Monetary Policy in a Liquidity Trap*

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In the United States, the Federal Reserve sets monetary policy by targeting the federal funds rate. This process usually involves lowering short-term interest rates when economic growth is weak and raising them when economic growth is strong. A wide class of economic models has shown that, in theory, conducting policy in this way allows the economy to employ resources efficiently. In addition, many empirical studies have shown that most central banks actually behave in this manner. In normal times, it is fairly easy for the central bank to conduct policy in this fashion. But there is one instance when conducting policy in this manner becomes problematic: when the economy finds itself in a "liquidity trap," a situation in which the short-term nominal interest rate is zero or very close to zero. In this article, Mike Dotsey analyzes the difficulties a central bank faces in such circumstances and discusses the tools available to monetary policymakers. Policy as usual is not an option, and the central bank's framework for conducting policy must change.

Monetary policy typically operates by targeting a short-term interest rate. For example, in the United States, the Federal Reserve targets the federal funds rate. In order to conduct monetary policy, central banks generally vary the short-term interest rate target in response to economic conditions. They do so because setting the short-term interest rate at a level consistent with economic fundamentals generally attains both the most efficient level of output[1] and an inflation rate consistent with long-run inflation objectives.

This process usually involves lowering short-term interest rates when economic growth is weak or inflation or expected inflation is below some desired rate and raising them when the economy is growing strongly or when inflation or expectations of inflation are high. It has been theoretically shown in a wide class of economic models that conducting policy in this way allows the economy to employ resources efficiently. Low and stable inflation is a desirable feature of a well-managed economy, and setting the interest rate in a pro-cyclical manner is consistent with economic efficiency.

This way of conducting monetary policy is not just theoretically sound. Many empirical studies have shown that most central banks actually behave in this manner. This description of monetary policy — varying the interest rate in response to inflation and economic activity — is called a Taylor rule or a Taylor-type rule, named after John Taylor, who first described these types of policies.

In normal times it is fairly easy for the central bank to conduct policy according to a Taylor-type rule. But there is one instance when conducting policy in this manner becomes problematic: when the economy finds itself in a "liquidity trap," which is defined as a situation in which the

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[1] The efficient level of output is the output that would occur if all prices and wages were continuously adjusted in response to changes in economic conditions.

short-term nominal interest rate is zero or very close to zero.

Because the nominal interest rate is generally bounded below by zero, the central bank cannot lower interest rates further even if it would be desirable to do so, as it would be if the economy were in a deep recession. Furthermore, as I'll discuss below, in this situation, trying to stimulate the economy by injecting more money or liquidity through open market operations may have little or no effect on output. Therefore, it may appear that monetary policy is impotent under these conditions.

This article analyzes the difficulties a central bank faces in such circumstances and discusses the tools available to monetary policymakers. Policy as usual is not an option, and the central bank's framework for conducting policy must change. Importantly, it must change in ways that alter individuals' expectations of what policy will be like when the zero lower bound on interest rates is no longer binding.

Thus, the conduct of monetary policy becomes quite subtle and depends on the credibility of proposed future actions. Further, economists have been concerned about the design of appropriate monetary policy in a liquidity trap for quite some time, and in what follows, I will draw heavily on the work of Gauti Eggertsson and Michael Woodford; Alan Auerbach and Maurice Obstfeld; and Paul Krugman.

ECONOMIC PROBLEMS ASSOCIATED WITH A LIQUIDITY TRAP

To understand the economic problems that ensue when an economy is in a liquidity trap, we must first understand the concept of the real interest rate and its role in efficiently allocating economic resources. What follows will be a fairly abbreviated analysis.[2]

The real interest rate, defined as the nominal interest rate less expected inflation, plays an important role in determining what fraction of output is consumed and what fraction is invested. In a perfectly competitive economy, the movement of the real interest rate in response to economic shocks is consistent with the optimal allocation of economic resources. That is, the real rate responds in such a way that the level of output and its allocation between consumption and investment is the one that provides the highest level of economic welfare. This interest rate, which is associated with perfect competition, is generally referred to as the economy's natural interest rate. For example, strong economic growth is associated with an opportune time to make investments, especially if that growth is generated by increased productivity. At such times, consumers are also wealthier and hence desire more consumption. In order to induce enough saving for financing the optimal quantity of investment, the real interest rate rises. Thus, resources are allocated toward increasing the capital stock, which, in turn, results in higher future output, higher future consumption, and higher wages. Analogously, when the economy is weak, the real interest rate falls, and when the economy is very weak, the real interest rate may even become negative. A negative real interest rate is sometimes observed during recessions.

Generating a Liquidity Trap. If the economy is sufficiently weak that a real interest rate below zero is desirable, it is possible for the economy to enter a liquidity trap. As indicated above, the real interest rate is defined as the nominal interest rate minus the expected rate of inflation. But this means that the nominal interest rate is the sum of two components: the real interest rate and the expected rate of inflation. This relationship is known as the Fisher equation. Importantly, the nominal interest rate cannot be negative because no one would lend at a negative rate. If they did, they would get less money back than they lent, and they would be better off putting their money in their mattress. Thus, in a liquidity trap, when the nominal interest rate is zero and a negative real interest rate is also desirable, the Fisher equation implies that expected inflation must be equal and of opposite sign to this negative real interest rate. Therefore, the desirability of a negative real interest rate implies the desirability of positive expected inflation.

If features of the economy prevent prices from adjusting flexibly, expected inflation may, in the end, not be high enough to generate a sufficiently low real interest rate. The monetary authority is also unable to lower the nominal rate below zero. Thus, in addition to the economic shocks that are

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[2] For a more detailed discussion, see my 2004 *Business Review* article.

responsible for the recession, interest rates cannot adjust in an optimal way. The presence of the liquidity trap places the economy in even greater jeopardy. Furthermore, because money and bonds are now perfect substitutes — each is earning a zero rate of interest — the inflation rate is not a current monetary policy phenomenon. The fact that both assets are now earning the same zero rate of interest implies that the public is indifferent between the relative amounts of money and bonds in its portfolio.[3] Therefore, current open market operations that alter the amount of bonds and money in public hands have no impact on inflation. Second, with no opportunity cost for holding money, the public is willing to hold just about any amount of money the central bank supplies. Thus, current injections of money have little effect on prices or inflation. This is why the occurrence of a zero nominal interest rate is called a liquidity trap.

However, future monetary policy can prove effective in the current environment, but understanding the subtle and indirect way in which that happens requires an understanding of how monetary policy affects prices in more normal times.

Controlling the Price Level and Inflation. In normal times, standard economic models suggest that a central bank should adjust the short-term nominal interest rate one-for-one with perceived movements in the real interest rate. This type of policy engenders an efficient economic response to the various types of disturbances that affect economic activity. Moreover, this type of policy is consistent with a policy of low and stable inflation. Only policy changes that move the real interest rate by larger amounts than dictated by underlying economic fundamentals have a substantive effect on inflation and economic activity. For example, a severe tightening of policy raises the short-term real interest rate above its efficient or natural level, temporarily choking off consumption and investment. The tightening of policy also brings down inflation. A good example is the disinflation during the tenure of Fed Chairman Paul Volcker, when the Fed maintained very high nominal and real interest rates. This policy contributed to the two ensuing recessions and a significant lowering of the inflation rate. The opposite occurs when the central bank reduces the real interest rate below its natural rate. The result is temporarily higher output and an increase in the inflation rate.

In normal times, standard economic models suggest that a central bank should adjust the short-term nominal interest rate one-for-one with perceived movements in the real interest rate.

However, a liquidity trap is a time when the central bank would like to bring the real rate down. Therefore, in theory, the central bank should desire an increase in near-term inflation that makes the real interest rate negative enough so that the economy is able to best cope with the fundamental factors that have reduced output growth. For example, suppose the natural real interest rate is -3.0 percent and inflation expectations are 1.0 percent. The zero lower bound on nominal interest rates implies that the real interest rate in financial markets can, at best, be lowered to -1.0 percent. To lower the real rate to the natural rate would require a nominal rate of -2.0 percent, which is impossible.

This higher-than-natural real rate will serve to choke off aggregate demand beyond what occurs due to economic disturbances, and the economy will be in for a deeper recession than it otherwise would be. This is the situation in which the liquidity trap has *severe* consequences and why all central banks endeavor to keep the economy out of these circumstances.

As discussed, this is also the situation in which the nominal rate cannot be lowered further, and standard monetary policy that relies on simple Taylor-style interest rate rules is helpless in ameliorating the weakness in the economy. Unfortunately for Japan in the 1990s and the U.S. economy today, this is where we find ourselves. Fortunately, there are policies the central bank can follow that will mitigate the effects of the liquidity trap, but policies in this situation involve departing from normal operating procedures and the rules that normally govern monetary policy. As a result, these alternative policies may be difficult to communicate, and because liquidity traps are rare events, these policies may not be deemed fully credible since the public has little experience with these situations, as well.

MONETARY POLICY IN THE LIQUIDITY TRAP

Credibility is an essential feature of the simple policy I will discuss and a feature of any successful

[3] Currency earns a zero rate of interest and other types of money, such as bank reserves, have, until quite recently, earned a zero rate of interest. When short-term bonds, such as Treasury bills, earn a positive rate of interest, holding money incurs an opportunity cost in terms of forgone interest.

monetary policy during a liquidity trap, and it may be an even more important ingredient than when the economy is functioning under normal circumstances.[4] The reason is that the central bank must depart from its normal behavior, and the public, having little experience with a liquidity trap, may not believe that policy has actually changed. Absent perfect credibility, the policies described below would lead to very different and much less beneficial economic outcomes.

If the economy is in a liquidity trap and the weakness in the economy is significant, it may be desirable to generate an increase in inflation expectations. In our previous example, lowering the financial real interest rate to a desirable -3.0 percent requires inflation expectations to increase to 3.0 percent. However, doing so requires the public to believe that future inflation will indeed reach 3.0 percent.

The success of altering future policy also requires that the economy not be in the liquidity trap forever. Historically, all instances of actual liquidity traps have been temporary. The current crisis appears to be temporary as well, and it appears that the public believes this to be the case. That inference is based on the fact that long-term interest rates are currently positive. Because long-term interest rates are an average of current and future short-term interest rates, a positive long-term interest rate implies that at some point in the future short-term interest rates will be positive as well. Hence, the evidence from long-term bond markets indicates that the zero lower bound will not last indefinitely. Liquidity traps, fortunately, appear to be temporary phenomena.

Role of Nominal Interest Rate in a Liquidity Trap. We have emphasized that there is nothing current monetary policy can accomplish while the economy is in a liquidity trap. However, once economic activity recovers to the point at which the nominal interest rate is positive, monetary policy can influence the level of economic activity. So at some point in the future, a lower-than-normal future short-term nominal interest rate will stimulate future economic activity.

Generating increased output growth in the future can have consequences for current output. Investment now becomes more attractive, and firms may be reluctant to lay off as many workers if they are confident that higher than normal output is around the corner. Expectations of better times ahead will also stimulate current consumption. The cost of the future monetary stimulus will be that future inflation would be higher than it otherwise would have been.

Thus, in a standard theoretical model a commitment by the central bank to temporarily increase future inflation above what it would be in the absence of a liquidity trap is a beneficial policy response when the economy is in a liquidity trap. The central bank makes such a commitment because the gain in economic activity more than offsets the cost of somewhat higher inflation. But because the commitment pertains to future actions, it will have an effect only if the policy is believed. This feature is an important component of the influential work of Gauti Eggertsson and Michael Woodford, who have analyzed the liquidity trap in great depth. An important theme resonating throughout their analysis is policy's ability to influence expectations and, importantly, inflationary expectations over long horizons. By doing so, the monetary authority influences the term structure of real interest rates and thereby influences current aggregate demand.[5] So, even in an environment where both prices and inflation respond slowly to economic shocks and monetary policy, the policies prescribed by Eggertsson and Woodford have substantial effects.

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In their work, Eggertsson and Woodford show that the zero bound can cause a significant problem for monetary policy in the case in which the interest rate rule does not change when the economy exits the liquidity trap. That is, a Taylor-type rule that works fine in normal times may not work so well when there is a zero lower bound problem.

[4] For a discussion of the importance of credibility in general, see my 2008 article and the Federal Reserve Bank of Philadelphia's 2007 annual report.

[5] The term structure of interest rates describes the relationship between interest rates on bonds of varying maturities.

A particularly important result of their analysis is that many policies advocated in the popular press when the economy is in a liquidity trap with zero nominal interest rates are not useful. In particular, in their framework, not only are current open market operations, which exchange short-term bonds for money, irrelevant, but temporarily providing additional bank reserves through increased open market operations will have no effect on the economy, irrespective of the types of assets the monetary authority purchases.

This last result occurs because efficient pricing of, say, long-term bonds that are currently yielding a positive interest rate can have an effect on behavior only if those purchases imply a change in the path of short-term rates. This is because, as mentioned, long-term rates are merely an average of short-term rates.[6] Thus, any policy response today that does not also reflect a change in future policy will not affect future economic activity. Therefore, it will not affect future short-term interest rates and hence should not affect the long-term bond rate in any meaningful way.

Two features of their model are responsible for the ineffectiveness of large-scale increases in central bank liabilities, often called quantitative easing: (1) any increases in money at the zero bound is done through open market operations and, therefore, does not affect the value of government liabilities, and (2) any increase in money, even if it is accomplished via government transfers, is transitory. Thus, as in the analysis by Alan Auerbach and Maurice Obstfeld, for increases in money to be beneficial, the increase must be permanent. By necessity, the underlying interest rate rule must change once the economy escapes from the zero lower bound. If policy returns to a normal interest rate rule, the money injected during the liquidity trap will have to be withdrawn to ward off an increase in the inflation rate. But this action would be inconsistent with the higher inflation promised while the economy was in the liquidity trap. Hence, if the public believes that upon exiting the liquidity trap the central bank would immediately return to normal policy, the promise of additional near-term inflation would not have been believed in the first place.

Thus, a policy that permanently changes the monetary base today must also be associated with a change in the interest rate rule if it is to have effects. It is not just the current setting of the interest rate that is important, but the path that policy sets for future short-term interest rates matters as well. This is analogous to saying that the systematic component of policy is important and that more importance should be attached to what will be done in the future than what is done today.

But there is an additional subtlety here. As mentioned, a change in future policy implies that the central bank must tolerate additional inflation in the future even after the zero bound is no longer a problem. This policy leads to less deflation at the zero bound and greater output growth in the future. The increase in future output growth implies greater output growth in the present, when the zero lower bound is binding, and implies that the natural interest rate is somewhat higher in the current environment than it would be absent the promise of future inflation. Thus, Eggertsson and Woodford show that the economic losses associated with a real interest rate that is too low can be reduced.

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A SPECIFIC POLICY

Eggertsson and Woodford provide specific policy advice for the central bank when a liquidity trap occurs. The specifics of their proposal are complex and particular to their model. However, they suggest that dealing with the public's expectations when the economy is in a liquidity trap will take some skill on the part of any central bank. Interestingly, in their framework, a simple price-level targeting rule comes very close to achieving the best outcome, and such a policy should be relatively easy to communicate. Rather than targeting inflation per se, as is typical of most central bank behavior, in a liquidity trap, the central bank should actually target the path of prices.[7] The

[6] Eggertsson and Woodford's argument is in fact more general and encompasses the government's purchase of any asset.

[7] For a detailed discussion of price-level targeting, see the article by Alexander Wolman.

important distinction is that a price path implies that should inflation be relatively low today so that the price level is below its target, future inflation must increase to get the price level back on track. Therefore, the occurrence of deflation would require higher future inflation, and as we have seen, somewhat higher than normal inflation is a useful mechanism for ameliorating the adverse effects of a liquidity trap.[8]

A price-level target is a way of formalizing that policy prescription. Because no central bank employs a price-level target, that could make credibility for this option problematic. The proposal could be couched as a time-varying inflation target, whereby the targeted inflation rate would be the rate that would get prices back to the price-level path. But, again, the public has little experience with such a rule. Thus, establishing credibility for future expansionary policy is an essential, but perhaps difficult, feature of successful policy at the zero lower bound.

Thus, a central message of Eggertsson and Woodford's research is that the monetary authority must be able to commit to expansionary policy once the zero-lower-bound problem is alleviated. In particular, it must commit to higher inflation than would otherwise occur if the zero bound had not been reached. A proposal of raising the price of long-term debt or, equivalently, lowering long-term interest rates is consistent with the optimal lower future path of short-term rates. It could, therefore, be useful for a central bank to buy large quantities of long-term debt as a way of signaling its intention to increase near-term inflation and inflation expectations. In this case, not carrying through on its implied promise would result in a fall in bond prices and a capital loss for the central bank.[9]

A LARGE INCREASE IN THE FED'S BALANCE SHEET

However, a potential challenge from the standpoint of the monetary authority is that once higher short-term inflation is realized, the public will alter its expectations of inflation and the central bank will now be facing an inflation scare and the problems that accompany a departure of inflation expectations from target.

A lack of perfect credibility, which may be an unavoidable reality, acts as a two-edged sword that makes dealing with a liquidity trap difficult.

Problems such as these have been well documented in Marvin Goodfriend's study and discussed in my essay with Charles Plosser.

Thus, a lack of perfect credibility, which may be an unavoidable reality, acts as a two-edged sword that makes dealing with a liquidity trap difficult.

Without full credibility, it is hard to generate an increase in inflation beyond what the public would normally expect, and if that inflation is generated, it subsequently may be difficult to return expectations of inflation to ones that are consistent with price stability. As discussions in the media suggest, the current large increase in the Federal Reserve's balance sheet could represent such a threat to the credibility of the Fed's long-run inflation target.[10]

The concern being expressed is that if it becomes difficult to unwind some of the assets currently on the balance sheet, the future money supply could be permanently higher. However, with interest rates returning to normal levels, the demand for money will not be permanently higher. A permanent increase in the money supply without a permanent increase in money demand can only lead to higher prices and higher inflation.

Currently, there is every expectation that the Fed will successfully reduce its balance sheet as the banking system recovers, and survey data on inflation expectations confirm this belief. Managing that expectation is thus an important part of policy, as evidenced in a number of speeches by Federal Reserve policymakers, including Philadelphia Fed President Charles Plosser.[11] It has become increasingly important for the Federal Open Market Committee (FOMC) to articulate an exit strategy and to indicate to the public that it will follow an exit strategy that does not ignite future inflation.

[8] In other models, such as the one in the study by Andrew Levin, David Lopez-Salido, Edward Nelson, and Tack Yun, a price-level target does not duplicate optimal policy nearly as well. Their model calls for even more aggressive policy, which leads to a permanent increase in the price-level path.

[9] Alternatively, as Lars Svensson has suggested, the central bank could deflate the value of the currency using an exchange-rate peg. Doing so would require purchasing foreign assets, and this policy may also be useful in establishing credibility for higher inflation. If higher inflation is not forthcoming, the home currency would appreciate, and the foreign assets on the central bank's balance sheet would depreciate, resulting in a capital loss for the central bank.

[10] The size of the Federal Reserve's balance sheet has more than doubled from $954 billion on September 17, 2008, to slightly more than $2 trillion as of August 26, 2009.

[11] See, for example, the speech by Charles Plosser.

Indeed, the FOMC has been quite explicit concerning its intentions for maintaining long-run price stability.

SUMMARY

This article describes the difficulties of conducting monetary policy when there is a liquidity trap. A very weak economy can require negative real interest rates, and rates that are sufficiently negative can be hard to achieve when the short-term nominal interest rate is bounded below by zero. Although, in theory, generating increased expectations of future inflation is helpful, this may be difficult to achieve because standard monetary policy that targets a nominal interest rate is ineffective once nominal interest rates have reached zero. Achieving the necessary increase in expected inflation falls on promises of future policy, but successfully accomplishing this goal may require credibility for temporarily deviating from the central bank's long-run inflation target. Furthermore, that deviation, if successful, could result in the public's no longer believing in the long-run target. The central bank could face a future destabilization of inflation expectations and all the problems that ensue when that occurs.

Thus, a liquidity trap is a perilous place for the economy and a central bank. Successfully navigating a liquidity trap requires open communication and transparency because it requires the public to understand not only current policy but future policy as well.

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