Krugman on the Liquidity Trap:
Why Inflation Won't Bring Recovery in Japan

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INTRODUCTION

The failure of the Japanese economy to respond to aggressive monetary easing in the form of a zero bid rate on the Bank of Japan's overnight financing facility has reminded some economists of Hicks's IS-LM rendition of Keynes's "liquidity trap". Those who use Hicks's famous diagram as the point of reference for evaluating monetary policy will recall that at some low rate of interest the horizontal portion of the LM curve emanating from the vertical axis is meant to represent the lack of influence of expanding the money supply on the rate of interest; monetary policy thus does not shift the intersection of the LM curve with the IS curve that determines the equilibrium level of output. Since monetary policy has no impact on the level of output along this horizontal portion of the LM curve, debt financing of government expenditure remains the only policy capable of influencing output. The explanation that is given of the failure of monetary policy is that interest rates are so low that they cannot be reduced further. In the case of Japan, since moving rates below their current zero bid rate would mean negative rates, it is considered to be the first known example of an economy facing a liquidity trap.

Those who have studied Keynes's original exposition of the influence of changes in the quantity of money on the level of output will recall that there "may be several slips between the cup and the lip" (JMK:VII, p. 173) and that his theory of liquidity preference, which is the foundation for the liquidity trap as an expression of total liquidity preference, challenged the simple mechanical relationship between money creation, the price level and the nominal level of economic activity that is the basis of the traditional quantity theory. It is paradoxical that the theoretical explanation of the way in which the liquidity trap is currently producing recession in the Japanese economy is founded on quantity theory models in which the rate of expansion of the quantity of money directly determines the rate of change in the price level. Indeed, in canonical quantity theory models money is neutral and has no impact on the long-run equilibrium of real output, irrespective of any reference to a liquidity trap, since money only affects nominal variables. The failure of a positive rate of change in the quantity of money to reverse the decline in the price level in these traditional quantity theory models is considered to be equivalent to the failure of expansionary money policy to reduce the rate of interest in Keynes's explanation of the liquidity trap.

This apparent contradiction is resolved once it is recognised that the liquidity trap in these neo-quantity theory models is seen as an expression of the failure of changes in the quantity of money to influence the "real" rate of return. Thus, with the nominal rate of interest bounded at zero, the real rate of interest can only be reduced if prices are rising. If on the contrary prices are falling, then the real rate is rising, and if the Central Bank is nonetheless increasing the money supply and prices are not responding, then the real rate is not falling and the economy is said to be in a liquidity trap since monetary policy has no influence on the real rate.

The explanation for the existence of the liquidity trap is then the failure of money growth to raise prices as postulated by the traditional quantity theory. This failure is not explained by any shortcomings in the theory, but by the failure of the Central Bank to make credible its intention to produce inflation. After decades of urging Central Banks to adopt independent policies and to create credibility in their pledge to keep prices stable by tying their hands and other sorts of sadistic practices, it is now argued that in Japan it is precisely the strength of this credibility that makes the attempt to create inflation incredible. Paradoxically, the current policy prescription for the Bank of Japan is to make its commitment to price stability incredible in order to convince market participants that it will produce a rate of inflation in nominal output that it sufficient to reduce the real rate of interest to the level that causes domestic savings to fall to the near zero level of real domestic investment expenditures.

The modern explanation of liquidity preference is not only couched in the quantity theory tradition, it is based on Irving Fisher's version of the theory in which the nominal rate of interest is determined by the real rate of return adjusted for the rate of change in the price level. If instead of rising, the price level is falling then nominal rates will have to be below real rates of return and equilibrium may even require negative nominal interest rates if the real rate is less than the deflation rate. But, if nominal rates are bounded from below at zero, then nominal interest rates cannot be adjusted downwards below zero; then the only way to restore savings-investment equilibrium is to reverse the deflation with a policy of inflation. This is precisely the policy that Fisher urged on Franklin Roosevelt during the Great Depression in the United States. It was also the basis of the decision to devalue the dollar by raising the price of gold and the various measures to create the "alphabet soup" US government agencies designed to put floors under domestic prices. The inflation policy that Paul Krugman is recommending for Japan is based on exactly the same principles as Irving Fisher's recommendations during the Great Depression.

Although mainstream economists have long been sceptical of the existence of the Keynesian liquidity trap, Krugman claims to have provided analytical support for the concept within both Hicks's ISLM model and more rigorous traditional theory. This paper will thus start by comparing Keynes's original explanation with Hicks's version, and then with Fisher's theory. A final section will assess similarities and differences in terms of the policy that Krugman has recommended for Japan.

HICKS'S HORIZONTAL LM CURVE AS LIQUIDITY TRAP

Hicks not only claimed to be "a convinced liquidity preference man" (JMK:XIV, p. 83), he also claimed that "Keynes accepted the IS-LM diagram as a fair statement of his position" (Hicks, 1977, p. 146) However, Keynes was not an uncritical reader of Hicks's exposition of his theory in the *Economic Journal* review of the *General Theory* and the subsequent derivation of the now famous IS-LL (as it was originally called) diagram. In particular, Keynes notes that Hicks inserted two illicit assumptions concerning the elasticity of supply of consumption goods and the income elasticity of the rate of interest in his discussion. Both were important to the derivation of the horizontal portion of the LM curve that represents the liquidity trap for most economists, but both were extraneous to Keynes's theory.

In his review Hicks notes that even if one accepts Keynes's multiplier proposition that an increase in investment will cause a rise in demand for consumption goods and thus a multiplied increase in aggregate income, the empirical magnitude of the increase in real output will be small if the elasticity of supply of consumption goods is low. Hicks thus concludes that Keynes must be implicitly assuming "a high elasticity of supply in the consumption goods industries ... ; and if things do work out this way, it is perfectly intelligible that the increased demand for loans from the investment industries should encounter an increased supply, so that there is no reason for the rate of interest to rise" (Hicks, CEII, pp. 89-91) when investment and output increase. The idea is that the increased output of consumption goods will produce the increased savings necessary to fund the loans for the new investment expenditures.

Hicks also argues that if the supply of consumption goods is inelastic during the expansive phase of the cycle: "Mr. Keynes's analysis of this case would evidently lead to the conclusion that there would be an indefinite rise in the prices of consumption goods ... but he would admit, on second thoughts, that this would lead to a more or less corresponding rise in the demand for money; and therefore that, unless the supply of money was indefinitely expanded, the rate of interest must rise ... I do not think that this differs essentially from what has been said by earlier writers [Hicks refers in a footnote to Hayek's *Prices and Production*]; they would, however, begin by assuming the supply of money not indefinitely expansible, and so proceed straight to the rise in the rate of interest. But they would admit, on their second thoughts, that if the supply of money were to be indefinitely expanded, the rate of interest could be kept down, and the inflation proceed without limit." (Hicks: CEII, pp. 93-4).

Thus, Hicks concludes that Keynes is assuming either a highly elastic supply of consumption goods or an infinitely elastic supply of money and that it is one or the other of these assumptions which allows Keynes's theory to differ from the traditional explanation of the response of the rate of interest to an increase in the level of activity. Thus, Hicks's explanation of the stability of the rate of interest in the face of an increase in investment and output, which becomes the horizontal range of the LM curve, is based on the assumption of either a high elasticity of supply of consumption goods (implicitly loanable funds)or of money.

Keynes, however, rejects any dependence of his theory on the elasticity of supply: "you argue ... that my argument depends on the assumption of a `high elasticity of supply of consumption goods', but why high" ... "Towards the end you speak of the imperfect elasticity of supply of consumption goods in a trade cycle leading to a `consequent hardening of interest rates.' I do not follow why the one is consequent on the other" (JMK:XIV, p.71, 72). In answer to this criticism Hicks agrees that the elasticity of supply need only be greater then zero and then goes on "Surely it is quite in accordance with your own theory to speak of the imperfect elasticity of supply of consumption goods in the trade cycle leading to a consequent hardening of interest rates. *As investment increases* , the prices of consumption goods rise; this raises the transaction demand for money, and if the supply of money is not perfectly elastic, *interest rates must*

rise too . The same thing may indeed happen to some extent merely by increasing employment, even if the supply of consumption goods is perfectly elastic, but imperfect elasticity of supply intensifies it. Is not this orthodox?" (JMK:XIV, p. 73 italics added). Keynes agrees that this is orthodox, but not his own theory, replying "I quite misunderstood what you meant ... I quite agree with what you say" (Ibid., p. 75).

The reader will note that this discussion confuses two separate points. Hicks's initial statement concerned the low probability of a rise in the rate of interest increasing saving out of a given income in order to balance the failure of the consumption goods industries to expand in step with increased investment, the same effect being produced by an elastic supply of consumption goods keeping prices constant and allowing the required increase in the supply of saving. What Hicks had in mind was presumably the availability of stocks to allow the operation of the temporal multiplier process without raising prices.

The second argument, on the other hand, refers to the impact of higher consumption goods prices in increasing the demand for money and thus raising interest rates, even when the multiplier is able to proceed without encountering supply shortages. Thus it is the assumption of the infinitely elastic supply of money which is crucial to the presumed constant rate of interest. But this proposition Keynes clearly accepted as being consistent with classical theory, and as such was not a distinguishing feature of this own theory or of any relation to the liquidity trap as defined above.

Having agreed that in his theory, as in any other, an increase in investment would in general cause an increase in output and probably prices and, via an increase in transactions demands for money an increase in the rate of interest, irrespective of the value of the elasticity of supply above zero, Keynes must have been perplexed by Hicks's statement in the article that set out the IS-LL analysis, "Mr Keynes and the Classics", that Keynes's theory leads to the "startling conclusion, that an increase in the inducement to invest, or in the propensity to consume, *will not* tend to raise the rate of interest, but only to increase employment" (Hicks: CEII, p. I07, italics supplied) and that "*the most important thing* in Mr Keynes's book" is that "It is not only possible to show that a given supply of money determines a certain relation between Income and interest (which we have expressed here by the curve LL) it is also possible to say something about the shape of the curve. It will probably tend to be nearly horizontal on the left, and nearly vertical on the right" (Ibid., p. 109, italics supplied), implying that the rate of interest would not rise as investment and output expanded until full employment was reached. But, given the above discussion the horizontal behaviour of the LL curve "on the left" could only take place even in the presence of a perfectly elastic supply of money, while its behaviour "on the right" could only result from a less than perfectly elastic supply of money.

Keynes was quick to note his disagreement with Hicks's clearly ad hoc representation of the behaviour of the rate of interest as the "most important thing" in Keynes's theory: "From my point of view it is important to insist that my remark is to the effect that an increase in the inducement to invest need not raise the rate of interest. I should agree that, unless the monetary policy is appropriate, it is quite likely to. In this respect I consider that the difference between myself and the classicals lies in the fact that they regard the rate of interest as a non-monetary phenomenon, so that an increase in the inducement to invest would raise the rate of interest *irrespective of monetary policy* " (JMK:XIV, p. 80, italics added).

Thus Keynes rejects the argument that the difference between his theory and the Classics lies in the restrictions placed on the money supply function, in particular the existence of a horizontal portion usually known as the "liquidity trap" or in any restriction on the elasticity of supply. Keynes clearly stated that liquidity trap conditions, while possible, had not yet been experienced; they thus could not not serve as an explanation for the Great Depression. Nonetheless, Hicks's formulation of liquidity preference led to a presentation of Keynes's theory which implicitly required either 1) the operation of the liquidity trap due to the elasticity of supply of money, or 2) the assumption of unchanging prices of consumption goods, for a horizontal LM curve represented stable prices in conditions of perfectly elastic supply of consumption goods. However, the IS-LM framework makes no reference to any supply conditions for money or consumption goods output, only the supply of savings. Even though this representation was never accepted by Keynes -- Hicks's suggestions to the contrary -- it has become the standard representation. Tobin, for example comments "In terms of the Hicksian language ... I thought (and I still think) ... the main issue ...is the shape of the LM locus" (Tobin, 1972, p. 853). Indeed, both Friedman and Tobin accept a positive slope for the LM curve, rejecting a vertical or horizontal curve. But, as Hicks's article pointed out, here there is no difference between Keynes's and the "ordinary method of economic theory." Clearly, Hicks's explanation of the liquidity trap as the horizontal portion of the LM curve is consistent with traditional theory, as Keynes agreed. But it cannot be considered as an analytical foundation for the failure of the rate of interest to respond to policy changes in the amount of base money created by the central bank for it deals with the behaviour of rates when output is increasing with perfectly elastic money supply, not the behaviour of rates when the quantity of money is increasing with perfectly elastic supply of output.

THE MODERN THEORY OF THE LIQUIDITY TRAP

Although Krugman considers Hicks's model as a "very useful heuristic" (Krugman, p. 7) he notes that it is considered too ad hoc and thus not the best vehicle for presenting the traditional version of the liquidity trap. In his view "A

liquidity trap may be defined as a situation in which conventional monetary policies have become impotent, because nominal rates are at or near zero - so that injecting monetary base into the economy has no effect, because base and bonds are viewed by the private sector as perfect substitutes." He notes that an alternative "way of stating the liquidity trap problem is to say that it occurs when the equilibrium real interest rate, the rate at which savings and investment would be equal at potential output, is negative" (op. cit., p. 16) As noted above, in traditional theory, if the nominal interest rate is determined by adjusting the real rate of return for depreciation in the monetary standard a rise in the inflation rate, given the nominal rate should cause the real rate to decline. If a rise in the growth of base money causes a rise in the rate of inflation, then it should be possible for monetary policy to achieve the required equilibrium real rate. This raises the question of , "how is the liquidity trap possible? The answer lies in a little-noticed escape clause in the standard argument for monetary neutrality: ... there is no ... argument that says that a rise in the money supply *that is not expected to be sustained* will raise prices equiproportionally - or indeed at all. In short, to approach the question from this level of abstraction already suggests that a liquidity trap involves a kind of credibility problem ... if monetary expansion does not work, if there is a liquidity trap, it must be because the public does not expect it to be sustained" (op. cit. p. 7). Although a one-shot increase in base money will lead to a once over increase in the price level, this should have no impact on the rate of inflation and leave the nominal rate of interest unchanged if the real rate of interest is unchanged. The liquidity trap thus occurs because the central bank cannot make individuals with rational expectations believe that it will keep money growing in perpetuum at the new higher rate so as to ensure a higher rate of inflation in perpetuum.

This looks just the opposite of Hicks's theory, which is based on stable prices of consumer goods and belief in the perfect elasticity of the money supply. Krugman argues that investors do not believe that the money supply will be perfectly elastic, indeed the increases that occur in the present period will be reversed in future. Thus, monetary policy cannot influence the real rate of interest to make it adjust to the level that will lower private sector savings to equality with the voluntary investment decisions of the private sector. "The easiest way to think about this is to say that there is an equilibrium *real* interest rate which the economy will deliver whatever the behaviour of nominal prices." (op. cit, p. 10) Thus, the liquidity trap occurs because the real rate cannot be influenced by monetary policy.

As already noted, this is a perfectly standard result within Fisher's version of the quantity theory and formed the basis for Keynes's belief that Hicks had not captured his essential difference from classical theory: "Put shortly, the orthodox theory maintains that the forces which determine the common value of the marginal efficiency of various assets are independent of money, which has, so to speak, no autonomous influence; and that prices move until the marginal efficiency of money, i.e. the rate of interest, falls into line with the common value of the marginal efficiency of other assets as determined by other forces. My theory, on the other hand, maintains that this is a special case and that over a wide range of possible cases almost the opposite is true, namely, that the marginal efficiency of money is determined by forces partly appropriate to itself, and that prices move until the marginal efficiency of other assets fall into line with the rate of interest" (JMK:XIV, p. 101).

LIQUIDITY PREFERENCE AND THE LIQUIDITY TRAP

Krugman notes that unlike Hicks's ad hoc version his explanation of the liquidity trap depends on the modern theory of intertemporal choice. But, it is precisely in the exposition of this intertemporal relation that Keynes differed from Fisher. Fisher's explanation -- which is the one used by Krugman -- of the determination of nominal interest rates is based on expectations of future goods prices relative to present goods prices as expressed in the expected rate of inflation or deflation of goods prices. The theory is based on a proposition presented in Irving Fisher's *The Theory of Interest* (1930) which on Fisher's own admission only applied to conditions in which "rational tendencies", based on "rational and empirical laws ... analogous to rational and empirical laws of physics and astronomy" (Fisher, 1930, p. 321). However, Fisher notes that where actuarial risk cannot be applied and "uncertain" conditions make the value of money unstable, "We must ... give up as a bad job any attempt to formulate completely the influences which really determine the rate of interest" (ibid). These are precisely the conditions which Keynes believed to be normal and thus the basis for this theory.

Both Fisher and Keynes specify the rate of interest as an intertemporal relationship represented by a spot-forward swap, or by the excess of the forward price over the par or spot price. However, In Fisher's *time* preference approach the rate of interest is the discount of future over present income that makes their utility equal at the margin, while for Keynes *liquidity* preference represents the return that must be paid on illiquid assets to make investors indifferent to holding more liquid assets.

Since time preference is a relation between real income today and in the future, it would be disturbed by changes in relative prices, thus Fisher argues that the money rate of interest that allows individuals to transfer income from the present to the future, r, must be corrected for the rate of inflation, p, in order to leave the time transformation of income undisturbed: thus the Fisher relation:

$(1+p)(1+r) = (1+i)$, and $i = [(1+r)(1+p)] - 1 = 1 + r + p + rp - 1$ which is usually written

>i = r + p when rp is small and p is the rate of inflation, r the rate of increase in real income, and i the rate of interest on money.

In the case of Japan, the problem is not inflation, but deflation, and p < 0. Then if i is constrained to be non-negative, r must be positive and it is impossible for the competitive market system to achieve an equilibrium which requires r to be negative. In simple terms this is Krugman's version of the liquidity trap. In Krugman's simple monetary view, p should be determined by the rate of growth of base money; but if money growth is indeed positive and p remains negative this can only be explained by the expectation that money growth will not remain positive and the expansionary monetary policy will be reversed in the medium run. Thus the system is stuck in a liquidity trap with a real rate of interest that is too high, or a nominal rate of interest that is too high, because the rate of inflation is too low when nominal interest rates are fixed at zero. The reason can only be the failure of the central bank to convince the public that p will be permanently higher. Overcoming the liquidity trap thus requires permanent and perfectly anticipated inflation in the form of a positive value of p sufficient to allow r to be negative when i is constrained to be non-negative.

Keynes has a very simple objection to Fisher's relation between the rate of interest and the rate of inflation. First, pace Krugman's emphasis on the lack of central bank credibility, he objected because it relied on the assumption of perfect foresight over the path of future incomes and prices (cf.1930, pp. 202-3 and JMK:VII pp. 142-3). Second, he objected because Fisher's argument that the money rate of interest should automatically reflect a perfectly foreseen rise or fall in the price level overlooks the impact of a rise or fall in interest rates on the capital value of existing stocks of financial assets. While it is true that if a rise in the price level for the coming year of 2% is perfectly foreseen, interest rates must be 2% higher to keep real returns for investors in one-year bills constant, the same would not be true for an investor holding fixed-interest assets of longer maturity in order to sell after one year, since there would be a positive or negative change in its capital value if interest rates change. Since market arbitrage should ensure that the one- year holding period rate of return should be the same for any instrument (even 30-year bonds sold one year after purchase) held for one year, longer-dated instruments should have a larger adjustment in their interest rates to offset the fall in capital value due to the rise in interest rates. A change in the rate of inflation should then have a differential impact on the rate of interest along the maturity spectrum, rising with time to maturity.

Keynes noted that a rise in the rate of interest from 10% to 12.2% will cause the price of a £100 par value British consol paying a £10 coupon to fall from £100 to £81.96, a decline of 1.8% and a capital loss of over £18. While the "variations in the rate of interest earned during the year in question are too small to make much difference" (e.g. the extra 2.2% earned on the reinvestment of the £10 coupon) relative to the much more substantial capital loss since the benefit of being able to invest the future £10 interest coupon payments at the higher rate of 12.2% will be swamped by the £18 decline in the capital value of the bond. The rise in the rate of interest equal to the rise in the rate of inflation could by no means be considered as sufficient to compensate for the loss in purchasing power. Thus, Keynes argues, Fisher's relation goes in the wrong direction for existing bondholders, since the higher yields required to preserve real yields cause capital losses that will more than offset the increased interest earnings.

What change in the rate of interest would be required to keep the capital position of the bond holder unchanged? Since the impact of the rate of interest will increase interest earned on reinvestment of coupon interest, while it changes capital values in the opposite direction, the breakeven condition for a perpetual bond will be $\Delta P - C = 0$, where ΔP is the annual cumulative change in price, and C its annual coupon payment. The price, or present value, of a perpetual bond is C/i, where 'i' is its current yield to maturity and C the annual coupon. The change in price ΔP of a perpetual bond is given by the product of its market price, the change in the rate of interest, Δi, and the modified duration of the bond. For a perpetual bond duration is given by $D = (1+i)/i$, and modified duration by $D/(1+i)$, which simplifies to $1/r$. Thus $\Delta P = P * \Delta i * MD$, which can be expressed $\Delta P = (C/i) * \Delta i * (1/i) = \Delta i * (C/i^2)$. Substituting in $\Delta P - C = 0$ gives $\Delta i * (C/i^2) - C = 0$ which simplifies to $\Delta i = i^2$ as the condition under which $\Delta P = C$ and is Keynes's square rule. Thus, for increases in the rate of interest equal to the increase in the rate of inflation to leave capital values unchanged they must be equal to i^2.

Thus, the Fisher relation will hold only for an increase in the rate of inflation $\Delta p = i^2$, but this only keeps capital values constant and does not provide any adjustment for inflation. For the Fisher relation to hold, interest rates must rise by more than this, but this means that capital value will fall further, etc, which illustrates Keynes's point that in general it is impossible for a simple adjustment in the interest rate to keep purchasing power unchanged once the impact of the interest rate on the value of existing stocks of assets is taken into account. There is thus no reason to expect the Fisher relation to hold, as has indeed turned out to be the case empirically.

But, Keynes's calculation also served another purpose. It can also be represented as the "breakeven" point for the two opposing forces working on the value of the bond, that is, the point at which the change in capital value is just offset by the opposite change in interest income from reinvesting coupon interest at the higher or lower interest rate over the remaining time to maturity of the bond. This point is called the "duration" of the bond in the finance literature. The lower the rate of interest, the higher the bond's "duration", and the longer it takes to recover the fall in capital values from the increased reinvestment earnings due to higher reinvestment interest rates. At a 3% nominal interest rate,

duration is 34.33 years, at 2% to 51 years. At 1% it is 101 years. Keynes's explanation of the liquidity trap is based on this relation. If an investor has to wait 101 years to recover the capital loss due to a rise in the rate of interest equal to 1% squared, which is only an absolute increase in rates from 1% to 1.01%, it seems rational for the investor to decide that it would be better not to hold bonds, but to hold money instead since the loss in holding money is only the interest rate, while the loss from holding the bond is the much larger decline in capital value. Thus, on Keynes's definition the liquidity trap will occur whenever investors expect interest rates to rise by more than the square of the current interest rate, for they will then prefer to hold money rather than bonds. Thus Keynes's statement that the lower the rate of interest, the more likely that liquidity trap will be sprung, since the longer it takes to recoup the capital loss through higher interest earnings and thus the higher the probability there will be a reversal in interest rates.

Since liquidity preference is a relative concept, it should be clear that the existence of a liquidity trap at high interest rates cannot be ruled out. At 8%, duration is 13.5 years and modified duration, 12.5 years. A rise in the rate of interest to .0864 would produce a fall in the price of a par 8% consol of 100*12.4*.0064 = £8 which is exactly the coupon value. An expectation of a rise in interest rates of more than 8% then should lead to a decision to sell bonds for money. If this expectation is generally held by investors then there will be no buyers of bonds other than the monetary authority and it will be impossible to change interest rates by buying bonds from the public since there is perfectly elastic supply at prevailing interest rates. The expected percentage rise in interest is however, twice as high as in the case of 4% rates. However, these should be judged relative to recent changes in bond prices. If 8% lies within two standard deviations from the mean of rate changes over the recent past, then it would be just as rational to remain liquid at 8% as it was at 4% in similar conditions of volatility. It is clear that the liquidity trap depends on expectations of future bond prices, and that expectations will be based on recent volatility of rates. In a volatile rate environment, it will become more difficult to use changes in interest rates to influence the demand for money since they will have to be larger in order to produce an impact.

It is also important to remember, as noted above, Keynes's argument refers primarily to the impact on long rates, or more precisely on the range of rates of assets of different maturities as represented by the yield curve. Of course, the argument given above concerns the impact of changes in short rates on the prices of assets of all maturities. Thus, Keynes notes that "If the monetary authority deals only in short-term debts, we have to consider what influence the price, actual and prospective, of short-term debts exercises on debts of longer maturity" (JMK:VII, p. 206).

Thus, the existence of the Keynesian liquidity trap does not depend on the absolute level of the interest rate, but on the size of the value of the square of the interest rate relative to the historic volatility of the interest rate and the uniformity of expectations concerning increases in interest rates in excess of this rate. It is also clear that it does not depend on the lack of credibility of the central bank in producing inflation, for even if the central bank's pledge to raise the inflation rate were credible and believed by the public, it would also have to induce the credible belief that there would be no upward shift in the entire yield curve as a result. As a result, Keynes recommends "Perhaps a complex offer by the central bank to buy and sell at stated prices gilt-edged bonds of all maturities, in place of the single bank rate for short-term bills, is the most important practical improvement which can be made in the technique of monetary management" (ibid) capable of overcoming the liquidity trap.

Although investors in Japanese securities may believe in the ability of the central bank to set the rate of growth of the money supply and/or its short term policy rate, they certainly do not believe that the central bank can control the shape of the yield curve. This would be particularly improbable given the changes that have taken place in ten-year rates since the Japanese Central Bank adopted its zero rate policy. Thus, even if investors have perfect confidence in the Central Bank's ability to increase the rate of inflation, the existence of a zero bid rate means that there is a zero probability of a further fall in rates short rates, making the expected value of the change in short rates positive. As long as there is a uniform market expectation that interest rates would rise by more than the square of themselves, the expectation is that long rates will rise by more than this and the failure of the economy to respond to monetary policy will remain (although the actual existence of a liquidity trap could only be confirmed if the Central Bank did attempt to influence long rates).

From a Keynesian point of view, Krugman's policy cannot work for a credible central bank policy for inflation would have to create perfect certainty not only that short term interest rates would not rise, but that the yield curve would remain stationary. In current Japanese conditions it is extremely unlikely that such conditions could be created. Government bond issuance has increased dramatically along with the rising government expenditure packages that have been introduced in response to the slump. The largest proportion (around 40% of existing stocks) of these bonds have gone into the portfolios of government agencies such as the Trust Fund Bureau (TFB). The next largest proportion went into bank portfolios (around a quarter). This shift was facilitated by what is called the "dual flight to quality" that has occurred in the post bubble period. in which the weakness of the banks caused households to shift from risky bank deposits to government guaranteed postal deposits (and the newly introduced ten year compound interest bearing savings accounts) which provided the funds for the TFB which invests in government securities. The weakness in the corporate sector caused a sharp fall in bank lending to the private sector, and banks increased their holdings of

government securities in their reduced balance sheets.

In the end of 1998 and early 1999 two important structural changes took place which are quite independent of the credibility of the Central bank's inflation policy. First, as part of Japan's financial liberalisation, banks will be required to mark their investment portfolios to market. The duration of a ten year bond issued at a 1% current yield is above 9.5 years. Any increase in long rates, such as the jump from around 1% to 2.25% that occurred during the last quarter of 1998 would produce a decline of around 12% in the value of the 1% par bonds in bank portfolios. For conditions prevailing in February 1999 it has been estimated that a 100 basis point rise in interest rates on long bonds would have produced a 15 trillion Yen capital loss for all financial holders of Japanese government bonds. It is thus likely that banks will be reducing their portfolio holdings of bonds, causing falling prices.

Further, the TFB announcement that it would reduce its purchases of securities from the 25 trillion Yen in fiscal 1998 to less than half (in January of 1999 it was only 5 trillion on an annual basis) because of maturing postal term deposits and the elimination of the requirement that postal deposits and pension contribution be held by the Bureau, concentrated the market's attention on the importance of public bond market management on supply conditions. It is quite clear that the continued financial liberalisation will reduce the holdings by government agencies, and that banks will reduce their portfolio holdings as the volatility of bond prices increases. Finally, banks will be given permission to raise funds through bond issues from the last half of fiscal 1999. All of these factors put a sustained upward pressure on term interest rates. This also means that banks will not only be unwilling to buy bonds, they will be hesitant to lend to finance private sector holdings of bonds or productive enterprise. In these conditions the market will suffer from continued fears of a steepening of the yield curve and the associated capital losses associated with holding long-term issues. Since there must be equivalence between short issues and long issues with short holding periods, this will mean continued upward pressure on short rates. Thus, the policy that the central bank would have to adopt in order to eliminate the risk of a rise in rates according to the square rule would be to peg long rates, much as was done in the US in the second world war (cf. IBJ Securities, 1999). This, however, does not seem likely for a Central bank that was just granted its independence in the context of big bang liberalisation.

Clearly, in present conditions it is not the lack of a credible inflation policy, but a credible interest rate policy that is creating difficulty. As Keynes notes in relation to Fisher's recommendations of inflating out of the Great Depression: "The stimulating effect of the expectation of higher prices is due, not to its raising the rate of interest (that would be a paradoxical way of stimulating output --in so far as the rate of interest rises, the stimulating effect is to that extent offset), but to its raising the marginal efficiency of a given stock of capital" (JMK:VII, p. 143) that is, raising the expectation of returns on new investment relative to the rate of interest, and this requires a credible policy that interest rates will not rise along with the rate of inflation, which is to say that the Fisher relation and the quantity theory should not hold. But the failure of a higher rate of increase in the quantity of money to increase prices and the rate of interest is what Krugman calls the liquidity trap and he identifies as the cause of Japan's recession. In Japan even if the Bank of Japan could mount a credible inflation policy, there would be no guarantee of the stability of the yield curve. What is required is a credible policy to ensure increased higher rates of return on investment, which may or may not be accompanied by rising prices. In general in Japan it has not. This requires credible increases in aggregate demand. Traditionally in Japan this has come from exports. Given recent Yen strength and other structural changes in global markets this is now unlikely. What Japan needs is a credible policy of increasing the return on producing for domestic demand. From a Keynesian point of view it might be more appropriate to say that Japan is in an underemployment equilibrium with deficient aggregate demand than in a liquidity trap.

NOTES

1. Although it is interesting to note that interbank deposit bid rates were in fact less than zero during 1998.

2. Cf. Joan Robinson's comment on this aspect of Hicks's Review (1937, p. 16): "There appears to be no warrant for Mr. Hicks' view ... that an indefinitely great rise of prices will develop in a state where capacity is limited but available labour unemployed. It is true, as Mr. Hicks says, that when effective demand increases and the supply of money is constant, the rate of interest will rise if the supply of consumption goods is less than perfectly elastic, so that prices rise. But it will rise even if supply is perfectly elastic and prices are constant".

3. "I know of no example of it hitherto" p. 207

Keynes always notes that his argument refers to "the objective of reducing the long-term rate of interest" (p. 202) or "a determinate rate of interest or, more strictly, a determinate complex of rates of interest for debts of different maturities." p. 205. He lists one of the reasons (in addition to the liquidity trap) why central banks have difficulty influencing the rate of interest as "the monetary authority's own practices in limiting it willingness to deal to debts of a particular type" p. 207, and that "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 [of the liquidity trap]" ibid. It is thus the influence on the long-term rate of interest that is crucial, but we would now talk in terms of affecting the slope of the yield curve.

4. The duration of a par perpetual bond with a £4 coupon is 26 years. Modified duration, defined as D/(1+I), which measures the volatility of bond prices, is 25 years. The change in the price of the 4% par consol is thus calculated by multiplying modified duration by the current price and the change in the bond's yield to maturity. In the case of a 16 basis point (4 basis points squared) rise in the yield from .04 to .0416, the value of the bond will fall over the year by 25*100*.0016 = £4, which is precisely the bond coupon. For any greater increase in interest rates, the fall in the bond's value will exceed the current coupon of the bond, producing net losses for the holder. If an investor expects interest rates to rise by more than the square of the current rate Keynes says the investor should prefer to hold cash rather than bonds. In such conditions, attempts to lower the rate of interest by increasing the purchase of bonds will find ready sellers at the prevailing interest rate, and the attempts of the monetary authority to lower rates will be prevented by a "liquidity trap".

5. As rates rise, the square rule produces larger and larger absolute changes in the interest rate, and the use of modified duration to calculate the change in price becomes less and less accurate. The full calculation of the change in the bond price will require the calculation of convexity. It is interesting to note that Hicks, 1939, p. 261, note 2, reproduces the square rule, and notes that it is very likely that returns will be negative, since the fall in capital values will be even greater if changes in risk are taken into account.

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