly, the rate of interest determined in

recent optimizing IS-LM models is the rate on a one-period bond. This is reminiscent of Hicks's ([1939] 1946) discussion of a spot economy with short loans only. Although it is occasionally mentioned (see, e.g., Krugman 1998, 146) that in a liquidity trap the interest rate is zero (or nearly so) on short-period bonds only, this is not generally incorporated into recent models. In any event, the implicit justification for such an approach is that long-term interest rates are also bound as soon as the short rates have hit their (near) zero lower bound, which is consistent with Hicks's 1937 insight.

As noted by Hicks (1969, 314), the "famous trouble of the 'floor' to the rate of interest" is "one of the legacies to 'modern' Keynesian economics of Keynes's preoccupation with the long rate." However, a liquidity trap may also arise in IS-LM models where the short rate is used as the representative interest rate; in this case the floor will be (near) zero. By focusing analytically on the short-rate minimum, the recent literature is led to stress deflationary expectations (just like some pre-Keynesian authors) or a negative natural rate of interest as necessary conditions for the emergence of a liquidity trap. Both elements are sufficient but not necessary conditions for the 1937 demonstration of a Hicksian liquidity trap. In the same vein, the possibility of a liquidity trap in recent discussion is not related to the interest elasticity of money demand or to the slope of the LM curve, since, by definition, money and bonds become perfect substitutes when the short rate hits its (near) zero lower bound. This is illustrated by Krugman's formulation of a vertical LM curve to investigate the liquidity trap concept.

The revival of interest in the notion of a liquidity trap has not been generally motivated—in contrast with the discussion by Hicks, Lange, and (to a lesser degree) Modigliani and Hansen—by an attempt to use the IS-LM model to distinguish between Keynesian and classical economics. We have seen that the liquidity trap concept played a key role in Hicks's IS-LM exercise in part because of his encompassing description of neo-Marshallian monetary theory. Hicks's suggestion that the *General Theory* is the economics of depression has been controversial in macroeconomic theory, but it did bring to the fore the idea of demand failures that cannot be corrected by cutting the interest rate all the way to its lower bound. This is the aspect of the liquidity trap concept that has attracted most attention recently (see, e.g., Krugman [1999] 2000, chap. 9), together with the possibility of deflationary spirals if the central bank follows a Wicksell-Taylor rule for the interest rate (Benhabib,

Schmitt-Grohé, and Uribe 2002). Hicks was aware that the notion of a liquidity trap—and of aggregate instability in general—depends heavily on the assumption about price expectations. The instability results of his classic 1939 book and of the 1937 article are built on the assumption of unit (or higher) elasticity of price expectations. The notion of elasticity of price expectations (adaptative expectations) has been replaced in the new generation of IS-LM models by forward-looking expectations, which has led to further developments of Hicks's original liquidity trap concept.

References

Ackley, G. 1961. *Macroeconomic Theory*. New York: Macmillan.

———. 1978. *Macroeconomics: Theory and Policy*. New York: Macmillan.

Bailey, M. J. 1962. *National Income and the Price Level*. New York: McGraw-Hill.

Benhabib, J., S. Schmitt-Grohé, and M. Uribe. 2002. Avoiding Liquidity Traps. *Journal of Political Economy* 110.3:535–63.

Blanchard, O. 1997. *Macroeconomics*. Upper Saddle River, N.J.: Prentice Hall.

Boianovsky, M. 2002. Simonsen and the Early History of the Cash-in-Advance Approach. *European Journal of the History of Economic Thought* 9.1:57–71.

———. 2005. Some Cambridge Reactions to the *General Theory*: David Champernowne and Joan Robinson on Full Employment. *Cambridge Journal of Economics* 29.1.

Champernowne, D. G. 1936. Unemployment, Basic and Monetary: The Classical Analysis and the Keynesian. *Review of Economic Studies* 3:201–16.

Christiano, L. 2000. Comment on Theoretical Analysis Regarding a Zero Lower Bound on Nominal Interest Rates. *Journal of Money, Credit, and Banking* 32.4:905–30.

Coddington, A. 1979. Hicks's Contribution to Keynesian Economics. *Journal of Economic Literature* 17:970–88.

De Vroey, M. 2000. IS-LM à la Hicks versus IS-LM à la Modigliani. *HOPE* 32.2:293–316.

Dixon, H., and B. Gerrard. 2000. Old, New, and Post Keynesian IS-LM Framework: A Contrast and Evaluation. In *IS-LM and Modern Macroeconomics*, edited by W. Young and B. Zilberfarb. Boston: Kluwer.

Dornbusch, R., and S. Fischer. 1978. *Macroeconomics*. Tokyo: McGraw-Hill.

Eggertsson, G., and M. Woodford. 2003. The Zero Bound on Interest Rates and Optimal Monetary Policy. *Brookings Papers on Economic Activity*, no. 1:139–233.

Fisher, I. 1896. *Appreciation and Interest*. New York: Macmillan.

Friedman, M. 1969. *The Optimum Quantity of Money and Other Essays*. Chicago: Aldine.

———. 1970. A Theoretical Framework for Monetary Analysis. *Journal of Political Economy* 78.2:193–238.

Froyen, R. 2002. *Macroeconomics: Theories and Policies*. 7th ed. Upper Saddle River, N.J.: Prentice Hall.
Fuhrer, J., and B. Madigan. 1997. Monetary Policy When Interest Rates Are Bound at Zero. *Review of Economics and Statistics* 79.4:573–85.
Gärtner, M. 2003. *Macroeconomics*. Harlow, U.K.: Financial Times/Prentice Hall.
Gordon, R. 2000. *Macroeconomics*. 8th ed. Boston: Addison-Wesley.
Grandmont, J.-M., and G. Laroque. 1976. The Liquidity Trap. *Econometrica* 44.1:129–35.
Haberler, G. 1946. *Prosperity and Depression*. 3rd ed. New York: United Nations.
Hall, R., and Taylor, J. 1986. *Macroeconomics: Theory, Performance, and Policy*. New York: Norton.
Hansen, A. 1949. *Monetary Theory and Fiscal Policy*. New York: McGraw-Hill.
———. 1953. *A Guide to Keynes*. New York: McGraw-Hill.
Hawtrey, R. G. 1932. *The Art of Central Banking*. London: Longman.
———. [1937] 1952. *Capital and Employment*. 2nd ed. London: Longmans, Green.
———. [1913] 1962. *Good and Bad Trade*. New York: A. M. Kelley.
Hicks, J. 1935. A Suggestion for Simplifying the Theory of Money. *Economica* 2:1–19.
———. 1937. Mr. Keynes and the "Classics": A Suggested Interpretation. *Econometrica* 5:147–59.
———. 1942. The Monetary Theory of D. H. Robertson. *Economica* 9:53–57.
———. [1939] 1946. *Value and Capital*. 2nd ed. Oxford: Clarendon.
———. 1950. *A Contribution to the Theory of the Trade Cycle*. Oxford: Clarendon.
———. 1957. A Rehabilitation of "Classical" Economics? *Economic Journal* 67:278–89.
———. 1967a. *Critical Essays in Monetary Theory*. Oxford: Clarendon.
———. 1967b. Interest. In vol. 7 of *Chambers's Encyclopaedia*. London: Pergamon.
———. 1969. Automatists, Hawtreyans, and Keynesians. *Journal of Money, Credit, and Banking* 1:307–17.
———. 1974. *The Crisis in Keynesian Economics*. Oxford: Basil Blackwell.
———. 1979. On Coddington's Interpretation: A Reply. *Journal of Economic Literature* 17:989–95.
———. [1936] 1982. Mr. Keynes' Theory of Employment. In Hicks 1982.
———. [1980–81] 1982. IS-LM: An Explanation. In Hicks 1982.
———. 1982. *Money, Interest, and Wages*. Cambridge: Harvard University Press.
———. 1989. *A Market Theory of Money*. Oxford: Clarendon.
Hondroyiannis, G., P. Swamy, and G. Tavlas. 2000. Is the Japanese Economy in a Liquidity Trap? *Economics Letters* 66:17–23.
Ireland, P. 2001. The Real Balance Effect. NBER Working Paper no. 8136.
Kaldor, N. 1937. Prof. Pigou on Money Wages in Relation to Unemployment. *Economic Journal* 47:745–53.
———. 1939. Speculation and Economic Stability. *Review of Economic Studies* 7:1–27.

Kalecki, M. [1943] 1991. *Studies in Economic Dynamics*. In vol. 2 of *Collected Works of Michal Kalecki*, edited by J. Osiatynsky. Oxford: Clarendon.

Keynes, J. M. 1936. *The General Theory of Employment, Interest, and Money*. London: Macmillan.

Klein, L. R. 1947. *The Keynesian Revolution*. New York: Macmillan.

Kregel, J. 2000. Krugman on the Liquidity Trap: Why Inflation Won't Bring Recovery to Japan. *Economia* 1.1:39–58.

Krugman, P. 1998. It's Baaack: Japan's Slump and the Return of the Liquidity Trap. *Brookings Papers on Economic Activity*, no. 2:137–205.

———. [1999] 2000. *The Return of Depression Economics*. 2nd ed. London: Penguin.

———. 2000a. Thinking about the Liquidity Trap. *Journal of the Japanese and International Economies* 14:221–37.

———. 2000b. How Complicated Does the Model Have to Be? *Oxford Review of Economic Policy* 16:33–42.

Krugman, P., and M. Obstfeld. 1994. *International Economics*. 3rd ed. New York: Harper Collins.

———. 2003. *International Economics*. 6th ed. Boston: Addison-Wesley.

Kuttner, K., and A. Posen. 2001. The Great Recession: Lessons for Macroeconomic Policy from Japan. *Brookings Papers on Economic Activity*, no. 2:93–185.

Laidler, D. 1969. *The Demand for Money: Theories and Evidence*. Scranton, Pa.: International Textbook Company.

———. 1999. *Fabricating the Keynesian Revolution*. Cambridge: Cambridge University Press.

Lange, O. 1938. The Rate of Interest and the Optimum Propensity to Consume. *Economica* 5:12–32.

Leijonhufvud, A. 1983. What Was the Matter with IS-LM? In *Modern Macroeconomic Theory: An Overview*, edited by J.-P. Fitoussi. Oxford: Basil Blackwell.

———. 1987. IS-LM Analysis. In vol. 2 of *The New Palgrave: A Dictionary of Economics*, edited by J. Eatwell, M. Milgate, and P. Newman. London: Macmillan.

Malkiel, B. 1966. *The Term Structure of Interest Rates*. Princeton, N.J.: Princeton University Press.

Mankiw, N. G. 2003. *Macroeconomics*. 5th ed. New York: Worth.

Marshall, A. [1890] 1990. *Principles of Economics*. London: Macmillan.

McCallum, B. T. 1989. *Monetary Economics*. New York: Macmillan.

———. 2000. Theoretical Analysis Regarding a Zero Lower Bound on Nominal Interest Rates. *Journal of Money, Credit, and Banking* 32:870–904.

McCallum, B. T., and E. Nelson. 1999. An Optimizing IS-LM Specification for Monetary Policy and Business Cycle Analysis. *Journal of Money, Credit, and Banking* 31:296–316.

McKinnon, R., and K. Ohno. 1997. *Dollar and Yen: Resolving Economic Conflict between the United States and Japan*. Cambridge: MIT Press.

Meltzer, A. 1995. Monetary, Credit, and (Other) Transmission Processes: A Monetarist Perspective. *Journal of Economic Perspectives* 9.4:49–72.

———. 1999. Commentary: Monetary Policy at Zero Inflation. In *New Challenges for Monetary Policy*. Kansas City, Mo.: Federal Reserve Bank.

Miyao, R. 2002. Liquidity Traps and the Stability of Money Demand: Is Japan Really Trapped at the Zero Bound? RIEB Discussion Paper Series, no. 127, Kobe University.

Mizen, P., and J. Presley. 1998. Keynes, Hicks, and the Cambridge School. *HOPE* 30.1:1–16.

Modigliani, F. 1944. Liquidity Preference and the Theory of Interest and Money. *Econometrica* 12:45–88.

Patinkin, D. 1959. Keynesian Economics Rehabilitated: A Rejoinder to Professor Hicks. *Economic Journal* 69:582–87.

———. [1956] 1965. *Money, Interest, and Prices*. 2nd ed. New York: Harper & Row.

———. 1976. Keynes' Monetary Thought: A Study of Its Development. *HOPE* 8.1:1–150.

Pearce, K., and K. Hoover. 1995. After the Revolution: Paul Samuelson and the Textbook Keynesian Model. In *New Perspectives on Keynes*, edited by A. Cottrell and M. Lawlor. *HOPE* 27 (supplement): 183–216.

Pigou, A. C. 1933. *The Theory of Unemployment*. London: Macmillan.

———. 1943. The Classical Stationary State. *Economic Journal* 53:343–51.

Rabin, A., and Z. Keilany. 1986–87. A Note on the Incompatibility of the Pigou Effect and a Liquidity Trap. *Journal of Post Keynesian Economics* 9:291–96.

Roberts, M. 1995. Keynes, the Liquidity Trap, and the Gold Standard: A Possible Application of the Rational Expectations Hypothesis. *Manchester School* 43:82–92.

Robertson, D. H. 1936. Some Notes on Mr. Keynes' General Theory of Interest. *Quarterly Journal of Economics* 51:168–91.

———. 1940. *Essays in Monetary Theory*. London: P. S. King.

———. [1922] 1948. *Money*. London: Nisbet.

Robinson, J. [1951] 1952. The Rate of Interest. In *The Rate of Interest*. London: Macmillan.

Romer, D. 2000. Keynesian Macroeconomics without the LM Curve. *Journal of Economic Perspectives* 14:149–69.

Samuelson, P. A. 1967. *Economics*. 7th ed. New York: McGraw-Hill.

Skidelsky, R. 1992. *John Maynard Keynes: The Economist as Saviour, 1920–1937*. London: Penguin.

———. 1996. The Influence of the Great Depression on Keynes's *General Theory*. *History of Economics Review* 25:78–87.

Smith, W. [1956] 1966. A Graphical Exposition of the Complete Keynesian System. In *Readings in Macroeconomics*, edited by M. Mueller. New York: Holt, Rinehart and Winston.

Sumner, S. 2002. Some Observations on the Return of the Liquidity Trap. *Cato Journal* 21:481–90.

Tobin, J. 1947. Liquidity Preference and Monetary Policy. *Review of Economics and Statistics* 29:124–31.

———. [1958] 1966. Liquidity Preference as Behavior towards Risk. In *Readings in Macroeconomics*, edited by M. Mueller. New York: Holt, Rinehart and Winston.

———. 1980. *Asset Accumulation and Economic Activity*. Oxford: Basil Blackwell.

Uhlig, H. 2000. Should We Be Afraid of Friedman's Rule? *Journal of the Japanese and International Economies* 14:261–303.

Vickrey, W. 1954. Stability through Inflation. In *Post Keynesian Economics*, edited by K. Kurihara. New Brunswick, N.J.: Rutgers University Press.

Walsh, C. E. 2003. *Monetary Theory and Policy*. 2nd ed. Cambridge: MIT Press.

Wicksell, K. [1898] 1936. *Interest and Prices*. Translated by R. F. Kahn. London: Macmillan.

Wilson, D. 1999. Is Shutting Krugman's Liquidity Trap the Answer to Japan's Problems? *Pacific Economic Papers*, no. 297.

Wonnacott, P. 1978. *Macroeconomics*. Homewood, Ill.: Irwin.

Woodford, M. 2003. *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton, N.J.: Princeton University Press.

Young, W. 1987. *Interpreting Mr Keynes: The IS-LM Enigma*. Cambridge: Polity.