THE ILLIQUIDITY TRAP

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INTRODUCTION

The "liquidity trap," an infinitely elastic demand for money resulting from the common expectation that interest rates will rise, has played a central and contentious role in the history of Keynesian analysis.[1] For the neo-Keynesians, starting with Hicks' reformulation and embodied in countless textbooks, the liquidity trap has been seen as the "special case" preventing interest rates from falling sufficiently to revive a depressed capitalist economy. However, it is a special case whose force, Pigou argued, was vitiated by the expansionary effects of falling prices on real wealth and consumption.[2] So, the liquidity trap is not much of a trap after all. And the debate over Keynesian economics has shifted to other grounds.

While the debate over the liquidity trap supposedly concerned a key point in Keynesian economics, Keynes himself thought that the liquidity trap was unimportant, at least in practical terms.[3] Writing in Chapter 15 of the *General Theory*, Keynes says,

> There is the possibility...that after the rate of interest has fallen to a certain level, liquidity preference may become virtually absolute. I know of no example of it hitherto. Indeed, owing to the unwillingness of most monetary authorities to deal boldly in debts of long term there has not been much opportunity for a test. [VII, 207]

Though he did not imbue the liquidity trap with the importance attributed it by later writers, Keynes did have another explanation of why interest rates might not fall sufficiently in a depression to revive the economy.

> There is finally the difficulty of bringing the effective interest rate below a certain level which may prove important in the era of low interest rates; namely the intermediate costs of bringing borrower and ultimate lender together, which the lender requires over and above the pure rate of interest...Thus the rate of interest which the typical borrower has to pay may decline more slowly than the pure rate of interest, and may be incapable of being brought by the methods of the existing banking and financial organization, below a certain minimum figure. It is also important in the case of short-term loans (e.g. bank loans) where the expenses are heavy, a bank may have to charge its customers 1.5 to 2% even if the pure rate of interest to the lender is nil. [ibid, 208]

Eastern Economic Journal, Vol. 21, No. 3, Summer 1995

Thus, says Keynes, in an era of low interest rates, it is important to consider the costs of the banking industry when analyzing the evolution of the macroeconomy. In particular, interest rates may have a floor above the pure rate of interest.[4]

Moreover, Keynes argued, it is important to consider the connections between the monetary policy of the central bank and the profitability and solvency of the banking system. In an era of low interest rates, the central bank may be reluctant to pursue a low interest-rate policy which will endanger banks' profitability, or even solvency. Keynes recognized the importance of bank costs in the determination of monetary policy in the 1930s. In a report to the British Economic Advisory Council, later published with some modification in the *Economic Journal* in September of 1932, Keynes advocated cheap money as a way to get out of the depression. But, at the same time, he described a serious obstacle standing in the way. Says Keynes,

> The position of the banks (the Big Five) presents a difficult practical problem. Since the War they have incurred expenses, partly through generosity to their employees, partly through ostentation and partly through excessive competition for new business, which assume the permanence of relatively dear money...The practical result is that, by obstinately maintaining their charges on advances at 5 per cent except to strong or favored customers or those who threaten to go elsewhere, the banks are something of an obstruction to a decline in the rate of interest to certain types of borrowers; and it is difficult to see the way out. *In the same way in the United States, the fears of the member banks lest they should be unable to cover their expenses is an obstacle to the adoption of a whole hearted cheap money policy).* [Keynes, XXI, 122, emphasis added][5]

The last sentence makes clear Keynes' view of the connection between bank expenses and monetary policy. He clearly saw the reluctance of the Federal Reserve to allow interest rates to fall below a particular floor because of the opposition of member commercial banks to its effects on their profits, given their expense obligations. Thus, while in 1936 in *The General Theory*, Keynes argued that there had been no example of a liquidity trap, in 1932 he pointed to the significance of bank costs and endogenous monetary policy in placing a floor on the interest rate above the liquidity premium on money.

A separate paper [Epstein and Ferguson, 1984] presents extensive archival and statistical evidence in support of Keynes' argument. There it is shown that, among other factors, member banks opposed expansionary open market operations because of their effects on bank interest margins. That opposition, and other considerations, caused the Federal Reserve to abandon in the middle of 1932 the only major attempt at expansionary policy during the early stages of the Great Depression.

This combination of bank costs and the central banks' concern for bank profitability and solvency may result in an insufficient supply of money and insufficiently low interest rates to revive a depressed economy. I call this the "illiquidity trap".[6]

This paper investigates the effects of the illiquidity trap on two simple models of the economy and raises doubts about Pigou's argument for the salutary effects of falling prices and wages in a depression. I suggest that when the bank cost constraint and endogenous monetary policy are taken into account, Pigou's "neoclassical" claim that falling prices will increase income will not necessarily hold, even in a very neoclassical world. In addition, considering the possibility that, at very low levels of output, banks' costs of intermediation are likely to rise, the Pigou effect is even less likely to work to restore full employment.[7]

The next section briefly lays the foundation for the illiquidity trap by indicating how falling interest rates may reduce bank profits. The following section discusses the effects of the illiquidity trap in a simple IS-LM model with constant costs in banking. The final section extends the model to include mark-up pricing and declining costs in banking.

THE EFFECTS OF INTEREST RATE CHANGES ON BANK PROFITS

The standard approach to analyzing the effects of interest rate changes on bank profits originated with Samuelson [1945] who developed the notion of "duration" independently of Hicks and MaCaulay and first applied it to financial intermediaries.[8] Duration analysis suggests that declines in interest rates will lower the net worth of a bank if the (weighted) duration of the bank's liabilities is longer than the (weighted) duration of the bank's assets, where the weights are the percentage of assets and liabilities maturing at each moment in time. The intuition behind this result is that if liabilities are of longer duration, when interest rates decline returns on assets will fall before costs do.

Recent analyses of bank runs imply that the duration approach to bank profits is inadequate because it does not take into account that causation might run not only from duration to returns, but also from returns to duration. Moreover the duration analysis only concerns the effects of interest rate changes on net worth in a steady state and does not take into account the interest rate effects on solvency in the short run.

For example Diamond and Dybvig [1983] develop a model of banks with two equilibria, one of which involves a bank run that drives the bank into insolvency.[9] This equilibrium is a self-fulfilling prophecy in which anything that leads depositors to expect a run will actually generate one. In the context of this paper, a reduction in interest rates might produce such a run if depositors think that costs cannot adjust rapidly enough and bank profits will fall below the solvency point. Thus even if the duration of the liabilities is shorter than that of assets, lowering interest rates may not increase bank profits. Falling rates may simply drive the bank into insolvency.

If such a run occurs, a bank crisis might ensue which would reduce banker and possibly depositor wealth. To avoid such an event, the central bank may choose not to allow interest rates to fall substantially in a depression. Here enters the illiquidity trap.[10]

THE ILLIQUIDITY TRAP: CONSTANT COSTS

Here I present a simple model of the macroeconomy in which the illiquidity trap is integrated into a standard IS-LM model.[11] When the monetary authority attempts to prevent falling interest rates from reducing bank profits, it pegs the interest rate at a level at which banks can cover costs. In this case, the monetary authority attempts to peg the interest rate at

$$i = i^*, \tag{1}$$

where i^* embodies the per unit costs of intermediation which have been squeezed to some minimum level. To see the effects of such an interest rate floor, integrate equation (1) into a simple IS-LM model:

$$y = c(y,(M + aB)/P) + I(i) \quad \text{goods} \tag{2}$$

$$M = PL(i,y) \quad \text{money} \tag{3}$$

$$W = (M + aB)/P \quad \text{wealth definition} \tag{4}$$

where y = real income,
c = consumption,
M = outside money,[12]
B = value of government bonds[13],
a = discount at which bondholders discount wealth of government bonds, (1=no discount; 0=complete discount) ($0 \leq a \leq 1$),
i = interest rate,
i^* = target interest rate,
I = investment,
P = price level,
L = demand for money (liquidity),
W = real wealth.[14]

The term, a, the degree to which government bonds are discounted, may require further discussion. Barro [1974] argued that because of their perfect foresight, taxpayers would view current government debt as a future tax liability and therefore would not count government debt as net wealth. In this case, $a = 0$. Barro's argument is far from universally accepted, even by neoclassical economists. Hence, it is more widely believed that, in general, $a > 0$.[15] The comparative statics of IS-LM models typically assume y and i are endogenous and M and P are exogenous. However, in the illiquidity trap model, i is exogenous, and monetary policy (the high-powered money supply) is endogenous. Through open market operations, the central bank adjusts M to maintain i at i^* by trading money for bonds:

$$dM = -dB. \tag{5}$$

The question to be investigated through the comparative statics is whether the Pigou effect works in the illiquidity trap. That is, will a decline in prices increase income (and employment) in the illiquidity trap? In terms of the typical IS-LM, supply-demand analysis, the question is whether the "Aggregate Demand Curve" slopes downward, so that falling prices will increase output.[16]

Evaluating the comparative statics where $M = P = 1$ for convenience, the comparative statics can be given as follows:[17]

$$\begin{bmatrix} (1-C_y) & -C_w(1-a) \\ L_y & 1 \end{bmatrix} \begin{bmatrix} dy \\ dM \end{bmatrix} = \begin{bmatrix} C_w(1+aB)dP \\ dP \end{bmatrix}$$

where, for example, C_y is the partial derivative of C with respect to y, and dP, for example, is the total differential of P. The effect of falling prices on y is given by:

$$dy/dP = [-C_w(1 + aB) + C_w(1 - a)]/[(1 - C_y) - L_yC_w(1 - a)]. \tag{6}$$

If ($a = 1$), that is if government bonds are not discounted, then equation (6) reduces to

$$dy/dP = [-C_w(1 + B)]/[1 - C_y] < 0. \tag{7}$$

Equation (7) says that if prices fall, they increase income through the Pigou effect. However, if $a = 0$, that is if government bonds are not net wealth, then

$$dy/dP=[-C_w + C_w]/[(1 - C_y) - L_yC_w] = 0. \tag{8}$$

A reduction in prices will not increase real income and employment.

In terms of the IS-LM diagram, the LM curve is horizontal, as in the liquidity trap, because of an infinitely elastic supply of money at i^*, not because of an infinitely elastic demand for money as in the traditional trap. However, unlike the traditional trap, the IS curve does not shift outward with falling prices because real wealth does not change. As prices fall, the central bank reduces the money supply to maintain the interest rate floor. The "Aggregate Demand"curve, therefore, is vertical.

The reason is that the central bank reduces the money supply in line with falling prices to keep interest rates from falling below the minimum bank profit level. The reduction in the money supply also reduces the nominal value of wealth keeping the real value of wealth constant. In this case, the illiquidity trap prevents falling prices from inducing an economic recovery through the Pigou effect.

Thus, in the illiquidity trap, falling prices will necessarily push the economy to increased employment only if government bonds are not completely discounted by the public. If they are completely discounted, falling prices will not increase income at all. Thus the extreme neoclassical assumption, that government bonds are not net wealth, lead to some rather anti-neoclassical results.[18]

VARIABLE COSTS IN BANKING

So far I have assumed that per unit costs of intermediation are constant, independent of the scale of banking. In eras of low interest rates and a depressed economy this is not likely to be true. If banks set interest rates on loans by marking up over costs, then they are likely to mark up over per unit variable and fixed costs.[19] In a depression, economic activity and therefore banking activity will go down. In this case, per unit fixed costs for banking will increase and the costs of intermediation and bank loan rates will go up, all other things equal. Moreover, in a depression, loan losses are also likely to go up substantially as prices fall [Kalecki, 1944; Fisher, 1933; Tobin, 1980]. To cover costs in an era of bad loans, banks are likely to increase rates as well.[20]

$$i = UVC + UFC + m, \tag{9}$$

where UVC = unit variable costs,
UFC = unit fixed costs,
m = mark-up.

If unit variable costs (consisting primarily of interest costs) are practically nil in the depression and the mark-up is squeezed to a minimum or constant, changes in unit fixed costs dominate changes in the interest rate. Moreover, unit fixed costs will be a negative function of economic activity and prices:[21]

$$UFC = U(P, y) \text{ where } U_p < 0 \text{ and } U_y < 0 \tag{10}$$

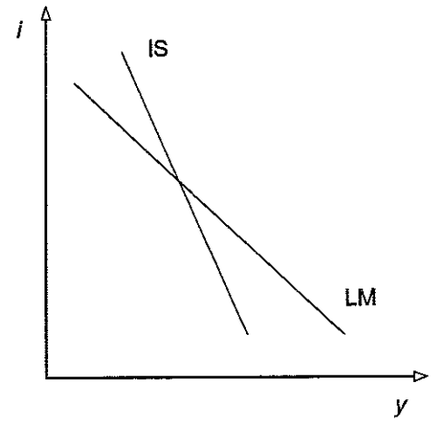
Combining equation (10) with the assumption of the illiquidity trap model that the central bank adjusts the money supply to keep interest rates in line with costs (equation (9)), yields the following equation for the interest rate:

$$i = A(P, y) \text{ where } A_p < 0, \text{ and } A_y < 0. \tag{11}$$

In this case, the LM curve is downward sloping. As income falls, interest rates which are already at low levels, will increase. Bank costs increase as income goes down (by equation (10)) and the central bank reduces the money supply to increase rates on bonds and to support the increase in loan rates.[22] (See Figure 1). For stability the IS curve must be more steeply sloped than the LM curve.(That implies that the denominator in the expressions below must be positive.)

To analyze the effects of price changes on real output, totally differentiate the system of equations (2), (3), (4), and (11). For the purposes of this analysis, the price level is exogenous and output, interest rates, and the money supply are endogenous.[23]

FIGURE 1
Illiquidity Trap Model



The new comparative statics of the model are:

$$\begin{bmatrix} 1 & -A_y & 0 \\ -I_i & (1-C_y) & -C_w(1-a) \\ -L_i & -L_y & 1 \end{bmatrix} \begin{bmatrix} di \\ dy \\ dM \end{bmatrix} = \begin{bmatrix} A_p dp \\ -C_w(1+aB)dP \\ dP \end{bmatrix}$$

Let $a = 1$, so that government bonds are entirely net worth. The determinant is

$$D = (1 - C_y) - A_y(I_i) > 0 \text{ for stability.} \tag{12}$$

In that case, the effect of falling prices on income is given by

$$dy/dp = [A_p(I_i) - C_w(1 + B)]/D. \tag{13}$$

Since D is assumed to be positive, the sign of equation (13) will be the same as the sign of the numerator. The sign of the numerator, however, is indeterminate. The first two terms in the numerator are negative, which makes their product positive. These two terms represent the effects of a change in the price level on interest rates and therefore on investment. From the first two terms, when prices fall, the costs of intermediation go up. This leads the central bank to reduce the money supply to increase interest rates so that the commercial banks are able to cover their costs of intermediation. These increased interest rates reduce investment and output. This first term captures the "illiquidity trap."

The second term represents the "Pigou effect." It is also positive. When prices fall, wealth, represented by nominal government bonds, also increases. As a result consumption rises which increases output, all else equal.

The net effect of falling prices on output depends on the strength of the Pigou effect relative to the illiquidity trap. In terms of the IS-LM diagram, falling prices shift up the LM curve and shift out the IS curve. The outcome depends on the relative strength of those two movements.[24]

In the previous section, the absence of bond discounting is a sufficient condition for falling prices to increase income in a simple IS-LM model. Here, where the costs of intermediation increase with price and output declines, even if government bonds are entirely net worth, the Pigou effect may not work in the illiquidity trap.

NOTES

The author would like to thank Duncan Foley, Edward Nell, Carlo Panico, Willi Semmler and two anonymous referees for extremely helpful comments. All errors are mine.

1. See Tobin [1958] for the standard exposition of the liquidity trap.
2. See Tobin [1980] for a good discussion.
3. The liquidity trap was not a central part of Keynes' argument in theoretical terms either. Keynes was concerned with showing two things: first, that a capitalist economy would not self-adjust to a full employment equilibrium and second, that money is not neutral. Since, in the standard exposition of the liquidity trap, money is neutral in the sense that money has no effect on "real" variables, the liquidity trap would provide a particularly weak basis for Keynes' argument. I thank an anonymous referee for this observation. Also see Kregel [1988] for a good discussion.
4. Keynes had another argument for a floor to the interest rate. In Chapter 17 of *The General Theory*, he argued that the nominal rate of interest could not fall below zero, the rate of return on money itself [Darity, 1988, 692; Tobin, 1980, 5]. Keynes' argument, and the argument of this paper, is that bank costs and monetary policy might keep the rate of interest above this floor in a depression.
5. I am indebted to Carlo Panico for directing me to this quote.
6. I am not concerned here with whether there exists an interest rate low enough to bring about full employment. I am only concerned with the existence of an interest rate floor above zero. See Eatwell and Milgate [1983] for a discussion of these issues.
7. I am not arguing that Keynes' case for an unemployment equilibrium in a capitalist economy "depends" on the existence of an "illiquidity trap." I am simply suggesting that the illiquidity trap is an additional, but largely ignored, argument that Keynes himself considered important in the particular case of the early 1930s. This paper also suggests that the illiquidity trap may be of wider interest.
8. See Weil [1973] for a discussion of the history of the concept of duration.
9. In this model, banks do not have deposit insurance, the situation in the 1930s.
10. This focus on the relationship between interest rates and profitability and their role in generating financial instability is similar to the important work of Minsky [Minsky, 1982; Dymski and Pollin, 1992; 1994]. Klein [1947] was also concerned with the political and institutional constraints on the effectiveness of price and wage cuts in a depression. Klein also emphasized the destabilizing effects of adverse expectations, which is not analyzed here [ibid., esp. 88-90].
11. Keynes, himself, was not an adherent of Hicks' IS-LM model, though he agreed with some aspects of it. See the interesting letter from Keynes to Hicks reproduced in Hicks [1973, esp. 9-10].
12. The basic results of this section and the next hold if a distinction is made between inside and outside money and a (inside) money supply equation of the form $S = S(i)$ (where $S_i > 0$) is integrated into the model.
13. For simplicity, I assume all government bonds are short term which avoids valuation issues arising out of changes in interest rates. In fact, during the great depression of the 1930s bank portfolios were increasingly filled with short-term bonds [Epstein and Ferguson, 1984].

14. In these models, wealth refers to financial wealth. If the capital stock were integrated into the model, the same results would hold if the valuation of capital (for example "Tobin's q") fell as the price level fell. This is likely to be the case in a depression [Tobin, 1975]. Also, see the last section in this paper.
15. For a discussion, see Blanchard and Fischer [1989, chapter 3] and Bernheim [1987].
16. For purposes of the comparative statics I take the price level to be exogenous in the sense that I am investigating the slope of the "aggregate demand" curve. Income and the money supply are endogenous in the sense that they both respond to changes in the price level, with income responding through wealth effects and the money supply responding through the reactions of the central bank in its attempt to keep the interest rate pegged at i^*.
17. This normalization has no effect on the results since prices and the money supply are allowed to change differentially through the comparative statics of the system. See equation (8), for example.
18. Whereas in this section, the degree of discounting of government bonds has an impact on the results, it does so in a way that is contrary to the neoclassical argument: namely, complete discounting, as in the Barro case, eliminates the expansionary effects of falling prices with a liquidity trap. In the next section, the degree of discounting of government bonds does not qualitatively affect the results.
19. For a discussion of mark-up loan rates, see Rousseas [1985].
20. This can be expressed as an increase in the mark-up or — if the loan losses are taken as fixed costs — an increase in the per unit fixed costs. For the purposes of this paper it does not matter which interpretation is used though the latter seems more relevant. Keynes did not condition his argument for an unemployment equilibrium on the assumption of increasing returns to scale as Weitzman [1982] seems to argue. However, it is interesting and relevant to the case of extremely low interest rates to investigate the effects of such increasing returns on the economy. For a discussion of these issues see the symposium in the *Journal of Post-Keynesian Economics*, Spring, 1985 on Weitzman's paper.
21. Prices negatively affect unit fixed costs because of the debt-deflation effects of falling prices on loan losses [Fisher, 1933; Kalecki, 1944].
22. In this view the central bank enforces an outcome in the money market which it views as necessary to maintain the solvency of these banks. In adjusting the money supply to be consistent with equation (1) it forces the money market equilibrium to be consistent with the costs in banking.
23. The price level is exogenous in the sense that the question being asked is, what are the effects of price changes on output levels? In a full blown model, of course, the price level would be endogenous.
24. It is easy to show that if government bonds are completely discounted, then declines in prices *lower* output because interest rates rise and there is no offsetting wealth effect.

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