DOES A "LIQUIDITY TRAP" EXIST TODAY (2009) AND DOES IT MATTER?

by

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Abstract

Can stimulative monetary policy be effective when there is a "liquidity trap"? This question surfaced during the Great Depression and is raising its head again today due to the current financial crisis. A definitive answer never materialized for the 1930's, as differences of opinion between non-monetarist and monetarist economists arose about this issue. This need not be the case today. In this thesis I will first enumerate several different meanings of the term "liquidity trap" and their implications for monetary policy. Then, with data from the Federal Reserve, I will attempt to validate the likelihood of a liquidity trap. I do this for the demand for money and bank liquidity traps. I use regression analysis over a fifteen year period with varying interest rates to determine if the elasticities of demand increase as interest rates fall, indicating a liquidity trap. My use of log linear regressions for both demand for money and bank liquidity traps, using data from the present financial crisis, adds to the evidence supporting the liquidity hypothesis, but does not empirically establish the existence of a liquidity trap.

Following my findings, I detail actions taken by the Federal Reserve and show the subsequent results through the summer and into the fall of 2009. From this, I make a conclusion that the United States is most likely in a liquidity trap and it does matter.

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CHAPTER 1 - "Liquidity Trap"

Is monetary policy effective when there is a "liquidity trap"? This question surfaced during the Great Depression and is raising its head again today due to the current financial crisis. A definitive answer never materialized for the 1930's as differences of opinion regarding the cause of the Great Depression between non-monetarist and monetarist economist arose. This need not be the case today. In this thesis I will first enumerate several different meanings of the term "liquidity trap" and their implications for monetary policy. Then, with data from the Federal Reserve, I will attempt to validate the likelihood of a liquidity trap. I will detail actions taken by the Federal Reserve and the subsequent results on the economy. From this, a conclusion can be made on whether the existence of a liquidity trap matters.

Liquidity

Before discussing a "liquidity trap", the term "liquidity" needs to be understood. It is important to understand the word "liquidity", because a financial crisis can occur when liquidity disappears. Liquidity has several different meanings. The most common and generalized meaning refers to the "relative ease with which an asset can be converted to money without significant commissions or other charges, inconvenience, and risk of loss of principal."[1] Cash is one hundred percent liquid, while other assets have varying degrees of liquidity. This type of liquidity is referred to as asset liquidity. There is however, liquidity known as funding liquidity and market liquidity.

Funding liquidity is similar to asset liquidity and is generally used in the world of financiers. "Funding liquidity describes the ease with which expert investors and arbitrageurs can obtain funding from (possibly less informed) financiers."[2] When it is easy to raise money, it is said that markets are "awash in liquidity" and therefore funding liquidity is high. The term "funding liquidity" is important to understand because some financial institutions rely largely on

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[1] Lloyd B. Thomas, Money, Banking and Financial Markets (Thomson, South-Western, 2006), p.26.
[2] Markus K. Brunnermeier, "Deciphering the Liquidity and Credit Crunch 2007-2008" Journal of Economic Perspectives, 23, No. 1 (Winter 2009) 91.

short term debt, such as commercial paper and repurchase agreements (known as "repos") that need to be rolled over nearly continuously. When financial institutions are unable to roll over this debt, it puts the institution in a precarious situation because it is in effect analogous to a run on the bank.[3] For those that invest in stocks it would be similar to a 100 percent margin call.

"The word "liquidity" is sometimes used in the context to describe the availability of credit in the financial market."[4] For example, individuals might say there is a lack of liquidity in the market. This means that it is difficult to borrow money (i.e., get credit). This is known as market liquidity. Like liquidity of an asset, the concept of market liquidity is relative. Some individuals or companies may not be able to obtain loans in a very liquid market, or will have to pay a relatively high interest rate. Other individuals or companies can obtain loans even in markets considered illiquid. Market liquidity is considered low, when selling the asset significantly depresses the sale price. With respect to financial institutions, it then becomes costly to shrink the balance sheet.

Researchers Tobias Adrian and Hyun Song Shin have come up with a new definition for liquidity in their article, "Liquidity, Monetary Policy, and Financial Cycles", published by the Federal Reserve Bank of New York in its periodical *Current Issues* in January/February 2008. In this article, they define liquidity as the "*rate of growth of aggregate balance sheets*" or, as they go on to say, "in more concrete terms, we can define liquidity as the rate of growth of repos, since repos and other forms of collateralized borrowing are the tools that financial institutions use to adjust their balance sheets." They feel that their definition of liquidity is better for a modern, market based financial system.

Market liquidity and monetary policy are closely associated, as related by Ben Bernanke, chairman of the Board of Governors of the Federal Reserve system in a speech at the Federal Reserve Bank of Atlanta Financial Conference, in May of 2008. He states that "well-functioning financial markets are an essential link in the transmission of monetary policy to the economy and a critical foundation for economic growth and stability." It was for this reason that the Federal

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[3] Ibid. p.96.
[4] Daniel L. Thorton, "The Fed, Liquidity, and Credit Allocation" <u>Federal Reserve Bank of St. Louis</u> <u>*Review*</u>, January/February 2009, 91(1), pp. 13-21.

Reserve recently implemented liquidity measures, as a sharp housing contraction resulted in a tightening of credit by the financial markets in the current financial crisis.[5]

Liquidity Trap

Now that the meaning of the word "liquidity" and its importance to monetary policy has been defined, I will proceed with defining what is meant by a "liquidity trap". Just like the word "liquidity" the term "liquidity trap" has different meanings. A trap can occur in the demand for money or a trap can occur within the banking system. A trap occurs either because the banks desire to hold more reserves or because the public is unwilling to borrow.[6] The term "liquidity trap" has also evolved over time. Its meaning today is different than when it was first coined by Dennis Robertson in 1936.[7] I will first discuss a "liquidity trap" with respect to the demand for money.

Demand for Money Liquidity Trap

"A liquidity trap is defined as a situation in which the short-term nominal interest rate is zero. In this case, many argue, that increasing the quantity of money in circulation has no effect on either output or prices."[8] This idea originated with John Maynard Keynes during the Great Depression and is contrasted with the quantity theory of money. The quantity theory of money uses the equation of exchange, $MV = PQ$ where

M = quantity of money

V = velocity of money

P = price level

Q = the quantity of output

to relate changes in the money supply to changes in prices and output. If the money supply (M) increases and velocity (V) is constant, then nominal GDP (PQ) must increase.

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[5] Ben Bernanke, "Liquidity Provision by the Federal Reserve", a speech given at the Federal Reserve Bank of Atlanta Financial Conference, Sea Island Georgia, May 29, 2008.

[6] Karl Brunner and Allan H. Meltzer, "Liquidity Traps for Money, Bank Credit, and Interest Rates," Journal of Political Economy, January/February 1968, 76, (1) pp.1-37.

[7] Mauro Boianovsky, The *IS-LM* Model and the Liquidity Trap Concept: From Hicks to Krugman: *History of Political Economy* Conference on "The IS/LM Model: Its Rise, Fall, and Strange Persistence", Duke University, 25-27 April 2003.

[8] Gauti, B. Eggertsson, "Liquidity Trap", The New Palgrave Dictionary of Economics. Second Edition. Eds. Steven Nidurlauf and Lawrence E. Blume. Palgrave Macmillion, 2008.

The Keynesian theory, on the other hand, implies that the money supply (*M*) affects prices (P) and output (Q) through nominal interest rates. Increasing the money supply reduces interest rates through the money demand equation.

Money Demand Function

In the money demand equation there is an inverse relationship between the interest rate and the quantity of money demanded, as shown in Figure 1 below.

Figure 1 The Money Demand Function
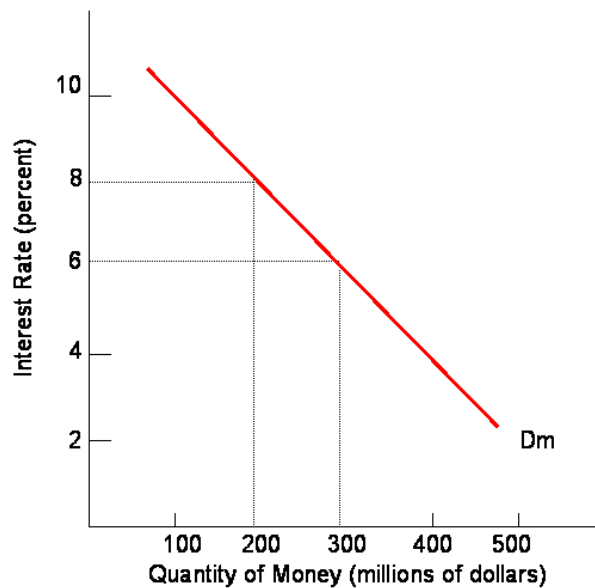
The interest rate is the opportunity cost of holding money. At a low interest rate, holding wealth in the form of money is rational, as the income foregone is minimal. However, at a higher interest rate, the amount of income foregone in holding money could be considerable. The higher the interest rate, the more income foregone, therefore less money is willingly held. The downward slope of the money demand curve (Dm), in the above figure, shows the inverse relationship between interest rates and the quantity of money demanded.[9]

The slope of the demand for money curve plays an important role in macroeconomics, because the slope will determine whether monetary policy or fiscal policy exerts more influence

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[9] William Boyes and Michael Melvin, <u>Macroeconomics</u>, 7th ed. (Boston, Houghton Mifflin, 2008), p. 334.

on aggregate demand. Keynesians, supporters of Keynesian theory, believe that fiscal policy plays a greater role influencing aggregate demand. They believe that the quantity of money demanded is sensitive to the interest rate, and that the curve shifts as it reacts to various economic events making it volatile. Those that believe monetary policy has a greater influence on aggregate demand, otherwise known as monetarists, believe that the demand for money curve is nearly vertical and quite stable. Therefore, the interest elasticity of demand also plays an important role. Keynesians believe, especially in a low interest rate environment, that elasticity of demand for money is quite high (-0.5 to -1.0), while monetarists believe that the elasticity is quite low (-0.1 to -0.3).[10] The actual shape of today's curve (quantity of money in relationship to interest rates) and the shifting of this curve, along with the elasticity of demand, will be shown in the next chapter.

Most economists believe that the demand for money (the reason people hold money), and by extension the slope of the demand curve, is influenced by the transaction, precautionary and speculative demand for money, along with institutional factors such as credit cards and the frequency of paydays. Of note, however, is the speculative demand for money. This demand is created by uncertainty about the value of other assets. If you want to buy stock, but you believe the price is going to fall, you hold the money pending a better opportunity. In the case of bonds, the decision is similar; one must decide when to buy bonds and when to hold onto money. Keynes analyzed this dilemma in the "context of an individual confronted with an alternative of investing wealth in government bonds or holding the wealth in the form of noninterest-earning money balances."[11] In the case of a perpetual bond, like British consols, it is important to note the relationship between bond prices and bond yields (interest rates), as depicted in the following equation.

$$P = \frac{R}{i}$$

where:

P is the price of the bond

R is the constant annual return

i is the current bond yield and current yield of other assets

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[10] Lloyd B. Thomas, Jr., <u>Money, Banking, and Economic Activity,</u> third edition. Prentice-Hall Inc.1986, p. 343.

[11] Ibid., p.346.

As such, bond prices are inversely proportional to yield or the interest rate. Consequently, when interest rates are low (near 2 percent in the case of Keynes' analysis) or near zero in today's environment, investors would believe that the rate can only go higher in the future. This would result in bond prices falling. Accordingly, investors would stay clear of bonds and hold their financial wealth in the form of money. Therefore, according to Keynes, the lower the current interest rate the lower the demand for bonds, and the greater the demand for money. Keynes referred to this as "liquidity preference" and a graphical depiction of it is provided in Figure 2 below.

Figure 2 Liquidity Preference
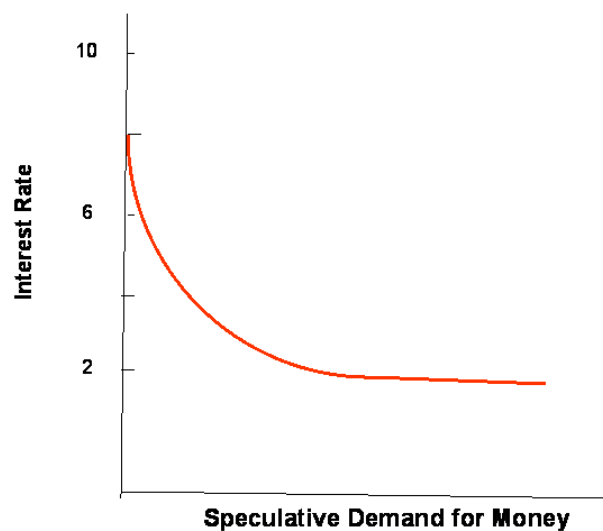
This graph shows that, at some low interest rate, the speculative demand for money, or as some analysts prefer the "interest-sensitive portion of demand for money", becomes perfectly elastic with respect to the interest rate. At some low interest rate, <u>all</u> investors would believe interest rates will only rise in the future (bond prices fall) and would therefore liquidate all bonds and hold all financial wealth in money.

Money Supply Function

The Federal Reserve is responsible for determining the quantity of money supplied. Because the Fed can choose the quantity of money supplied, means that the money supply

function by itself is independent of the interest rate. Figure 3 illustrates the money supply function.[12]

Figure 3 The Money Supply Function
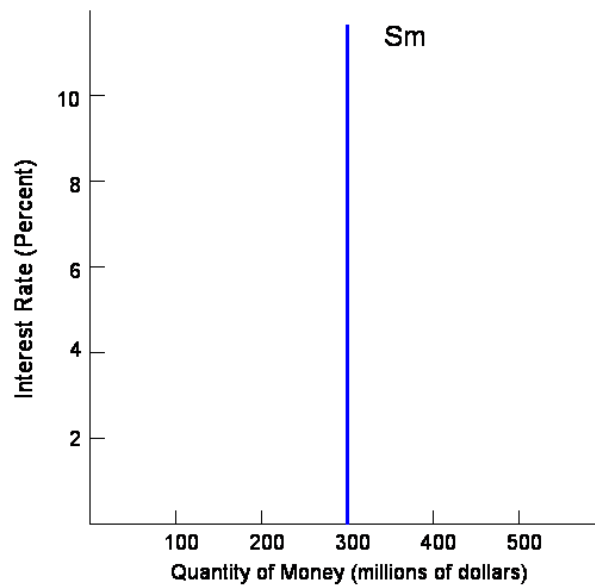
In the figure, the money supply is $300 million at all interest rate levels. If the Fed increases the money supply, the vertical money supply function shifts to the right. If the Fed decreases the money supply, the function shifts to the left.

Combining the money demand function with the money supply function shows how an increase in the money supply causes the interest rate to fall. See Figure 4 below.

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[12] Some economists depict the money supply function as upward sloping as opposed to vertical. Their rationale is that bank demand for excess reserves is negatively related to interest rates. Banks are more aggressive in lowering excess reserves (expanding loans and security holdings) as interest rate increases.

Figure 4 Money Supply Increases and Interest Rate Falls
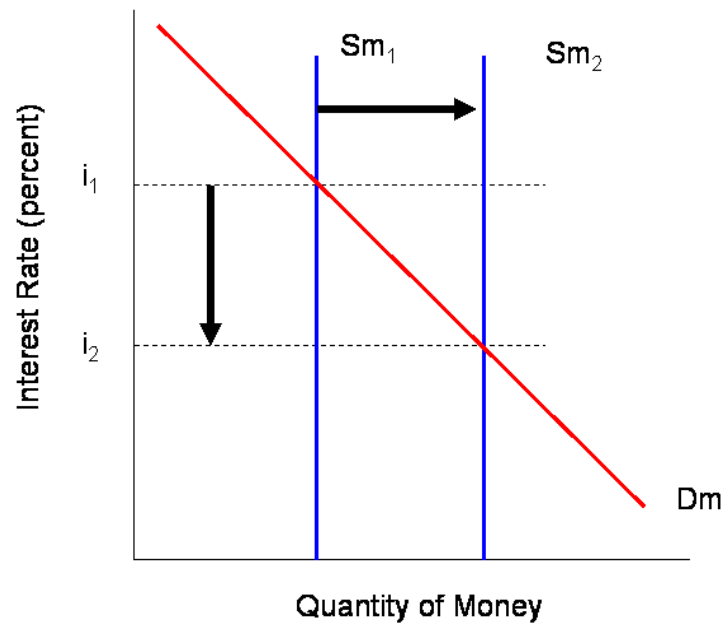
As the money supply increases from Sm_1 to Sm_2, the equilibrium rate of interest falls from i_1 to i_2. This is the cornerstone of Keynes model. "In Keynes view, if a change in the money supply is to influence economic activity, it must do so via its impact on interest rates."[13] This is readily seen in Figure 5 below.

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[13] Lloyd B. Thomas, Jr., Money, Banking, and Economic Activity, third edition. Prentice-Hall Inc., p. 349.

Figure 5 Keynesian Model
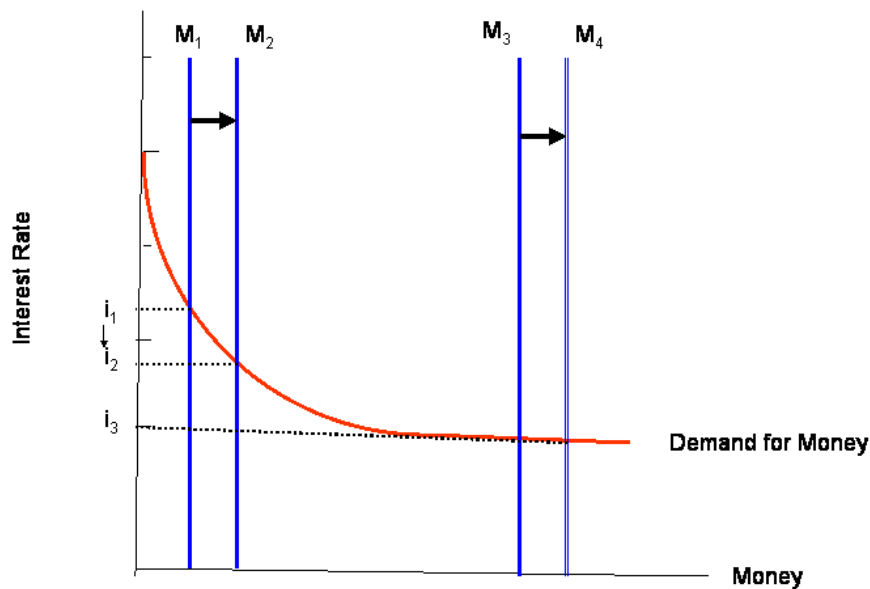
In the figure above, as the money supply increases from M_1 to M_2, the interest rate declines from i_1 to i_2. However, note that when interest rates are low and the demand for money is perfectly elastic, the increase in money supply has no effect on the interest rate. This is shown when M3 increases to M4; the interest rate remains constant at i_3. In terms of $MV = PQ$, this means as $M \uparrow$ increases, $V \downarrow$ decreases proportionately. So, MV or aggregate demand, is unaffected by the expansion of the money supply when the money demand curve is perfectly elastic. The extra money supplied by the Federal Reserve is held in the form of speculative money; none of the money is spent. This is why Keynes' believed that monetary policy is ineffective when interest rates are low, and the economy is caught in a "liquidity trap".

However, in normal times when the money demand curve is not perfectly elastic, lower interest rates stimulate spending and thus output. This is shown below in Figure 6.

Figure 6 Spending and Output Increases
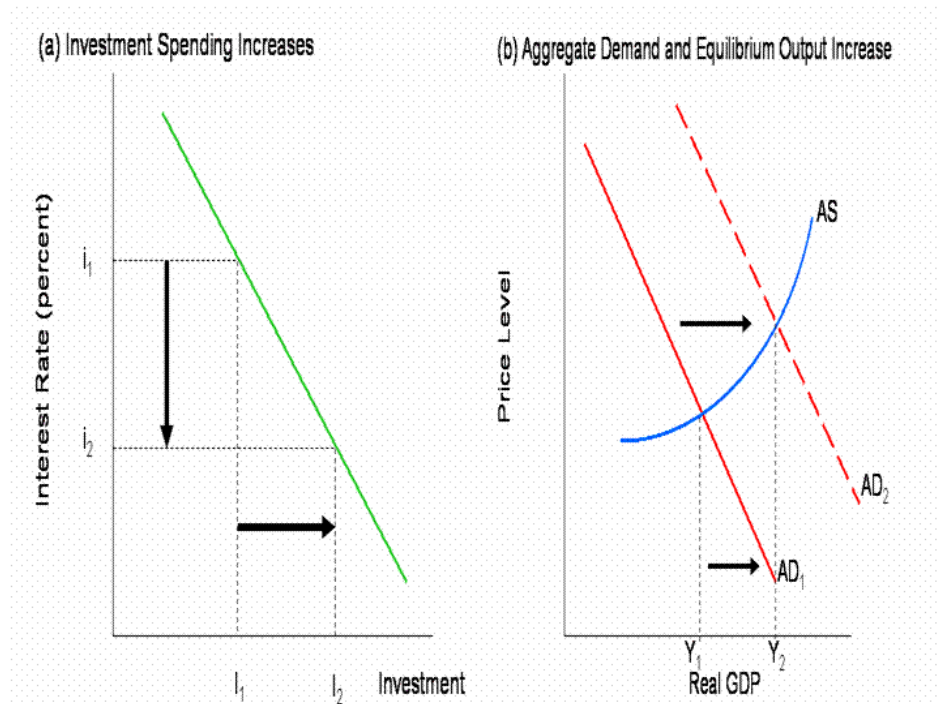
In Figure 6(a) you can see the effect of lower interest rates on investment spending. As the interest rate falls from i_1 to i_2, investment increases from I_1 to I_2. When spending increases, aggregate demand (AD) in figure 6(b) increases, shifting the AD curve rightward and increasing output from Y_1 to Y_2.

Even though increasing the money supply normally reduces interest rates through the money demand equation, the interest rate can never go below zero percent. No one will lend money unless they get back, as a minimum, the amount they loaned. A negative interest rate would imply banks paying borrowers to take out loans. Therefore, once the Federal Reserve has increased the money supply to the point of lowering interest rates to zero, there would no longer be an impact on prices or output. In fact, in Keynes' original work, *The General Theory of Employment, Interest, and* Money, it was suggested that a trap would occur at an interest rate of perhaps 2 percent, rather than at zero percent. Consequently, further increases in the money supply will be useless, and thus a "liquidity trap" will exist rendering monetary policy ineffective, as was previously shown in Figure 5.

A common approach for discussing a "liquidity trap" is through the use of the *IS-LM* model. The *IS-LM* model provides a framework for analyzing aggregate demand. It shows what

determines output for a given price level by analyzing the interaction between the goods and services market and the money market.[14] As there are different meanings for "liquidity" and different meanings for "liquidity trap", there are different approaches to developing the *IS* and LM curves in the *IS-LM* Model. The results are the same, which will become apparent as I show two derivations of the *IS-LM* curves for completeness and understanding. I will call the two different approaches to deriving the *IS-LM* curves simply, method 1 and method 2.

IS-LM Derivation Method 1

The following figure expresses that the quantity of money balances demanded, must equal the quantity of money balances supplied.

The LM Curve

Figure 7 Method 1 Derivation of LM Curve[15]
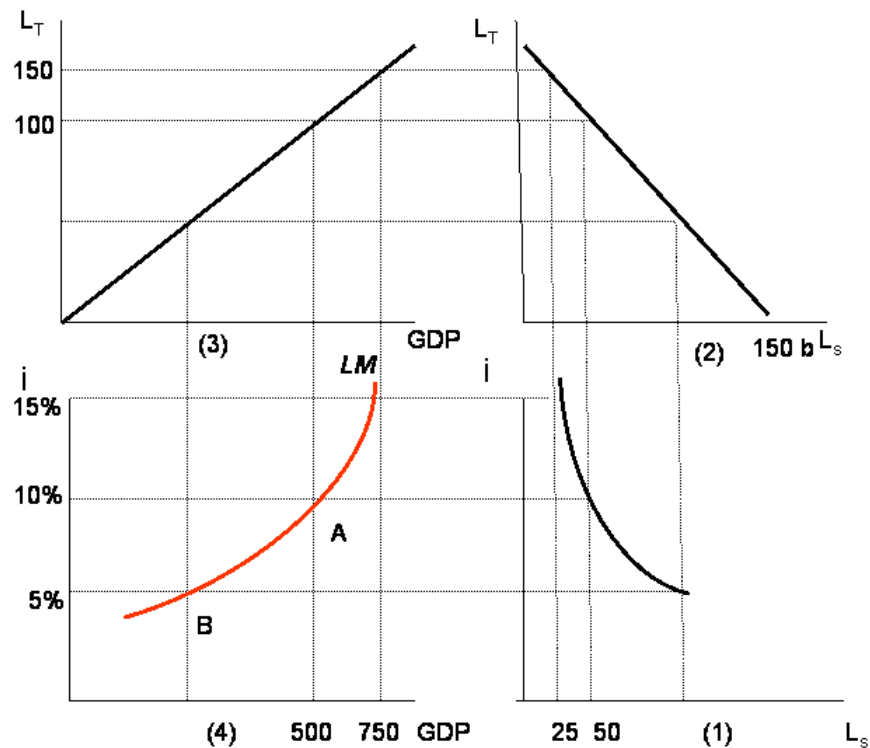
The speculative (or interest-sensitive portion of the) money demand function is shown in the 1st quadrant of Figure 7. The 3rd quadrant shows the transactions demand and precautionary

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[14] N. Gregory Mankiw, Macroeconomics 5th ed., (Worth Publishers, New York, 2003) p. 531.
[15] Lloyd B. Thomas, Jr., Money, Banking, and Economic Activity, third edition. Prentice-Hall Inc., p 408

demand for money and is designated L_T. It is a positive function of GDP. Quadrant 2 shows different combinations of the existing money supply consisting of speculative holdings (L_S) and precautionary and transaction demand balances (L_T). The *LM* curve is shown in quadrant 4 and is derived from the three other quadrants. The *LM* curve depicts all combinations of interest rates (i) and income levels (GDP) that are consistent with equilibrium in the market for money.

From Figure 7 it can be seen that the *LM* curve is made up from the demand for money (transaction, precautionary and speculative) and the money supply. It portrays the relationship between interest rates and GDP in equilibrium in the market for money.

As an example, starting with the 1st quadrant, suppose the interest rate is 10 percent. The amount of money to satisfy the speculative demand for money is $50 billion. Quadrant 2 shows that, given the existing money supply of $150 billion, $100 billion is available to finance transactions and precautionary money demand. Quadrant 3 shows that, if L_T is to be $100 billion, then GDP must be $500 billion. Therefore, a 10 percent interest rate in combination with $100 billion GDP will result in equilibrium. This is depicted as point A in quadrant 4 on the *LM* curve.

If the interest rate falls to 5 percent, quadrant 1 shows that speculative money demand increases. Given the existing money supply, fewer funds are available to satisfy transactions and precautionary motives. This, in turn, indicates that GDP must be lower in equilibrium (point B). Hence, the LM curve is an upward-sloping function of the interest rate.

It can be seen that the *LM* curve depends upon the money supply and the demand for money. A change in the money supply or demand for money will result a change in the *LM* curve's position. A change in the slopes of the speculative and/or precautionary demand for money will change the slope of the *LM* curve.

The IS Curve

The IS curve represents the various combinations of interest rates and levels of GDP that satisfies the state of equilibrium in the goods and services market. In a three-sector model, with no foreign trade, equilibrium occurs where S + T = I + G. That is, where leakages from income, in the form of Savings and Taxes (S+T), are offset by injections in spending by investments and government spending (I+G).

In quadrant (1) of Figure 8, I + G is a downward-sloping function of the interest rate. The lower the interest rate the greater the spending. To be in balance, the lower the interest rate, the higher S+T must be.

Figure 8 Method 1 Derivation of IS Curve[16]
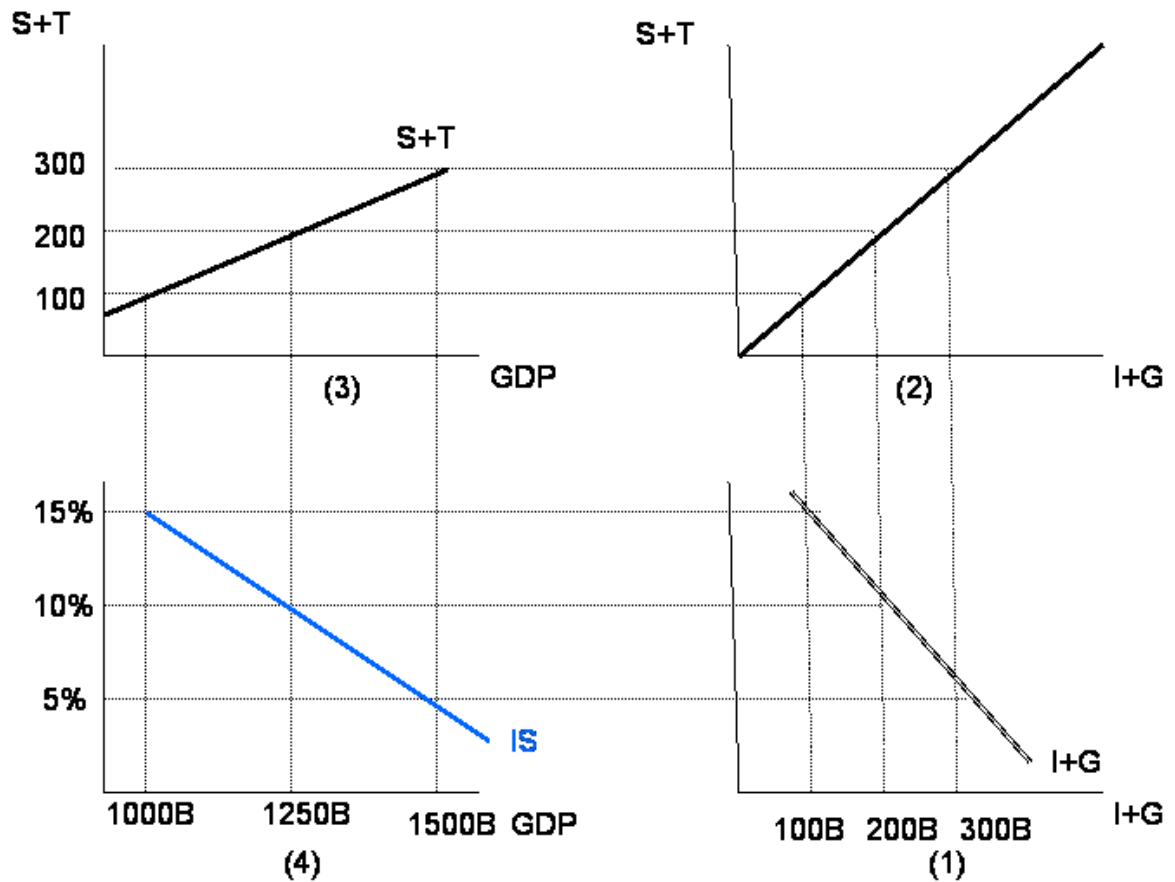
The following example shows the derivation of the *IS* curve. Starting in quadrant (1), an interest rate of 10 percent implies spending (I+G) of $200B. If I+G is $200B, then to be in equilibrium, S+T must be $200B in quadrant (3). Subsequently quadrant (4) shows an equilibrium on the *IS* curve at an interest rate of 10 percent and a GDP of $1250B.

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[16] Ibid., p. 411.

The *IS* curve will shift rightward when any event shifts I+G rightward or S+T rightward. GDP in turn would expand. The *IS* curve will shift leftward when any event shifts I+G or S+T leftward. GDP would then contract.

General Equilibrium

It has been shown that there are an infinite number of possible combinations of interest rate and GDP levels that result in money market equilibrium. This is represented by a positive sloping *LM* curve. Likewise, it has been shown that there are an infinite number of possible combinations of interest rate and GDP levels that result in goods and services equilibrium. This is represented by a negative sloping *IS* curve. General equilibrium can be shown by the intersection of the *IS-LM* curves. This is depicted in Figure 9.

Figure 9 Method 1 General Equilibrium
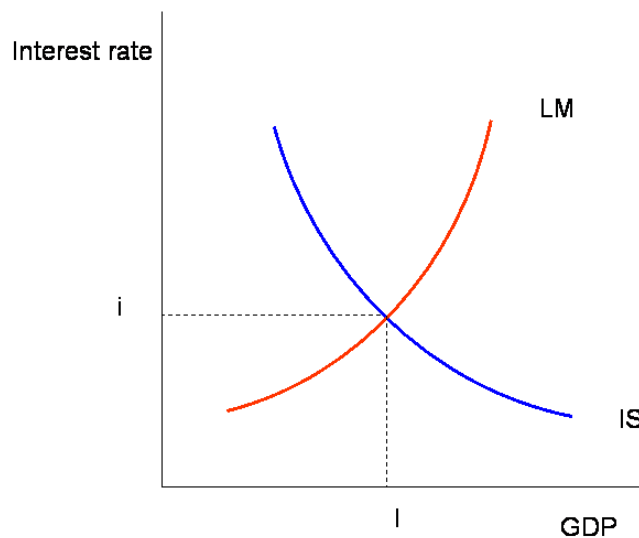
At the intersection of *IS* and *LM* the money market and the goods and services market are in equilibrium.

IS-LM **Derivation Method 2**

The IS Curve

As was previously mentioned in Method 1, in the *IS-LM* model, the *IS* (investment-saving) curve plots the relationship between interest rate and the level of output in the goods and services market. It is derived from the investment function, Figure 6(a), and the Keynesian Cross. The Keynesian Cross is a simple model of Keynes theory on national income. Keynes ideas, as outlined in his *The General Theory of Employment, Interest, and Money* (1936), proposed that an economy's income was in the short run, determined largely by the desire to spend by households, firms, and the government. If there is idle capacity in the economy, the more people want to spend, and the more goods and services firms can sell. The more firms can sell, the more output they will choose to produce, and the more workers they will choose to hire. Thus, the problem during recessions and depressions, according to Keynes, was inadequate spending.[17] The Keynesian Cross is a depiction of intended expenditure (the amount households, firms, and government plan to spend on goods and services) versus the nation's level of output and income. This is shown in Figure 10 below, with planned expenditures on the vertical axis and actual output and income on the horizontal axis.

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[17]N. Gregory Mankiw, <u>Macroeconomics 5th ed.</u>, (Worth Publishers, New York, 2003) p. 259.

Figure 10 Keynesian Cross
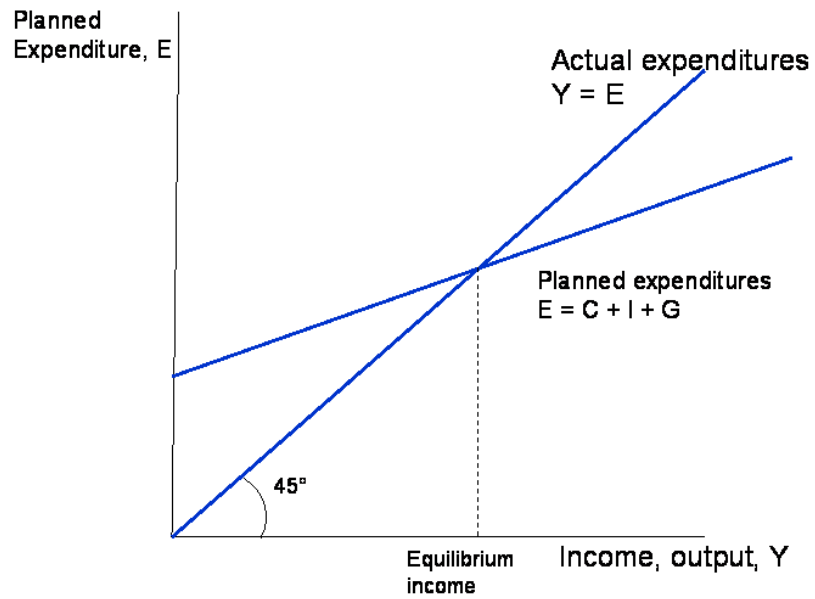
Combining the Investment Function, Figure 6(a), with the Keynesian Cross, Figure 10, one can derive the *IS* curve, as shown in Figure 11 below.

Figure 11 Method 2 Derivation of IS Curve
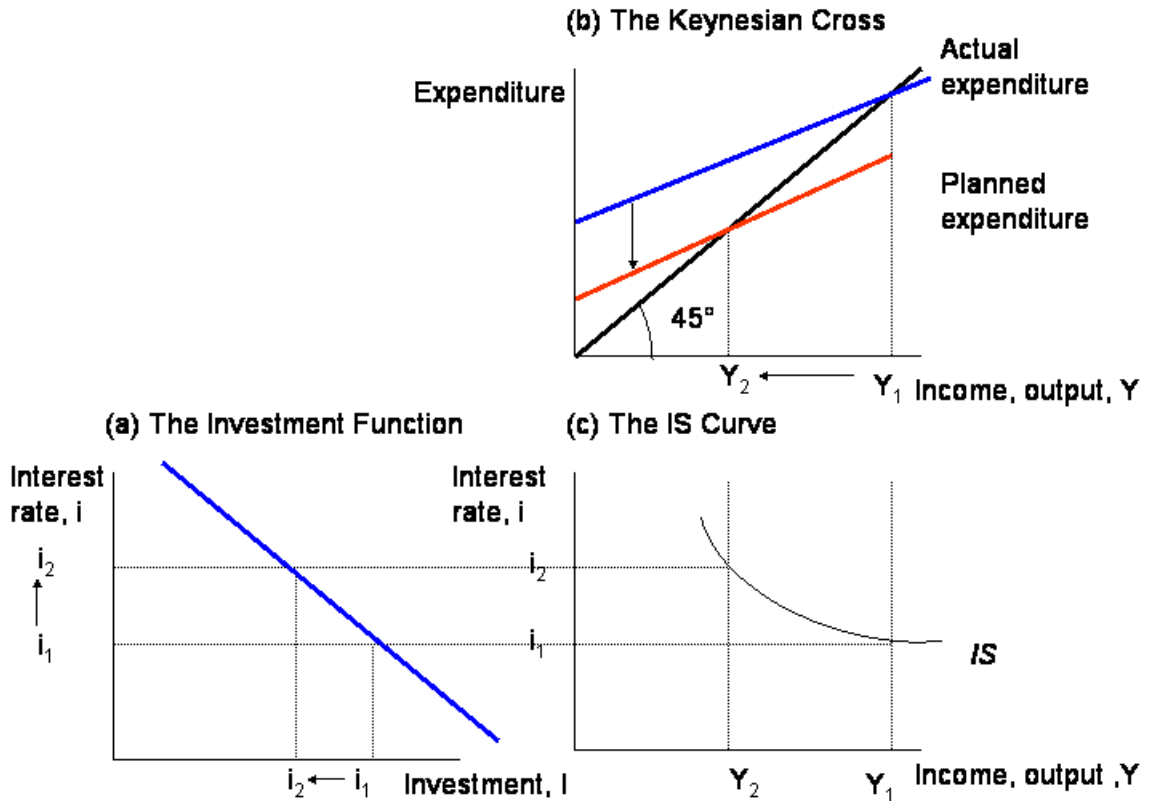
Figure 11(a) shows the investment function: an increase in the interest rate from i_1 to i_2 reduces planned investment from I_1 to I_2. Figure 11(b) shows the Keynesian Cross: a decrease in planned investment from I_1 to I_2 shifts the planned expenditure function downward and thereby reduces income from Y_1 to Y_2. Figure 11(c) shows the *IS* curve summarizing this relationship between interest rate and income: the higher the interest rate, the lower the level of output and income.

The LM Curve

In the *IS-LM* model, the *LM* curve plots the relationship between the interest rate and the level of income or GDP (as in method 1), which arises in the market for money balances (money market). "In his classic work, "*The General Theory*", Keynes offered his view of how the interest rate is determined in the short run. That explanation is called the theory of liquidity

preference, because it posits that the interest rate adjusts to balance the supply and demand for the economy's most liquid asset-money. Just as the Keynesian cross is a building block for the *IS* curve, the theory of liquidity preference is the building block for the *LM* curve."[18] The theory of liquidity preference says that the supply and demand for money balances determines the interest rate. This is shown in Figure 12 below.

Figure 12 Liquidity Preference
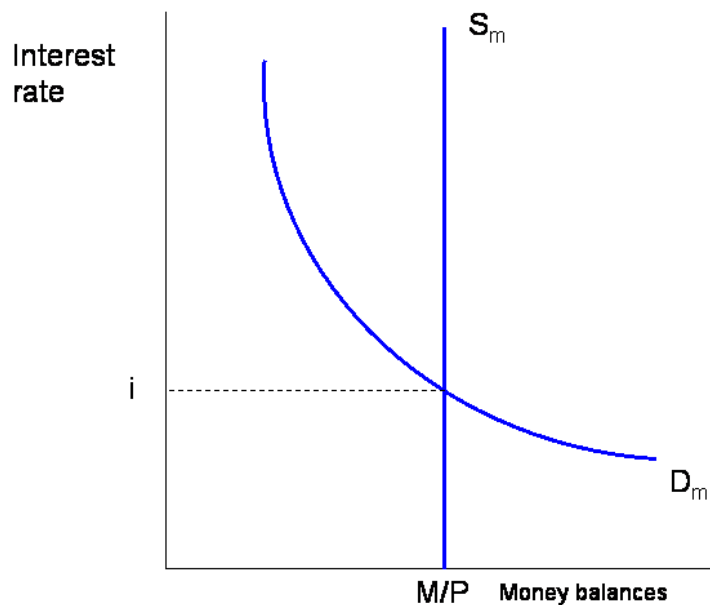
The supply curve for money balances is vertical, because we assume the supply does not depend on the interest rate. The demand curve for money balances is downward sloping, because higher interest rates raise the cost of holding money and thus lower the quantity demanded. The equilibrium interest rate is where the quantity of money balances demanded equals the quantity of money balances supplied.

Now that it has been shown how the interest rate is determined, the theory of liquidity preference can be used to show how the interest rate responds to changes in the money supply. This is shown below in Figure 13.

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[18] Ibid. p. 271.

Figure 13 Increase in the Money Supply Under Liquidity Preference
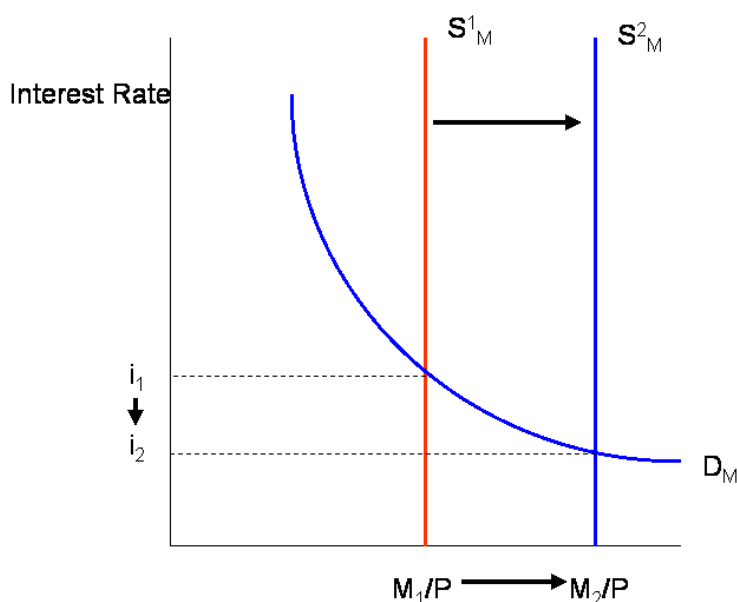
If the price level P is fixed, an increase in the money supply from M_1 to M_2 increases in the supply of money balances (M/P). At i_1, people are initially holding more money than they desire relative to bonds and other debt instruments. They use these excess money balances to buy bonds, driving up bond prices and reducing yields (the "interest rate"). The equilibrium rate therefore falls from i_1 to i_2, at which point the quantity of money demanded has caught up with the increased supply of money.

Having shown how the theory of liquidity preference determines the interest rate, the *LM* curve can now be developed. The demand for money depends on income, as well as interest rates. Money demand varies directly with nominal income. As income increases, more transactions are carried out and more money is required to finance those transactions. Therefore, the greater nominal income, the greater the demand for money. The increase in income shifts the demand for money curve upward, raising interest rates as shown below in Figure 14.

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Figure 14 Increase in Income
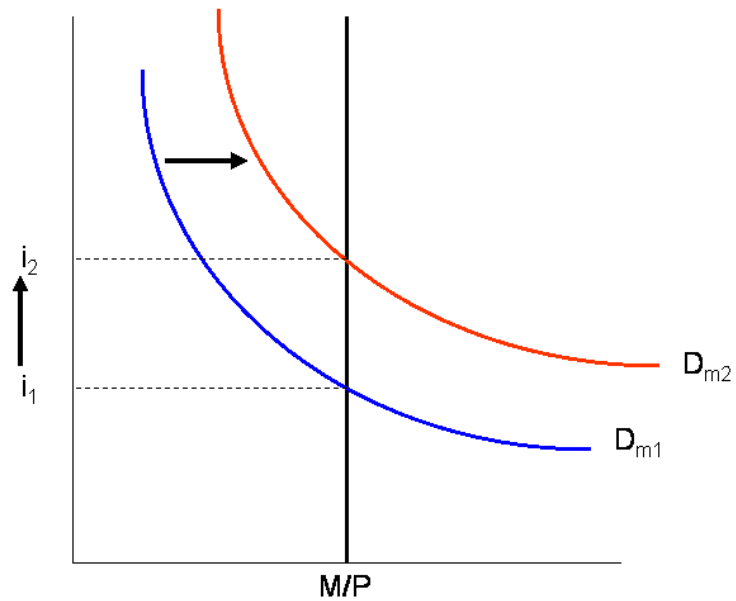
With the supply of money balances unchanged, higher income leads to a higher interest rate.

The *LM* curve plots the relationship combinations of the levels of income and interest rate that would yield equilibrium in the market for money. The higher the level of income, the higher the demand for money, the higher the interest rate must be to produce equilibrium. This results in the *LM* curve sloping upward. This is shown below in Figure 15.

Figure 15 Method 2 Derivation of LM Curve

(a) Increase in Income

(b) The *LM Curve*

M/P
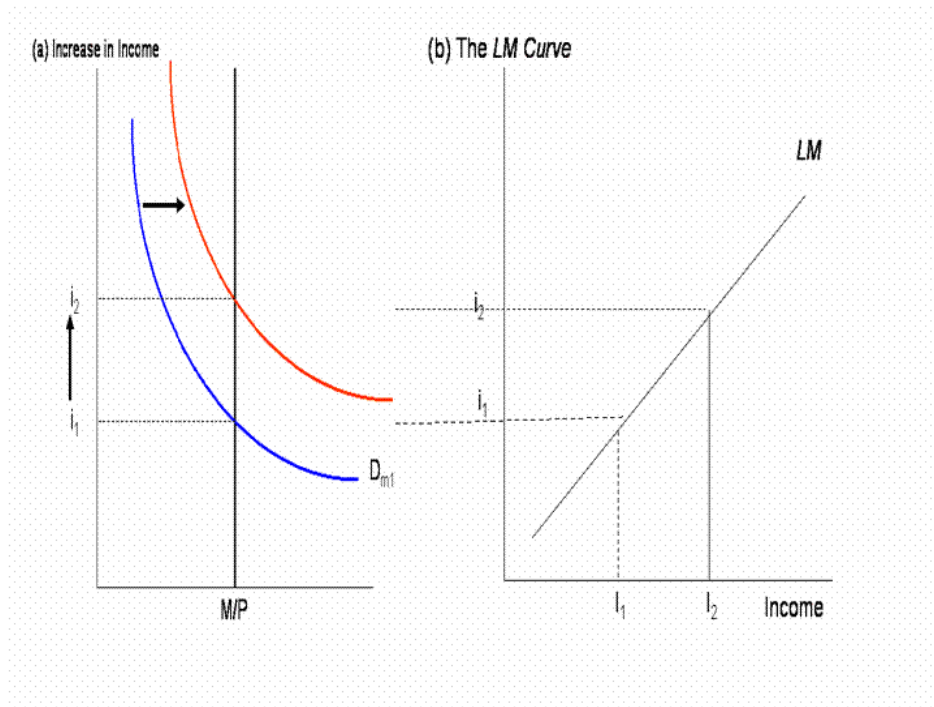
Income

Figure 15(a) shows the effect an increase in income has on interest rates. Figure 15(b) shows the *LM* curve summarizing this relationship between interest rate (i) and income (I): the higher the level of income, the higher the interest rate must be, given the existing money supply.

General Equilibrium

The *IS-LM* curves are shown together in Figure 16 below.

Figure 16 IS-LM Curve

Interest rate

LM

i

IS

I

GDP
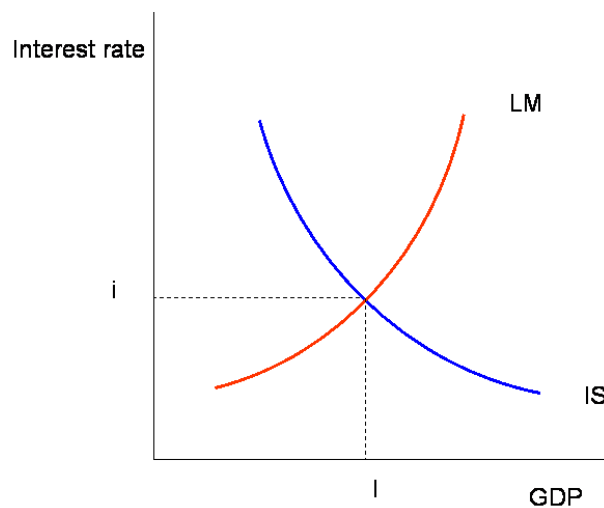
The *IS-LM* model joins the Keynesian Cross with the theory of liquidity preference. The *IS* curve shows all combinations of interest rate levels and income levels that satisfy equilibrium in the goods and services market. The *LM* curve shows all combinations of interest rate levels and income levels that satisfy equilibrium in the money market. The intersection of the *IS-LM* curves shows the interest rate and income that satisfy equilibrium in both markets. Note that the general equilibrium outcome is exactly the same for method 2 as it was for method 1.

Expansionary Monetary Policy

An expansionary monetary policy, depicted by an increase in the money supply is shown in Figure 17.

Figure 17 Expansionary Monetary Policy
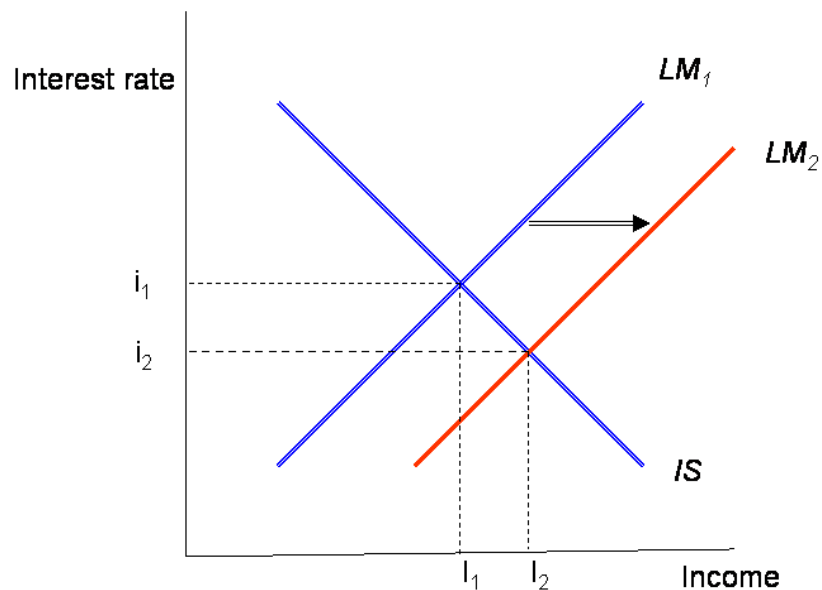
An increase in the money supply raises money balances, shifts the *LM* curve rightward, lowers the interest rate, and raises income. Consequently, an increase in the money supply shifts the aggregate demand curve to the right, as shown in Figure 18 below.

Figure 18 Aggregate Demand
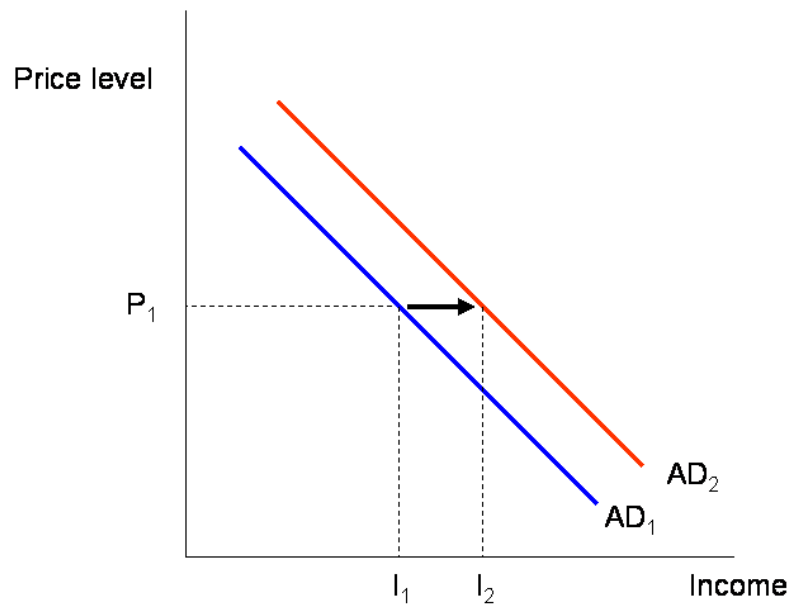
"Liquidity Trap"

      Based on the explanations thus far, it is now possible to show how a "liquidity trap" can be depicted in the *IS-LM* model. This is shown in Figure 19.

Figure 19 IS-LM Liquidity Trap
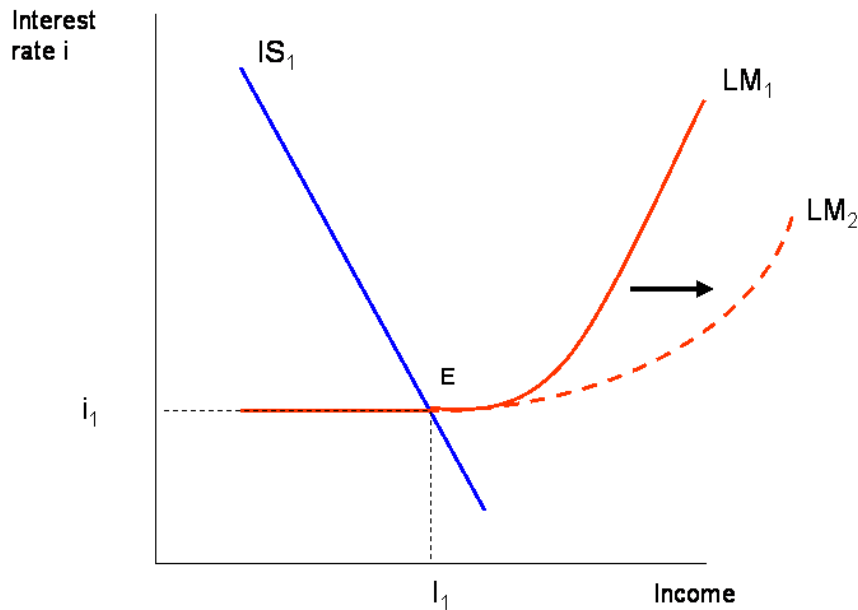
As the money supply *M increases* the *LM* curve shifts from LM_1 to LM_2. However, given the position of the *IS* Curve and the shape of the *LM* Curve, the interest rate i_1 does not decrease and income does not increase, resulting in a "liquidity trap". The *IS-LM* model is usually used to discuss a "liquidity trap" because

> "according to the *IS-LM* model, expansionary monetary policy works by reducing interest rates and stimulating investment spending. But if interest rates have already fallen almost to zero, then perhaps monetary policy is no longer effective. Nominal interest rates cannot fall below zero: rather than making a loan at a negative nominal interest rate, a person would simply hold cash. In this environment, expansionary policy raises the supply of money, making the public more liquid, but because interest rates can't fall any further, the extra liquidity might not have any effect. Aggregate demand, production, and employment may be "trapped" at low levels."[19]

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[19] Ibid. p. 303.

Bank "Liquidity Trap"

Unlike a demand for money liquidity trap, a bank "liquidity trap" is a "potential situation in which bank demand for excess reserves is perfectly elastic with respect to the interest rate, rendering the central bank incapable of increasing the money supply".[20] In a bank liquidity trap, any additional excess reserves provided by the central bank are hoarded by banks, rather than being used to expand loans or security holdings. A graphical depiction of the relationship between interest rates and bank demand for excess reserves is displayed in Figure 20 below.

Figure 20 Bank Demand for Excess Reserves
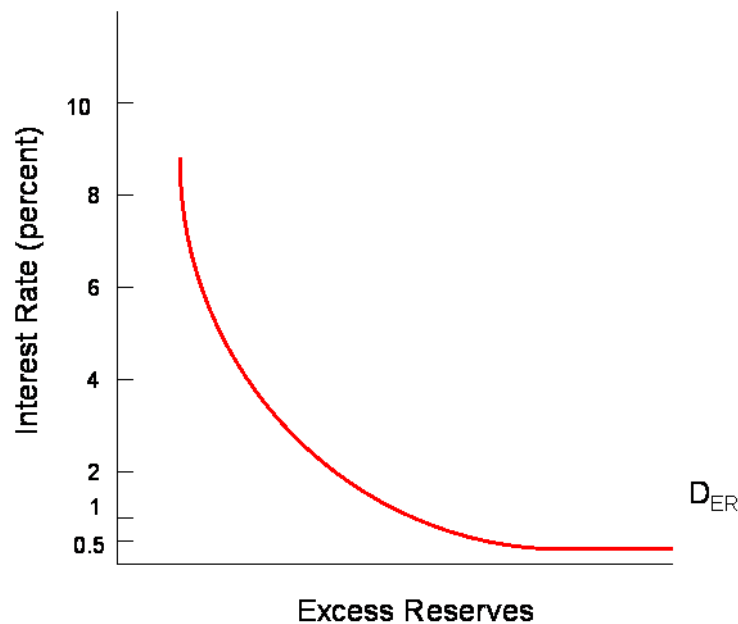
If we combine the above graph depicting excess reserves with an increase in the bank reserves by the Federal Reserve, we can see that the increase in reserves has no effect on the money supply, again rendering monetary policy ineffective. This is shown in Figure 21 below.

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[20] Lloyd B. Thomas, <u>Money, Banking and Financial Markets</u> (Thomson, South-Western, 2006), p.386.

Figure 21 Supply and Demand for Bank Excess Reserves
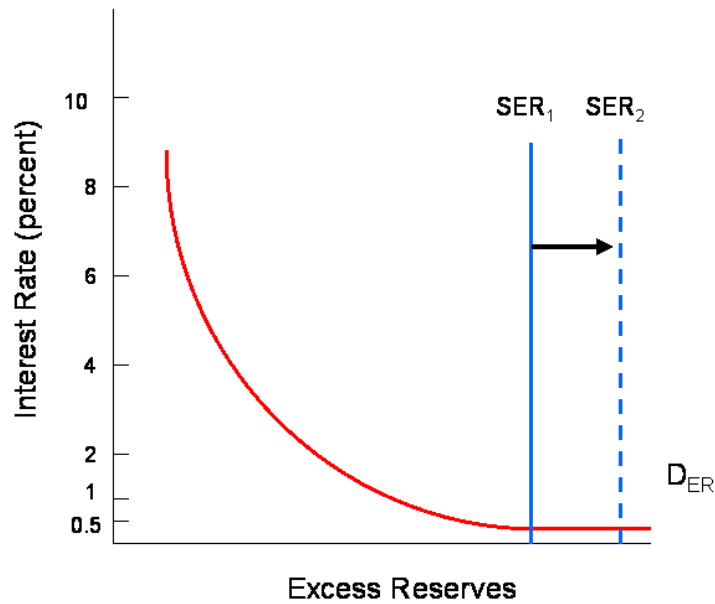
The reason why the bank demand curves for excess reserves become perfectly elastic as depicted above, is that at some low interest rate the risk associated with loaning the reserves and the transaction costs associated with using the reserves to buy government securities outweighs the meager expected rate of return (the interest rate).

Reasons Why Banks Hold More Money

The Federal Reserve controls the money supply through its ability to influence bank reserves and money creating power of banks. This can be expressed by a simple equation $M = m \cdot B$, where M is the money supply, m is the money supply multiplier and B is the monetary base. The money supply multiplier is the ratio of the money supply to the monetary base. The monetary base consists of bank reserves and currency held by the public. The Federal Reserve normally manipulates the money supply through open market operations (the buying and selling of government bonds) that affect the monetary base. Banks are required to maintain a level of reserves (vault cash or deposit with the Federal Reserve). When the Federal Reserve increases the monetary base, the money supply increases by the multiplier, m times the increase in the base. Banks traditionally loan out almost all reserves in excess of the required amount,

because normally the opportunity cost of holding excess reserves is significant.[21] However, when nominal interest rates are zero or close to zero, the opportunity cost of holding excess reserves becomes zero. Compounding this situation is the fact that bank precautionary hoarding may occur, along with tightened lending standards. Precautionary hoarding occurs when financial intermediaries feel that they may need their own funds due to potential shocks to the economy, or if outside funding is expected to be difficult to obtain.[22] Therefore, banks tend to hold excess reserves and the demand curve for excess reserves becomes highly elastic, at some low, positive interest rate, as is depicted above in Figure 21.

How the Meaning of "Liquidity Trap" Has Changed Over Time.

As quoted earlier, the phrase "liquidity trap" was coined by Sir Dennis Robertson, an English economist and colleague of John Maynard Keynes. Robertson used the phrase "liquidity trap" in critiquing Keynes' idea of liquidity preference that Keynes used in his classical work *The General Theory of Employment, Interest, and Money* (1936). Robertson's phrase "liquidity trap" was originally invented to illustrate the influence of a negatively sloped money demand on the saving-investment process, rather than a perfectly elastic demand for money, as the term is noted for today.[23]

Most of the "liquidity trap" literature associated with Keynes and another colleague of Keynes, Sir John R. Hicks, concerned the existence of a positive floor to the interest rate, not the zero or close to zero interest rate the liquidity trap is associated with today.[24] It is Hicks and Alvin H. Hansen that are credited with developing the *IS-LM* model. It has been the model that has helped explain and espouse Keynesian economic policies.

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[21] The degree of significance has declined as the Federal Reserve has started paying some interest on required bank reserves and excess bank reserves as of October, 2008. The interest rate paid on required reserve balances is determined by the Federal Reserve Board of Governors and is intended to remove part of the implicit tax that reserve requirements impose on depository institutions. The interest rate paid on excess reserve balances is also determined by the Board of Governors. Paying interest on excess balances is intended to establish a lower bound on the federal funds rate by lessening the incentive for institutions to trade balances in the fed funds market at rates much below the rate paid on excess balances. Paying interest on excess balances will permit the Federal Reserve to provide sufficient liquidity to support financial stability while conducting monetary policy in support of maximum employment and price stability goals.

[22] Markus K. Bunnermeier, "Deciphering the Liquidity and Credit Crunch 2007-2008", Journal of Economic Perspectives, 23, No.1 (Winter 2009) 95.

[23] Mauro Boianovsky, The *IS-LM* Model and the Liquidity Trap Concept: From Hicks to Krugman: *History of Political Economy* Conference on "The *IS/LM* Model: Its Rise, Fall and Strange Persistence", Duke University, 25-27 April 2003, p. 15.

[24] Ibid. p. 2.

The ideas that underlie the "liquidity trap" were conceived in the Great Depression when short-term nominal interest rates were close to zero. As the memory of the Great Depression faded over time, and with inflation becoming the norm in the industrialized world following World War II, monetary policy, in a deflationary environment, largely remained the subject only of historical inquiries.[25]

Nevertheless, the liquidity trap received much more attention in the late 1990's as the Japanese financial crisis unfolded along with the availability of new economic data. During the crisis, Japanese interest rates were essentially zero for most of the late 1990's. The Bank of Japan more than doubled the monetary base, yet output remained stagnant.

With the Japanese crisis a modern view of a liquidity trap emerged. The modern view relies on economic models where aggregate demand depends on both current and expected future real interest rates, rather than simply the current rate, as with the traditional Keynesian economic models.

> "The aggregate demand relationship that underlies the model is usually expressed by a consumption Euler equation, derived from the maximization problem of a representative household. On the assumption that all output is consumed, that equation can be approximated as:

$$Y_t = E_t Y_{t+1} - \sigma(i_t - E_t \pi_{t+1} - r_t^e)$$

> where Y_t is the deviation of output from the steady state, i_t is the short-term nominal interest rate, π_t is inflation, E_t is an expectations operator and r_t^e is an exogenous shock process (which can be due to host of factors). This equation says that the current demand depends on expectations of future output (because spending depends on expected future income) and the real interest rate which is the difference between the nominal interest rate and expected future inflation (because lower real interest rates make spending today relatively cheaper than future spending)."[26]

The importance of the equation is that it shows that monetary policy today might still be effective even if current interest rates are zero. Monetary policies would work through future expected inflation and thus future interest rates. The catch is that monetary policy must shape peoples expectations about future inflation.

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[25] Athanasios Orphanides, "Monetary Policy in Deflation: The Liquidity Trap in History and Practice", The North American Journal of Economics and Finance, vol. 15 (1) pp 101-124, March 2004.
[26] Gauti, B. Eggertsson, "Liquidity Trap", The New Palgrave Dictionary of Economics. Second Edition. Eds. Steven Nidurlauf and Lawrence E. Blume. Palgrave Macmillion, 2008.

Nobel economist Paul Krugman established in his May 1998 article, *It's baaack! Japan's slump and the return of the liquidity trap* that Japan's monetary easing (near-zero interest rates and Bank of Japan's balance sheet expansion by 50 percent per annum in 1998) failed because the Bank of Japan was unable to change the public's expectations about future inflation. When nominal interest rates are near zero, expected inflation needs to be positive to keep ex ante real interest rates sufficiently low and thus impact private spending and aggregate demand. When, the public expects the central bank to maintain price stability, as the Japanese populace did with the Bank of Japan, then inflation expectations remain very low resulting in ex ante real interest rates being too high to spur spending by the public. This failure to initiate an increase in aggregate demand renders monetary policy ineffective.

Accordingly, the only way out of a liquidity trap is to raise inflationary expectations. This is possible by government increasing deficit spending with fiscal policy or with "irresponsible monetary policy" – that is, convincing the public that monetary expansion is not merely temporary and that the central bank will *not* reverse its policy of monetary expansion when prices begin to rise.[27]

Theory Review

Normally, the Federal Reserve can stimulate the economy by increasing the monetary base and lowering interest rates. Typically these actions, increase borrowing, investment, and aggregate spending. However, when interest rates are near zero, the Federal Reserve can no longer lower interest rates to stimulate the economy. The Federal Reserve can increase the monetary base. This money must find its way into the economy, which is normally accomplished through the banks. However, the banks are unwilling to lend, so the newly created liquidity is trapped behind unwilling bank lenders, thus forming the liquidity trap.[28] Therefore, when nominal interest rates are close to zero, the opportunity cost of holding money becomes negligible and banks, firms and individuals hold more money than they need for transaction purposes. Traditional monetary policy becomes ineffective in stimulating the economy because the money creation process does not function. In turn, the liquidity trap brings about inability to combat deflation, i.e. a continuous decline in prices. When deflation is persistent, even if

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[27] Paul Krugman, "It's baaack! Japan's slump and the return of the liquidity trap. <u>Brookings Papers on Economic Activity</u> 1998 (2). 137-187.

[28] E. Ralph Hostetter, "Avoiding a Liquidity Trap", <u>DC Journal</u>, 22 January 2009.

combined with an extremely low interest rate, a floor on real interest rates creates a vicious cycle of output stagnation and further expectations of deflation that perpetuates high real interest rates and continuing economic stagnation.[29]

[29] Hiro Ito, "Liquidity Trap", The Princeton Encyclopedia of the World Economy, Eds. Kenneth Reinert and Ramkishen Rajas, Princeton University Press, December 2008.

CHAPTER 2 - Is There Evidence of Liquidity Trap?

I will now review recent data to shed light on the question whether the United States is in a "liquidity trap".

Demand for Money "Liquidity Trap"

Based on the presented explanations, the first requirement for a "liquidity trap" is that short term nominal interest rates be near zero. The following data regarding the federal funds rate show that is in fact the case today.

Figure 22 Federal Funds Rate
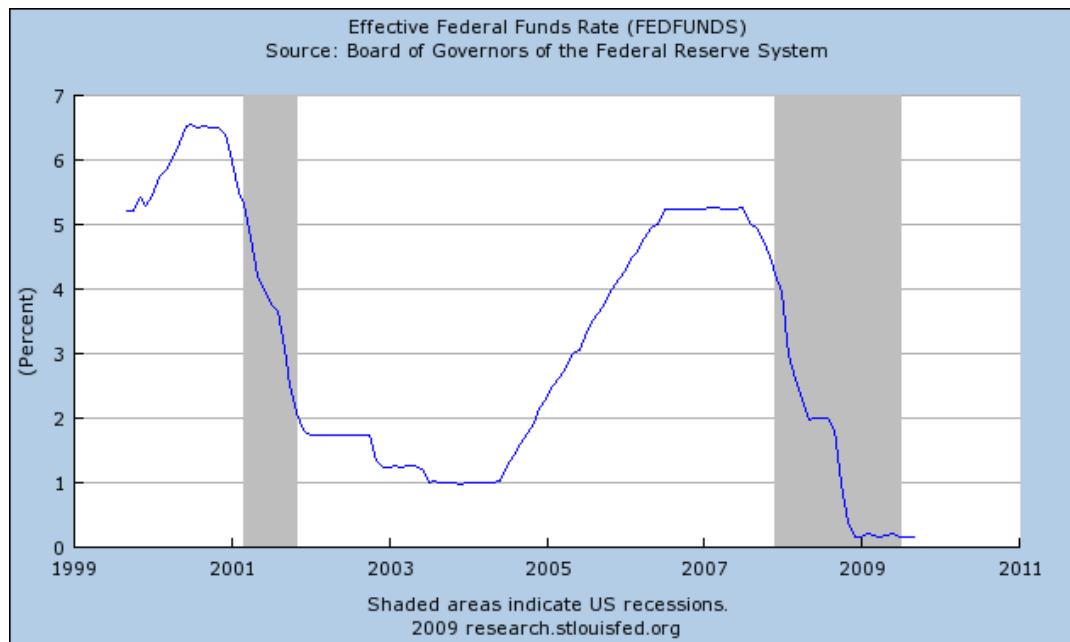
In its effort to ward off a recession, the Federal Reserve started reducing its federal funds rate in August 2007. It continued reducing the interest rate until it reached it's historic lows on December 16, 2008 of a target rate between zero and quarter percentage point. That target, of between zero and a quarter percentage point, has continued throughout 2009 to date (December

2009). The Federal Reserve also reiterated, at its Federal Open Market Committee (FOMC)
meeting in November of 2009 that it expects to keep the target rate between zero and a quarter
percentage point for the foreseeable future.

The second requirement for a money demand liquidity trap is that when the Federal
Reserve increases the money supply, it has no effect on output or prices. The following graph
shows that the money supply (M2) has increased, indeed, at an above-trend pace since the
beginning of 2008. M1 has also increased at an above-trend rate.

Figure 23 M2 Money Supply
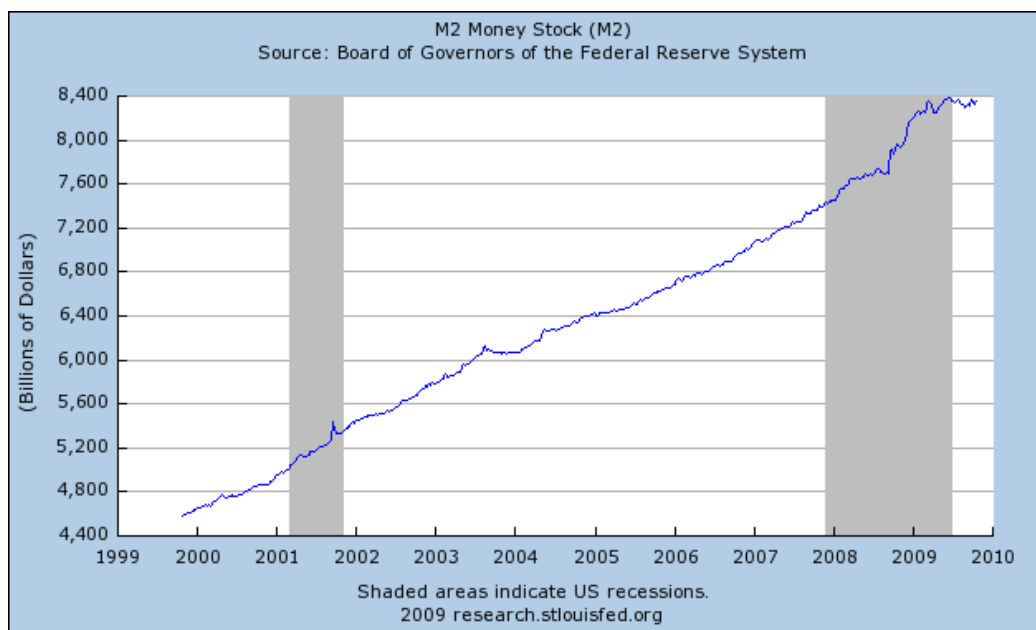
The M2 monetary aggregate increased at a 10 percent annual rate during the second half
of 2008 and 8.5 percent for the year as a whole.[30] In its 21 July 2009 *Monetary Policy Report to*

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[30] Board of Governors of the Federal Reserve System, "part 2, Recent Financial and Economic
Developments" Monetary Policy Report to Congress, February 2009,. p. 25-26. M2 consists of (1) currency outside
the U.S. Treasury, Federal Reserve Banks, and the vaults of depository institutions; (2) traveler's checks of nonbank
issuers; (3) demand deposits at commercial banks (excluding those amounts held by depository institutions, the U.S.
government, and foreign banks and official institutions) less cash items in the process of collection and Federal
Reserve float; (4) other checkable deposits (negotiable order of withdrawal, or NOW, accounts and automatic
transfer service accounts at depository institutions, credit union share draft accounts, and demand deposits at thrift
institutions); (5) savings deposits (including money market deposit accounts); (6) small-denomination time deposits
(time deposits in amounts of less than $100,000) less individual retirement account (IRA) and Keogh balances at
depository institutions; and (7) balances in retail money market mutual funds less IRA and Keogh balances at money
market mutual funds.

the Congress, the Federal Reserve states that "the M2 monetary aggregate expanded at an annual rate of 7 ¾ percent during the first half of 2009."[31]

Figure 24 Nominal GDP
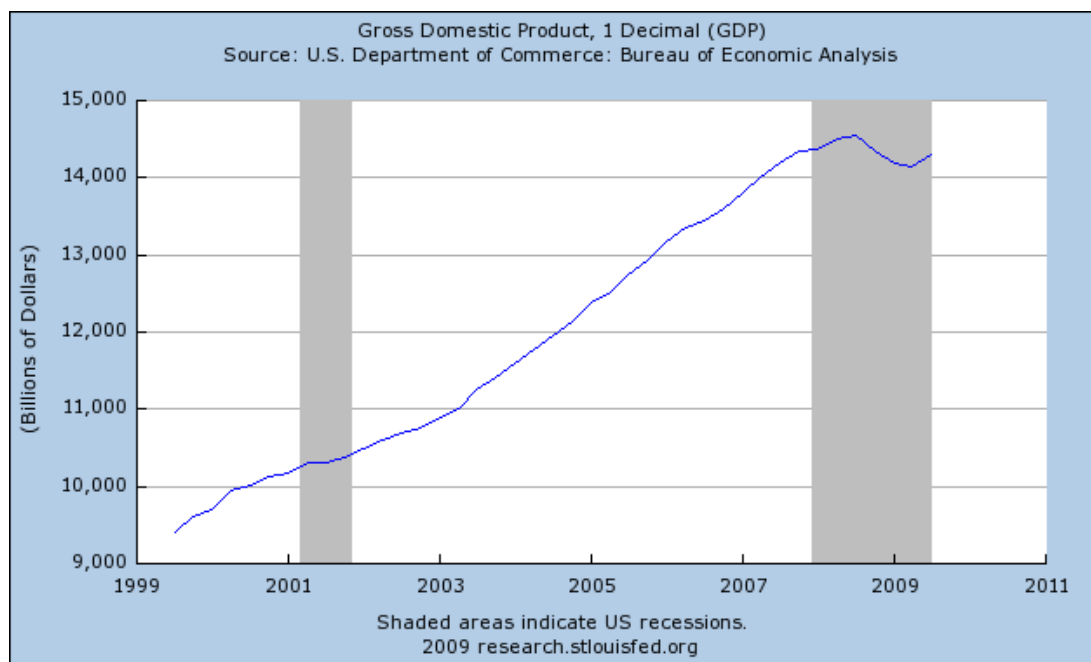
Figure 24 above shows that nominal GDP in the United States declined slightly in the third quarter of 2008 and then decreased at an annualized rate of 6.3 percent in the 4th quarter. The decline continued at a 6.4 percent annual rate in the 1st quarter of 2009 and at an annual rate of 1% in the second quarter of 2009. [32] This decrease occurred despite the sharp increase in the money supply and decrease in short term nominal interest rates. However, nominal GDP did increase at an annual rate of 2.8 percent in the third quarter of 2009. [33] This increase in nominal GDP reflects upturns in personal consumption expenditures, exports, private inventory investment, federal government spending and residential fixed investment.

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[31] Board of Governors of the Federal Reserve System, "part 2, Recent Financial and Economic Developments" <u>Monetary Policy Report to Congress,</u> July 21, 2009, p. 25.

[32] Bureau of Economic Analysis, "News Release" regarding National Income and Product Account Gross Domestic Product: Second Quarter 2009 (Advance Estimate), July 31, 2009.

[33] Bureau of Economic Analysis, "News Release" regarding National Income and Product Account Gross Domestic Product: Third Quarter 2009 (Advance Estimate), October 29, 2009.

Table 1 Equation of Exchange Variables

FISCALYEAR	GDP (IN BILLIONS)	M2 (IN BILLIONS)	VELOCITY (GDP/M2)	%Δ M2	%ΔV
2006:1	13183.5	6647.9	1.983	-----------	------
2006:2	13347.8	6743.5	1.979	1.43	-0.20
2006:3	13452.9	6803.6	1.977	0.89	-0.10
2006:4	13611.5	6879.1	1.979	1.11	0.10
2007:1	13795.6	6994.0	1.972	1.67	-0.35
2007:2	13997.2	7096.3	1.972	1.46	0.00
2007:3	14179.9	7198.8	1.970	1.44	-0.01
2007:4	14337.9	7298.4	1.965	1.38	-0.25
2008:1	14373.9	7405.3	1.941	1.46	-1.22
2008:2	14497.8	7560.2	1.918	2.09	-1.18
2008:3	14546.7	7666.5	1.897	1.40	-1.09
2008:4	14347.3	7744.1	1.853	1.01	-1.75
2009:1	14178.0	8020.0	1.768	3.56	-4.59
2009:2	14151.2	8278.2	1.709	3.21	-3.34
2009:3	14301.5	8360.2	1.711	0.99	0.12

Although the equation of exchange is simply an identity, it is instructive to review the behavior of the variables in this equation. The above table created from FRED (Federal Reserve Economic Data) displays the equation of exchange variables from the first quarter of 2006 (approximately a year before the start of the current recession) until the third quarter of 2009 (the latest data available). M2 is the quarterly average of the monthly data reported in FRED.[34]   The table shows that, as the Federal Reserve increased the money supply, the country's nominal output (GDP) increased from 2006:1 until the 2008:3. Subsequently, nominal GDP started to fall and continued to decline up until the third quarter of 2009, when it rose. In the context of the equation of exchange, the proximate cause of this decline in GDP is the decline in velocity. Velocity has decreased persistently throughout the range of data (until the third quarter 2009), slowly at first, and then considerably faster starting in 2008:1. There are two particular items of note. First, from 2008:3 through 2009:2, the percent decline of velocity was greater than the

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[34] M2 includes a broader set of financial assets held principally by households. M2 consists of M1 plus: (1) savings deposits (which include money market deposit accounts, or MMDAs); (2) small-denomination time deposits (time deposits in amounts of less than $100,000); and (3) balances in retail money market mutual funds (MMMFs). Seasonally adjusted M2 is computed by summing savings deposits, small-denomination time deposits, and retail MMMFs, each seasonally adjusted separately, and adding this result to seasonally adjusted M1.

percent increase in the money supply (M2). This explains the decline in nominal GDP. Additionally, the drops in velocity are rates per quarter. This means that the annual rate of decline in velocity in 2009:1 was 18.4 percent per year! Velocity decreased as households and firms increased money holdings relative to expenditures.

A graphical depiction of the GDP and Velocity columns in the above table are provided in Figures 25 and 26 respectively. In the three years ending in 2009:2, M2 velocity declined about 14 percent

Figure 25 Nominal GDP
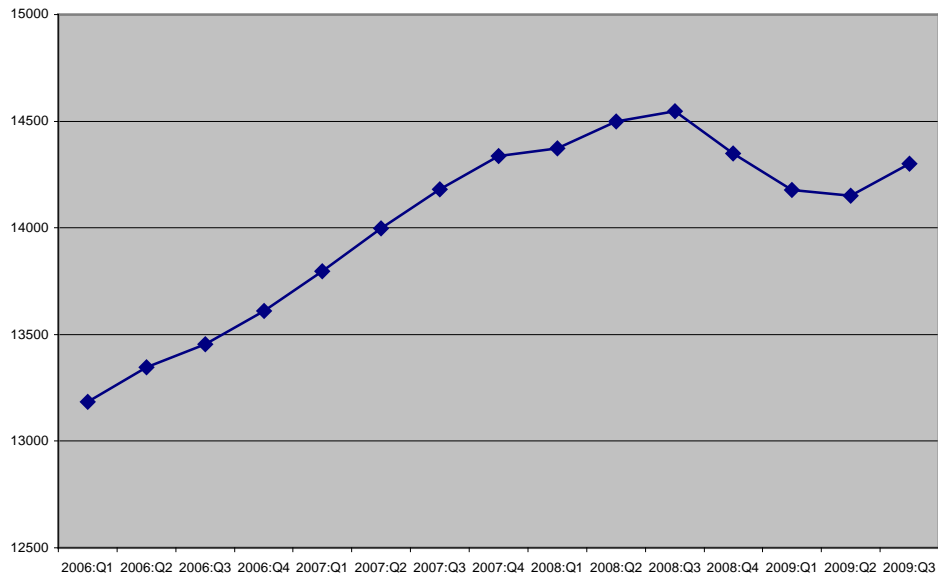
Figure 26 Velocity (GDP/M2)
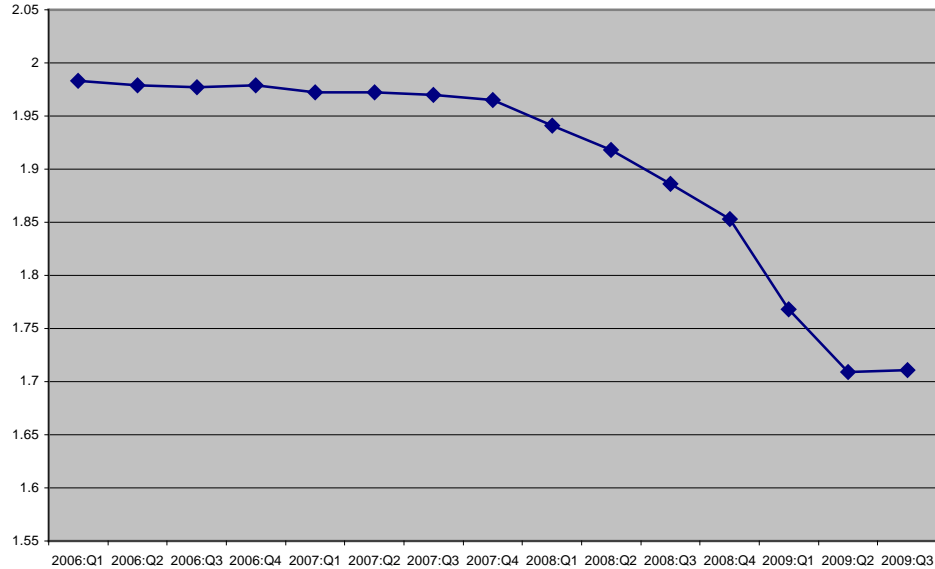
The following graph also shows that despite an increase in the money supply and a decrease in interest rates, prices at the producer level have generally fallen. The index declined from a high of 205.5 in July 2008 to 168.1 in March 2009, showing a fall in prices of approximately 18 percent in this 8-month period. Prices have risen and fallen slightly since March 2009 with a measure of 174.6 as of September 2009, resulting in an overall decline of nearly 15 percent since the high of July 2008.

Figure 27 Producer Price Index

Producer Price Index: All Commodities (PPIACO)
Source: U.S. Department of Labor: Bureau of Labor Statistics

Shaded areas indicate US recessions.
2009 research.stlouisfed.org
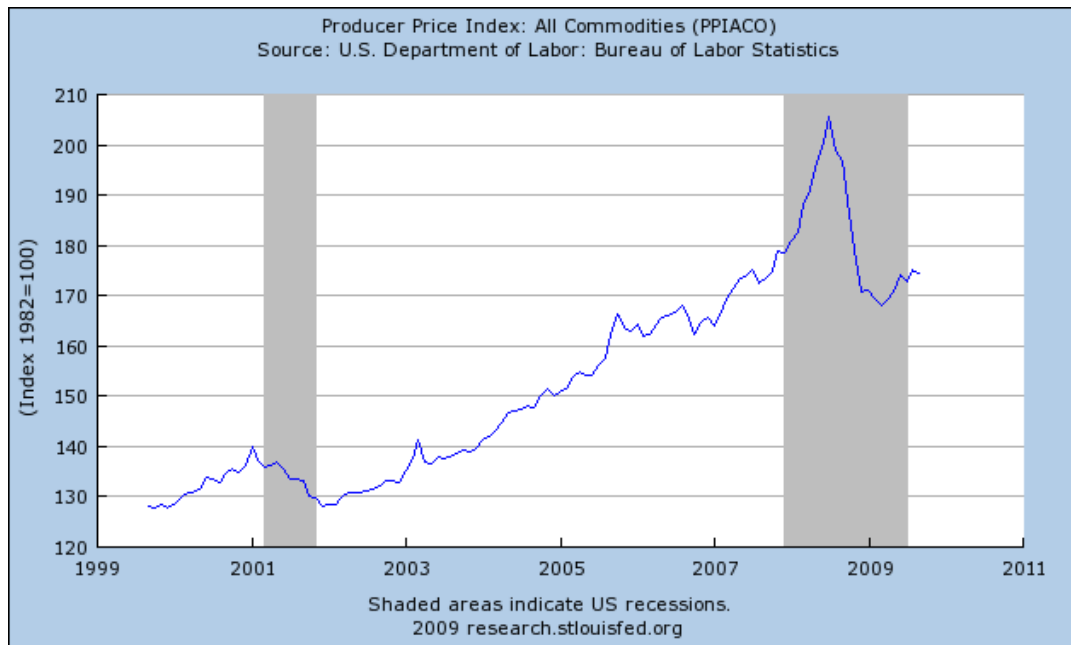
These graphs suggest that monetary policy has been ineffective and is consistent with the hypothesis that a "liquidity trap" exists based on the typical understanding of the meaning "liquidity trap". Increases in the money stock engineered by the Federal Reserve have not resulted in an increase in aggregate expenditures.

In chapter 1, it was stated that the slope of the demand for money curve plays an important role in macroeconomics because the slope determines whether monetary policy or fiscal policy exerts more influence on aggregate demand. A graph depicting the recent relationship between the 3-Month Treasury bill rate and money balances using the same M2 data as in Table 1 is shown below.

Figure 28 Money and Interest Rates 2006:1-2009:3
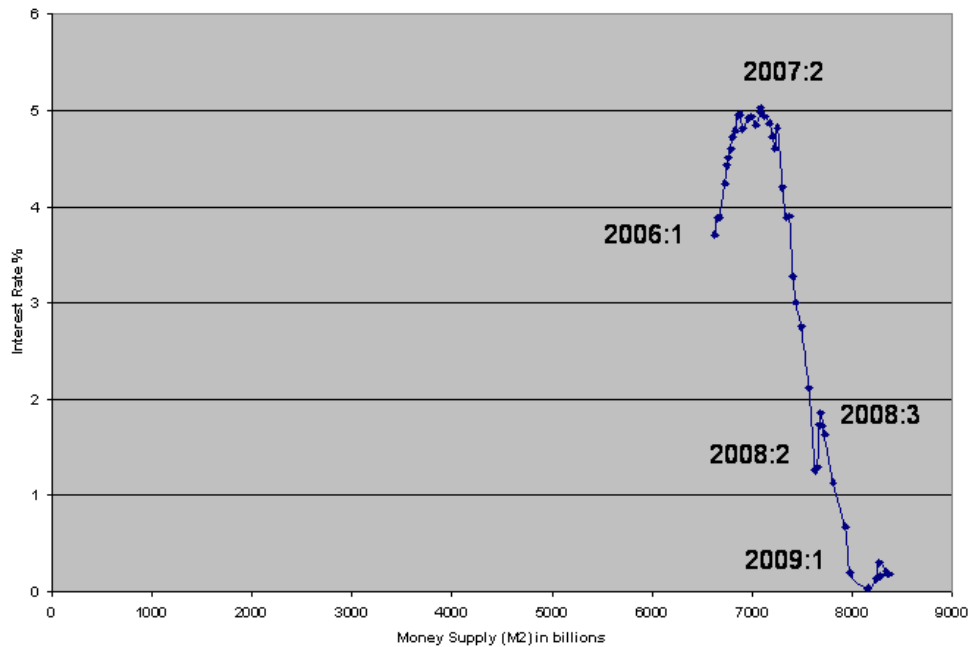
Supporters of Keynesian theory believe that fiscal policy plays a greater role than monetary policy in influencing aggregate demand in a low interest rate environment. They believe that the quantity of money demanded is sensitive to the interest rate and that the money demand curve shifts as it reacts to various economic events, thus making velocity volatile. Those that believe monetary policy has a greater influence in shaping the aggregate demand curve, otherwise known as monetarists, believe that the demand for money curve is nearly vertical and quite stable. The above graph may lead one to believe that, in this financial crisis, the monetarists are correct. One may believe that monetary policy has had a greater influence in shaping the aggregate demand curve since the relationship curve shown above is nearly vertical. However, the demand for money depends also on other factors such as income and economic uncertainty. Consequently, it would be useful to analyze the interest elasticity of money demand to help determine if a "liquidity trap" truly exists. As referred to in Chapter 1, the interest elasticity of money demand plays an important role in macroeconomics. Keynesians believe that the interest elasticity of demand for money is relatively high (-0.5 to -1.0), while monetarists

believe that the elasticity is quite low (-0.1 to -0.3)[35]. According to David E. W. Laidler "If the liquidity trap hypothesis is true, it must be the case that the interest elasticity of demand for money becomes greater as the rate of interest falls…" [36] In a liquidity trap the interest elasticity of demand goes to infinity at some very low interest rate, as the percent change in demand for money is divided by the percent change in interest rate, as shown by the following formula.

$$\frac{\% \Delta D_M}{\% \Delta i} \rightarrow \infty$$

Of note however, is Laidler's follow on statement regarding this relationship. He states that "there appears to be little evidence that this is in fact the case."[37] This statement not withstanding, regression analysis can be used to estimate the interest elasticity of demand for money, which in turn, will help determine the existence of a liquidity trap.

Regression Analysis to Investigate Interest Elasticity of Money Demand

Regression Procedure

To determine the existence of a traditional demand for money liquidity trap, different regression iterations of the following equation were run.

$$\ln\left(\frac{M}{P}\right) = alpha + beta \ln(GDP) + delta \ln(Risk) + gamma \ln(InterestRate)$$

$\left(\frac{M}{P}\right)$ was determined by using monthly data for both M1 and M2. Then, each was divided by the Consumer Price Index (CPI). CPI is a representative variable for Price (P). M2 was used to be consistent with Table 1 and Figure 28. However, M2 includes several highly liquid financial assets, such as savings deposits and money market mutual fund shares that pay interest. It is also a broader measure of money that is used when one wants to emphasize the store-of-value function of money. Consequently, regressions were also run using M1, a measure

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[35] Lloyd B. Thomas, Jr., <u>Money, Banking, and Economic Activity,</u> third edition. Prentice-Hall Inc.1986, p. 343.
[36] David E. W. Laidler, <u>Demand for Money</u> *Theories, Evidence & Problems*, fourth edition. HarperCollins College Publishers. 1993, p. 150.
[37] Ibid., p. 150.

that includes currency, demand deposits and other checkable deposits that pay little to no interest and emphasizes the medium exchange function of money.

Since GDP data are reported in FRED on a quarterly basis, monthly GDP data were estimated by using interpolation. The interest rate used was the 90-day Treasury bill yield. Risk, a gauge of economic uncertainty, was measured by using the difference between Moody's Aaa corporate bond yield and Moody's Baa corporate bond yield, as reported in FRED. A priori, one expects the signs on beta, delta, and gamma to be positive, positive, and negative, respectively.

Periods of different interest rates were used to observe how gamma changed when interest rates were relatively low, as compared to times when interest rates were higher. Data were chosen that went back fifteen years to 1994. Regressions were run using data through April 2009. April of 2009 was the latest date that data were available for all variables, since GDP data, at the time, only existed for the first two quarters of 2009.

The log-linear model with equation $\ln Y = \beta_1 + \beta_2 \ln X$ was used as the functional form. This is also known as the double-log form and is the most common functional form. In this form, the natural log of Y is the dependent variable and natural log of X is the independent variable. Generally, this functional form is used when slopes are not constant. This is the case for interest elasticity of demand for money and thus the reason for using this functional form. Natural logs also make it easier to determine impacts in percentage terms. "If you run a double-log regression, the meaning of a slope coefficient is the percentage change in the dependent variable caused by a one percentage point increase in the independent variable, holding the other independent variables in the equation constant. It's because of this percentage change property that the slope coefficients in a double-log equation are elasticities."[38]

Regression Results

Regression results are reported in the following table.

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[38] A. H. Studenmund, Using Econometrics, *A Practical Guide*, fifth edition, Pearson Education Inc. 1996, p. 211.

Table 2 Estimation of Money Demand Model (January 1994- April 2009)

ln M1/P = alpha + beta ln GDP + delta ln Risk + gamma ln Interest Rate						
	alpha	ln GDP	ln Baa-Aaa	ln Interest Rate	# obs	R^2
Interest Rates ≤ 1%	1.945 (390.87)			-.028 (-9.48)	18	0.725
	3.007 (3.62)	-.113 (-1.27)		-.038 (-4.28)	18	0.769
	1.796 (2.49)	.016 (0.21)	-.033 (-3.03)	-.043 (-4.16)	18	0.804
Interest Rates > 1%	1.908 (221.84)			-.009 (1.36)	166	0.007
	3.225 (18.14)	-.138 (-7.40)		-.017 (-2.59)	166	0.257
	2.817 (15.27)	-.093 (-4.76)	-.089 (-5.80)	-.041 (-5.53)	166	0.322
ln M2/P = alpha + beta ln GDP + delta ln Risk + gamma ln Interest Rate						
Interest Rates ≤ 1%	3.502 (369.38)			-.070 (-4.34)	18	0.764
	-1.785 (-1.72)	.564 (5.07)		-.020 (-1.69)	18	0.952
	-.400 (-0.45)	.416 (4.33)	.038 (3.33)	-.014 (-1.15)	18	0.960
Interest Rates > 1%	3.570 (227.37)			-.168 (-12.30)	166	0.311
	-2.150 (-30.61)	.603 (79.87)		-0.48 (-15.56)	166	0.986
	-2.158 (-30.90)	.604 (81.62)	-.001 (-0.20)	-.048 (-16.84)	166	0.986
ln M1/P = alpha + beta ln GDP + delta ln Risk + gamma ln Interest Rate						
Interest Rates ≤ 2%	1.926 (443.85)			-.045 (-7.07)	50	0.600
	2.956 (10.46)	-.109 (-3.64)		-.053 (-6.69)	50	0.658
	2.374 (9.47)	-.046 (-1.72)	-0.64 (-6.23)	-.071 (-7.48)	50	0.796
Interest Rates > 2%	1.952 (58.49)			-.018 (-0.83)	134	0.005
	3.479 (17.54)	-.156 (-7.87)		-.078 (-3.77)	134	0.311
	3.273 (13.21)	-.134 (-5.45)	-.038 (-1.46)	-0.081 (-.416)	134	0.318
ln M2/P = alpha + beta ln GDP + delta ln Risk + gamma ln Interest Rate						
Interest Rates ≤ 2%	3.506 (516.98)			-0.67 (-6.01)	50	0.572
	-.540 (-3.51)	.431 (26.22)		-.036 (-5.53)	50	0.966
	-.521 (-3.77)	.428 (29.11)	.002 (0.34)	-0.035 (-5.11)	50	0.966
Interest Rates > 2%	3.774 (67.94)			-.299 (-8.18)	134	0.229
	-2.210 (-29.54)	.612 (81.99)		-.063 (-9.62)	134	0.989
	-2.118 (-22.41)	.603 (65.02)	.017 (1.64)	-.062 (-9.40)	134	0.990

Note: The numbers in parentheses are t-statistics calculated by using the Newey-West method.

Regression Analysis

The most pertinent finding in the above table pertains to gamma. Gamma is an estimate of the interest elasticity of demand for real money balances (M/P). In a pure liquidity trap this would be negative infinity. Otherwise, as previously detailed by David Laidler, the interest elasticity of demand or gamma should increase (in absolute terms) as interest rates fall. This occurs for some of the regression iterations. For example, when comparing gamma for M1/P when interest rates were greater than 1 percent, with interest rates when they fell to less than or equal to 1 percent, the regression iteration

$$\ln\frac{M1}{P} = alpha + gamma\ln InterestRate$$

shows that gamma increased (in absolute terms) for all three iterations from -.009 to -.028, from -.017 to -.038 and from -.041 to -.043 respectively. These low interest elasticities (fairly close to zero) do not confirm the existence of a liquidity trap. However, when comparing gamma for M1/P when interest rates were greater than 2 percent, with interest rates when they fell to less than or equal to 2 percent, there is only one iteration that increased and that was from -.018 to -.045. This is not to be unexpected, as there is less likelihood of a liquidity trap at higher interest rates.

Note that the coefficients on the ln GDP variable exhibit the expected sign in the M2/P regressions and exhibit very high t-statistics. These coefficients range in magnitude from roughly 0.40 to 0.60, indicating that M2 is a normal good, confirming economies of scale in money balances. As GDP rises over time, demand for M2 rises more slowly. However, in the M1/P regressions, the signs on the estimated ln GDP coefficients are uniformly negative and often highly significant statistically.

This result is likely picking up the action taken by the Federal Reserve to pump liquidity into financial markets since the beginning of the financial crisis. From January 2008 to September 2009, M1 increased more than 19 percent. This is most likely the reason M1/P regressions are exhibiting the wrong sign on the GDP and risk variables. M2/P regression results are better. M2 has only grown by 11 percent over the same time period. This is probably because M2 has not been impacted as much by the Federal Reserve actions.

The regressions indicate that the measure for risk, ln(Baa –Aaa) is statistically insignificant in the M2/P regressions, and exhibits the wrong sign in the M1/P regressions (and is sometimes statistically significant). This may be because the risk variable (Baa-Aaa) and the loss of confidence that was occurring in the economy were not picking up the shifts that were occurring in the money demand function. It is extremely difficult to disentangle the effect of very low interest rates from other forces causing increases in money demand here such as safe haven forces, as the stock market crashed (Dow Jones Industrial Averages fell from a high of nearly 14,000 in October of 2007 to a low of nearly 6600 the second week of March 2009) .

Bank "Liquidity Trap"

What about a bank "liquidity trap"? Previously, it was stated that a bank "liquidity trap" is a potential situation in which bank demand for excess reserves is perfectly elastic with respect

to the interest rate, rendering the central bank incapable of increasing the money supply. In this situation, all additional reserves injected into the banks by the Federal Reserve are simply held by the banks, rather than being used to extend credit. The following graphs show this. Figure 29 shows total bank reserves and figure 30 shows the excess reserves held by banks.

Figure 29 Total Bank Reserves
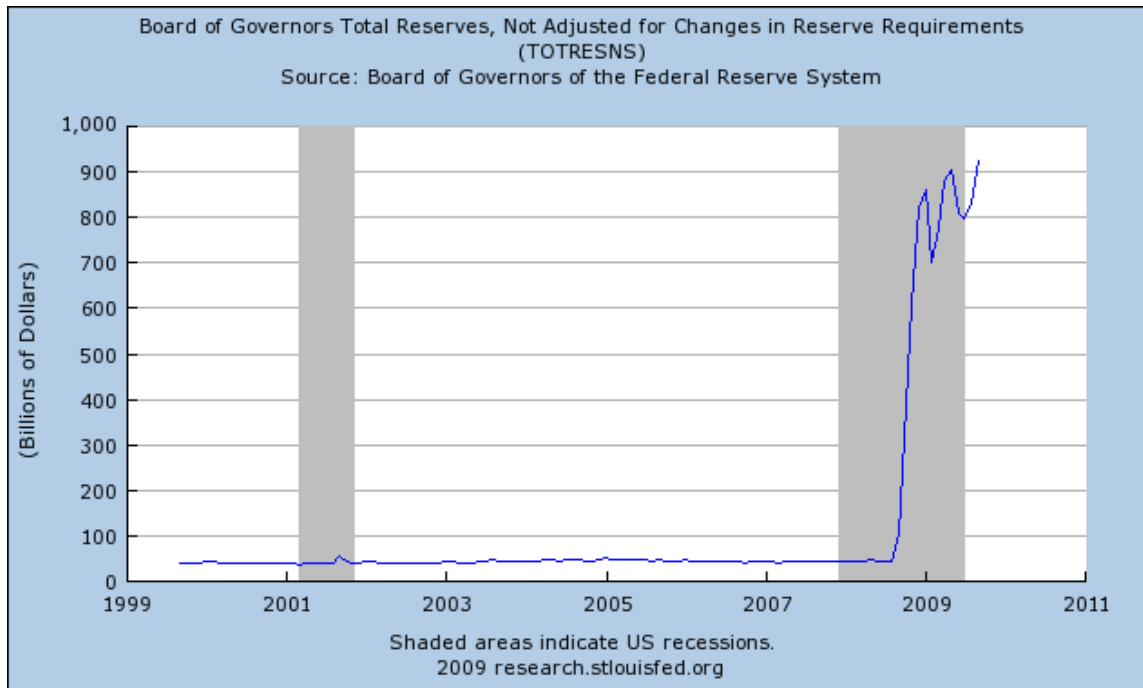
Figure 30 Excess Reserves
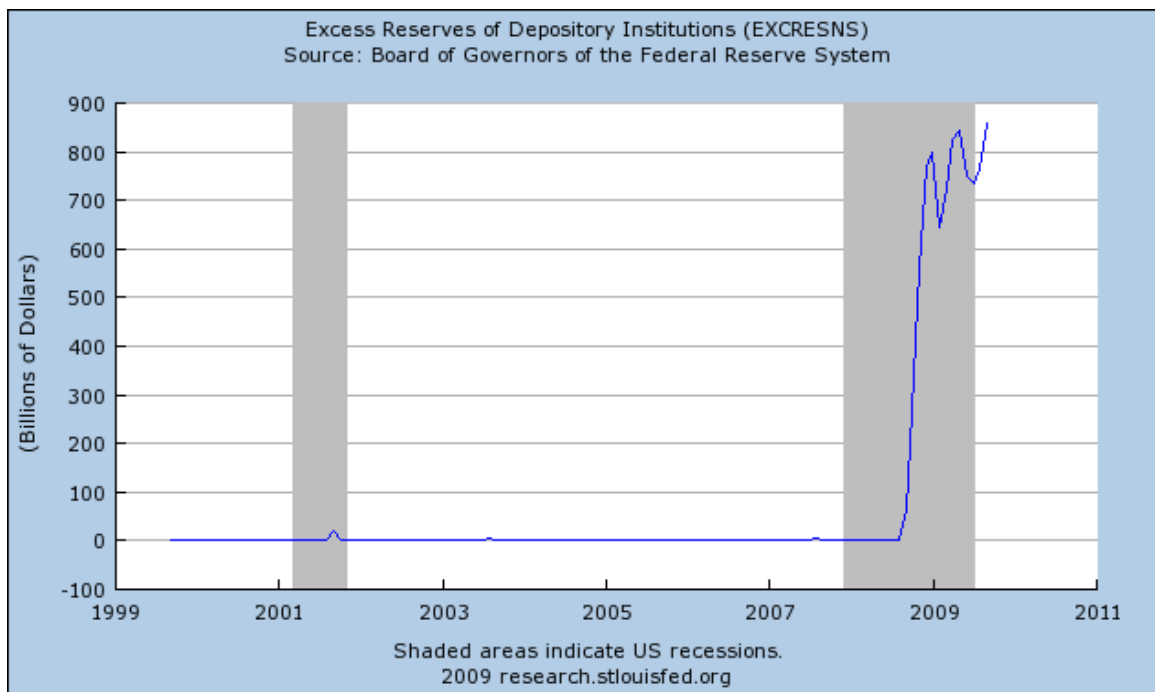
Clearly, banks started to rigorously hold excess reserves midway through 2008. They continue to do so as the nominal short-term interest rates have remained near zero and as the opportunity cost of holding excess reserves is extremely low.

Banks also build up excess reserves if they cut back on their lending through a tightening of standards or for precautionary reasons. The following graph shows that the amount of loans that banks have made has declined, even as excess reserves increased. In fact, the decline started in earnest about the time the Federal Reserve lowered its interest rate target to between a quarter and zero percent. In its February 2009 monetary report to Congress, the Board of Governors reported a decreased demand for credit in response to slowing business activity along with a tightening of lending standards.[39] Additionally, the Senior Loan Officer Opinion Survey conducted in April 2009 "indicated that large fractions of banks continued to tighten lending standards and terms on loans to businesses and households over the preceding three months".[40]

Figure 31 Amounts of Bank Loans

Total Commercial and Industrial Loans Including Foreign Related Institutions (TOTCI)
Source: Board of Governors of the Federal Reserve System
(Billions of Dollars)
Shaded areas indicate US recessions.
2009 research.stlouisfed.org

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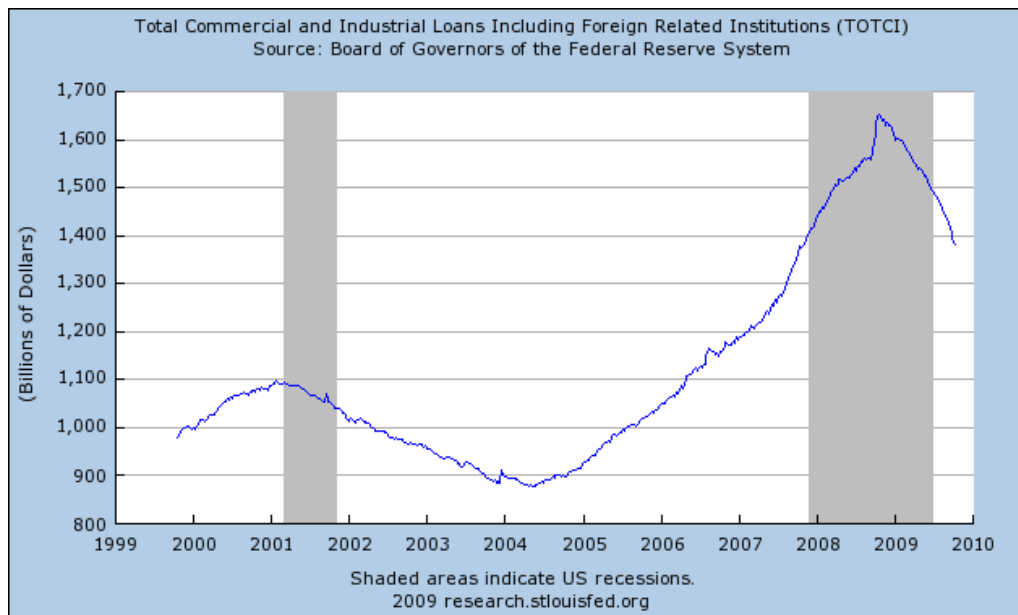
[39] Board of Governors of the Federal Reserve System, "part 2, Recent Financial and Economic Developments" Monetary Policy Report to Congress, February 2009, p.11.
[40] Board of Governors of the Federal Reserve System, "part 2, Recent Financial and Economic Developments" Monetary Policy Report to Congress, July 21, 2009, p. 24.

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The next chart shows the increase in the monetary base by the Federal Reserve. According to the Federal Reserve Board of Governors Monetary Policy Report to the Congress of February 2009, the monetary base increased swiftly because of the heavy use of the Federal Reserve's liquidity programs. Credit extended through the Federal Reserve programs caused the balance sheet of the Federal Reserve to expand considerably. In its July 21, 2009 report to Congress, the Federal Reserve noted that the monetary base continued to expand rapidly in the first quarter of 2009. As discussed earlier, the Federal Reserve normally controls the money supply through its control over the monetary base.

Figure 32 Monetary Base
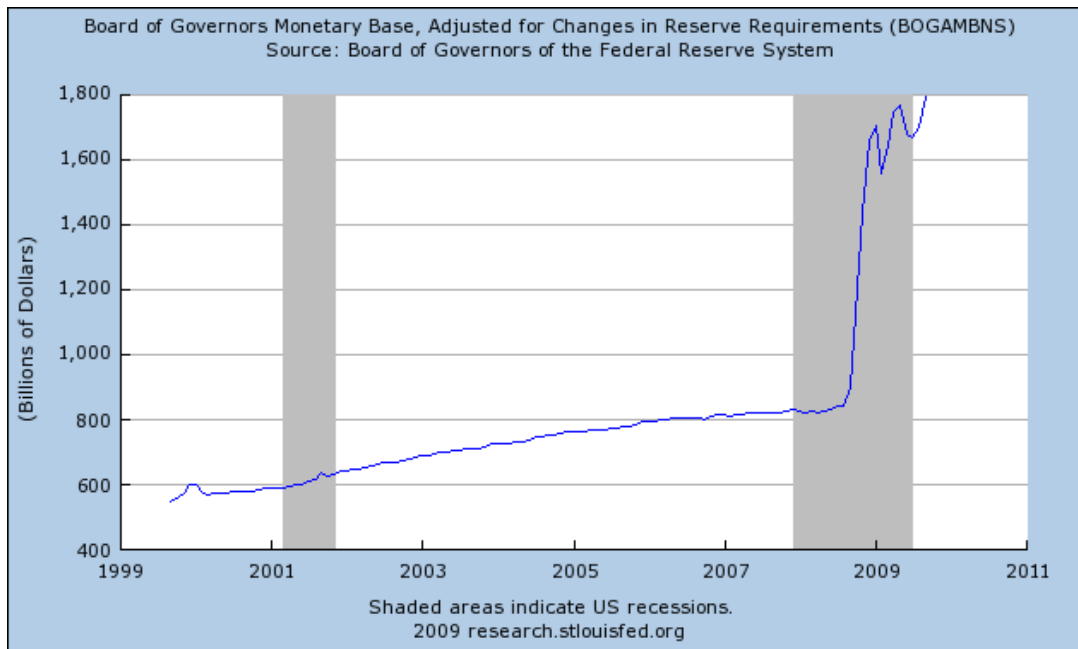
The money supply (M2) can be written as the product of the monetary base (B) and a multiplier (m). The money supply multiplier can be found by dividing the money supply by the monetary base.

$$m = \frac{M2}{B}$$

The recent behavior of the money multiplier is shown in Figure 33.

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Figure 33 M2/Monetary Base
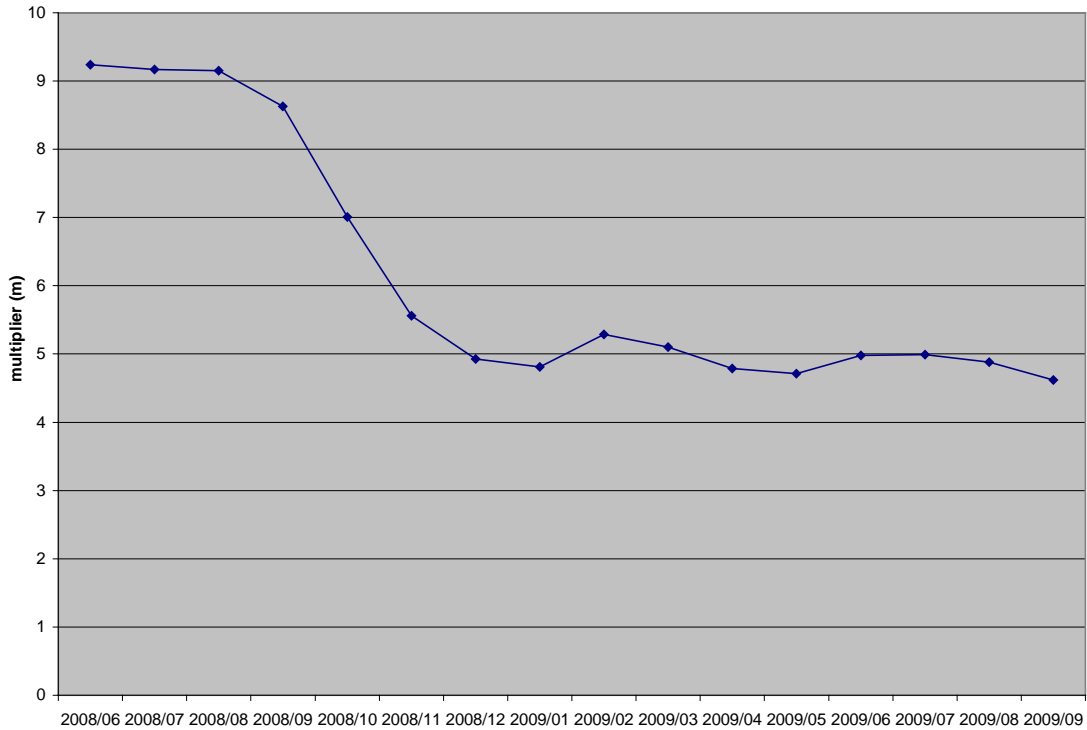
It is evident that there has been a huge decline in the money supply multiplier since August, 2008. This is due to the unprecedented increase in bank willingness to hold excess reserves.

If the data provided by the Federal Reserve regarding 3-Month Treasury bill interest rates and excess reserves are plotted, a graph depicting bank demand for excess reserves versus interest rates can be drawn. From a traditional Keynesian viewpoint, as shown previously in Figure 21, such a graph will show that the bank demand curve for excess reserves will become extremely elastic, if in fact the economy is in a "banker's liquidity trap". The following graph does just that. Plotting monthly data from January 2007 through July 2009 shows that bank demand for excess reserves becomes highly elastic.

Figure 34 Keynesian View of Bank Demand for Excess Reserves

Bank Demand for Excess Reserves
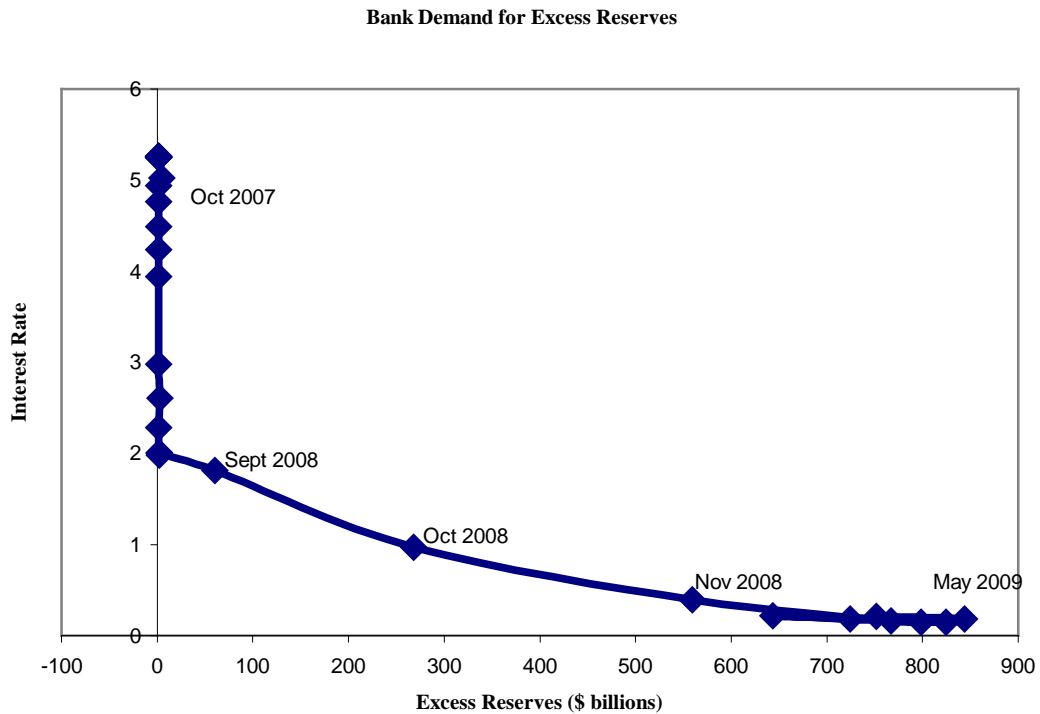
As was previously done with the demand for money liquidity trap, a regression analysis can be run to investigate whether a banker's liquidity trap exists.

Regression Analysis to Investigate Existence of a Bank Liquidity Trap

Regression Procedure

The procedure used to investigate a possible bank liquidity trap is similar to the one used for the demand for money liquidity trap. A bank's decision to hold excess reserves is governed by considerations of risk and opportunity cost. The opportunity cost of holding excess reserves is interest income that could have been earned on these funds. Several regression iterations of the following log-linear model equation were run.

$$\ln(Excess\ reserves) = alpha + beta \ln(Risk) + gamma \ln(Interest\ Rate)$$

Excess reserve data were taken from FRED for a fifteen year period from January 1994 through April 2009, as was done in the demand for money liquidity trap regressions. We employed two variables as proxies for risk. The Baa-Aaa yield differential and the variable VIX

were used. The reason for this was to capture the economic uncertainty that the banks have been operating under. The Baa-Aaa corporate bond yield differential is a proxy for perceived default risk in business loans. An increase in this perceived risk leads banks to tighten lending standards and increase holdings of excess reserves.

VIX is the Chicago Board Options Exchange Volatility Index. The Chicago Board Options Exchange created VIX as measure of equity market volatility. VIX is computed real time throughout the trading day. The computation of the value of VIX is based on the implied volatility of eight option series on the S&P 100 index. The VIX is quoted in percentage points per annum. As an example, a VIX value of 20.23 represents an annualized implied volatility of 20.23 percent. The VIX is sometimes called the "investor fear index", since investor uncertainty can lead to high market volatility. Options are traded on the VIX, enabling additional hedging and speculation positions on volatility. VIX is employed as a proxy representing economic uncertainty that influences bank demand for excess reserves.

Regressions were run for the 90-day Treasury bill yields less than or equal to 1 percent, greater than 1 percent, less than or equal to 2 percent and greater than 2 percent as was done in the demand for money liquidity trap regressions. However, additional regressions were run for all interest rates, including interest rates when they were higher at less than or equal to 4 percent and greater than 4 percent. This resulted in 184 observations. The main intent was to estimate gamma. We are particularly interested in the question of whether gamma increases in absolute values as interest rates decline.

Regression Results

Regression results are reported in the following table:

Table 3 Estimation of Banker's Liquidity Trap Model Jan 1994-April 2009

ln Excess Reserves = alpha + beta lnRisk + gamma lnInterest Rate						
	alpha	ln VIX	ln Baa-Aaa	ln Interest Rate	# obs	R^2
All Interest Rates	1.810 (7.83)			-1.112 (-6.74)	184	0.544
	-.805 (-1.32)	.826 (3.83)		-.959 (-7.04)	184	0.593
	1.446 (8.45)		1.582 (4.42)	-.558 (-4.25)	184	0.617
	-.266 (-0.55)	.561 (3.45)	1.302 (4.20)	-.552 (-4.33)	184	0.637
Interest Rates $\leq$ 1%	.928 (2.20)			-2.555 (-4.31)	18	0.726
	-11.49 (-9.09)	4.161 (9.46)		-1.063 (-3.43)	18	0.954
	.726 (3.03)		4.679 (8.16)	-.248 (-0.80)	18	0.953
	-5.855 (-1.72)	2.238 (1.89)	2.359 (1.56)	-.589 (-1.54)	18	0.963
Interest Rates > 1%	.827 (5.36)			-.359 (-3.50)	166	0.168
	.245 (0.81)	.185 (1.39)		-.329 (-3.94)	166	0.187
	.719 (6.20)		.424 (2.35)	-.205 (-3.59)	166	0.203
	.279 (0.95)	.143 (1.15)	.379 (2.32)	-.199 (-3.53)	166	0.214
Interest Rates $\leq$ 2%	1.357 (8.88)			-2.245 (-6.77)	50	0.736
	-5.783 (-3.98)	2.254 (4.81)		-1.706 (-6.10)	50	0.854
	.735 (5.09)		2.616 (5.68)	-1.329 (-4.51)	50	0.866
	-2.532 (-1.69)	1.099 (2.22)	1.714 (4.48)	-1.382 (-5.20)	50	0.878
Interest Rates > 2%	1.207 (4.28)			-.601 (-3.40)	134	0.179
	.801 (4.72)	.146 (1.26)		-.611 (-3.38)	134	0.199
	1.149 (4.10)		.465 (4.20)	-.470 (-2.68)	134	0.235
	.779 (5.05)	.133 (1.16)	.451 (3.97)	-.484 (-2.62)	134	0.251
Interest Rates $\leq$ 4%	1.726 (9.42)			-1.572 (-8.00)	82	0.600
	-2.456 (-1.97)	1.326 (3.23)		-1.235 (-7.38)	82	0.664
	1.258 (10.24)		2.077 (4.74)	-.832 (-5.34)	82	0.696
	-.158 (-0.11)	.477 (1.02)	1.689 (3.23)	-.849 (-5.54)	82	0.701
Interest Rates > 4%	1.763 (3.10)			-.943 (-2.73)	102	0.113
	1.422 (2.54)	.112 (1.64)		-.934 (-2.79)	102	0.134
	1.377 (2.57)		.448 (3.20)	-.612 (-1.85)	102	0.193
	.965 (1.92)	.130 (2.02)	.468 (3.39)	-.587 (-1.84)	102	0.221

Note: The numbers in parentheses are t-statistics calculated by using the Newey-West method.

Regression Analysis

Economic theory indicates the signs on beta and gamma are expected to be positive and negative, respectively. The findings are consistent with this expectation, as all variables exhibit the expected signs and are in most instances statistically significant at conventional levels. The key variable of interest is gamma, the interest elasticity of bank demand for excess reserves. The banker's liquidity trap hypothesis implies that this elasticity increases in absolute value as the interest rate declines and becomes infinitely large at some low interest rate (such as 0.5 or zero). While our estimates of gamma cannot confirm an infinite elasticity of demand, they do indicate that the absolute value of this elasticity increases as interest rates decline. Using absolute values

for gamma it is noted that at interest rates above 4 percent, gamma ranges from 0.59 to 0.94. At interest rates below 2 percent, gamma ranges from 1.33 to 2.25. In the 18 months in which interest rates were below 1 percent, gamma estimate is as high as 2.55. However, with only 18 observations in which interest rates were extremely low, we may have a problem with degrees of freedom. In all cases, the explanatory power of the model is appreciably higher in periods of lower interest rates. Bankers do respond to changes in opportunity cost. With short-term interest rates very close to zero in the past year, the opportunity cost of holding excess reserves is extremely low.

The risk variables show up as uniformly exhibiting the expected sign, indicating the demand curve for excess reserves shifts rightward, as expected, when banker's perception of risk increases. Because the Federal Reserve aggressively lowered interest rates at the same time major financial shocks were occurring in volatile years of 2008 and 2009, it is possible that multicollinearity exists in the regression equations, which may be influencing the estimates of the interest elasticity of demand for excess reserves. Simultaneity bias may also be occurring (another term for simultaneity bias is "endogeneity"). This happens when there is a feedback relationship between the dependent variable and one or more of independent variables. Many financial shocks and policy actions that occurred in 2008 and 2009 may have appreciably influenced the results reported in Table 3. Therefore, the model was re-estimated using data only from January 1994 through July 2007. These results are provided in the following table. Note that the explanatory power of the model is much lower than when the observations after July 2007 are included (Table 3). The risk variables are often statistically insignificant in this period of high economic stability in which there was little variation in the amount of excess reserves. And gamma is statistically insignificant in periods in which interest rates were below 2 percent.

Table 4 Estimation of Banker's Liquidity Trap Model from Jan 1994-Jul 2007

ln Excess Reserves = alpha + beta ln Risk + gamma ln Interest Rate						
	alpha	ln VIX	ln Baa-Aaa	ln Interest Rate	# obs	R^2
Interest Rates $\leq$ 1%	1.341 (3.56)			10.800 (2.55)	11	0.430
	-1.277(-0.44)	.900 (0.86)		10.428 (2.49)	11	0.509
	1.464 (4.38)		1.041(2.35)	11.861(3.36)	11	0.645
	1.738 (0.50)	-.092 (-0.08)	1.083 (1.70)	11.942 (3.23)	11	0.646
Interest Rates > 1%	.623 (10.07)			-.233 (-6.22)	152	0.130
	.478 (2.00)	.046 (0.52)		-.227 (-7.32)	152	0.133
	.595 (9.26)		.175 (1.90)	-.179 (-4.21)	152	0.141
	.495 (2.03)	.032 (0.35)	.166 (1.66)	-.178 (-4.34)	152	0.142
Interest Rates $\leq$ 2%	.492 (6.59)			-.167 (-0.97)	36	0.035
	.238 (0.79)	.085 (0.93)		-.199 (-1.15)	36	0.045
	.492 (6.45)		-0.10 (-0.08)	-.164 (-0.88)	36	0.545
	.083 (0.21)	.137 (1.19)	-.114 (-0.60)	-.186 (-1.01)	36	0.052
Interest Rates > 2%	1.19 (3.53)			-.601 (-2.83)	127	0.175
	.851 (5.10)	.133 (1.02)		-.626 (-2.71)	127	0.193
	1.216 (3.64)		.495 (4.12)	-.512 (-2.55)	127	0.239
	.855 (5.72)	.139 (1.08)	.501 (4.10)	-.537 (-2.45)	127	0.258

Note: The numbers in parentheses are t-statistics calculated by using the Newey-West method.

The above results suggest that the previous results are heavily influenced by the observations after July 2007. To estimate how much of the recent surge in excess reserves was due to low interest rates rather than other factors, a regression (not in log form) was run for the following equation.

$$ER = alpha + beta(yield) + delta(risk) + gamma(demand\ deposits)$$ Where ER represents excess reserves and gamma (demand deposits) was added to provide a scale factor. This covered the period of time before the financial crisis until the end of 2007 for all interest rates and interest rates less than or equal to 2 percent. The results are provided in the following table.

Table 5 Estimation of Banker's Liquidity Trap Model (Jan 1994-Dec 2007, non log form)

Excess Reserves = alpha + beta (t-bill yield) + delta (risk) + gamma (deposits)								
	alpha	beta (t-bill yield)	delta (VIX)	delta (Baa-Aaa)	gamma (demand deposits & other checkable deposits)	gamma (demand deposits)	# obs	R^2
All Interest Rates	1.644 (1.02)	-.137 (-2.44)	.028 (0.74)		-.0002 (-0.12)		168	0.047
	4.039 (2.70)	-.166 (-1.92)		-.437 (-0.86)	-.002 (-2.2)		168	0.037
	2.391 (2.41)	-.164 (-1.98)	.028 (0.73)	-.383 (-0.85)	-.0007 (-0.52)		168	0.048
	1.541 (1.10)	-.137 (-1.76)	.029 (1.00)			-.0001 (-0.05)	168	0.047
	2.259 (2.25)	-.148 (-1.74)		-.002 (-0.01)		-.0004 (-0.12)	168	0.028
	2.280 (2.33)	-.158 (-1.69)	.032 (1.01)	-.400 (-0.97)		-.001 (-0.42)	168	0.048
Interest Rates ≤ 2%	-2.198 (-1.14)	-.186 (-0.77)	.024 (2.07)		.005 (2.31)		36	0.115
	-1.818 (-0.56)	-.229 (-1.04)		.604 (0.94)	.005 (1.15)		36	0.105
	-5.683 (-1.38)	-.146 (-0.67)	.026 (2.31)	.680 (1.03)	.010 (1.82)		36	0.153
	-2.051 (-0.82)	-.380 (-1.63)	.020 (1.68)			.011 (1.52)	36	0.137
	-.367 (-0.17)	-.351 (-1.30)		.245 (0.65)		.006 (1.07)	36	0.104
	-2.056 (-0.78)	-.382 (-1.39)	.020 (1.98)	.013 (0.04)		.011 (1.51)	36	0.137

Note: The numbers in parentheses are t-statistics calculated by using the Newey-West method.

The above results again confirm that the regressions run through April 2009 are heavily influenced by the post 2007 observations. The t statistics and the R^2s reported in Table 5 are very low. Because there was little variation in excess reserves in this period, we extended our data sample back to 1970. Therefore, additional regressions were run using the following equations with 464 observations.

$$ER = alpha + beta(t-bill\ yield)$$

$$ER = alpha + beta(t-bill\ yield) + gamma(demand\ deposits\ and\ other\ checkable\ deposits)$$

$$ER = alpha + beta(t-bill\ yield) + gamma(demand\ deposits)$$

where ER = Excess Reserves

Given the unsatisfactory results reported in Table 5, we decided to enlarge the sample size to provide greater variability in the dependent and independent variables. Observations were included in the analysis as far back as 1970. This was done to get a greater range in

fluctuations in the volume of excess reserves and most likely a stronger t-statistics and R^2s. Given the results reported in Table 5, we deleted the risk variables from the model. The time period through August 2008 was chosen to estimate the normal bank demand for excess reserves based on interest rates and aggregate demand deposits, and to estimate how much of the recent surge in excess reserves was due to factors other than low interest rates. With the commencement of Federal lending programs, excess reserves expanded tremendously in September 2008 (as previously shown in Figure 30). Beta defines the effect of interest rates on bank demand for excess reserves, given the scale of bank deposits. For this reason the regressions were run using the long sample period from 1970 through August 2008.

The results of these regressions are provided in the following table.

Table 6 Regressions from Jan 1970-Aug 2008

Excess Reserves = alpha + beta (t-bill yield) + gamma (deposits)						
	alpha	beta (t bill yield)	gamma (demand deposits & other checkable deposits)	gamma (demand deposits)	# obs	R^2
All	1.697 (12.43)	-.131 (-7.86)			464	0.133
Interest	.269 (2.45)	-.060 (-4.20)	.002 (20.84)		464	0.259
Rates	-.286 (-2.45)	-.076 (-6.60)		.005 (9.57)	464	0.246

Note: The numbers in parentheses are t-statistics calculated by using the Newey-West method.

As anticipated, the t-statistics and R^2s are considerably higher and a better fit than those reported in Table 5. Beta and gamma exhibit expected signs and are statistically significant at conventional levels. Therefore, based on traditional behavior of excess reserves, these results can be used to predict what the excess reserves would have been post August 2008 in the absence of the extraordinary shocks that likely shifted the banker's demand curve for excess reserves.

This was accomplished by substituting the post August 2008 values of the Treasury bill yield, DDO, and DD into the three equations in Table 6 to estimate normal bank demand for excess reserves in the absence of extremely risky conditions. The results are provided in Table 7.

Table 7 Predicted vs. Actual Excess Reserves

Date	Equation	Predicted Excess Reserves (billions)	Actual Excess Reserves (billions)
2008:09	ER = alpha +beta (t-bill yield)	1.549	60.054
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.331	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.345	
2008:10	ER = alpha +beta (t-bill yield)	1.609	267.904
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.367	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.464	
2008:11	ER = alpha +beta (t-bill yield)	1.672	559.039
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.399	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.732	
2008:12	ER = alpha +beta (t-bill yield)	1.693	767.398
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.427	
	ER = alpha +beta (t-bill yield) + gamma (DD)	2.130	
2009:01	ER = alpha +beta (t-bill yield)	1.680	798.233
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.409	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.836	
2009:02	ER = alpha +beta (t-bill yield)	1.658	643.486
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.389	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.578	
2009:03	ER = alpha +beta (t-bill yield)	1.669	724.632
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.401	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.681	
2009:04	ER = alpha +beta (t-bill yield)	1.676	824.378
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.410	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.743	
2009:05	ER = alpha +beta (t-bill yield)	1.673	844.100
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.407	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.728	
2009:06	ER = alpha +beta (t-bill yield)	1.673	751.378
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.417	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.909	
2009:07	ER = alpha +beta (t-bill yield)	1.673	733.008
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.417	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.902	
2009:08	ER = alpha +beta (t-bill yield)	1.675	765.851
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.417	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.863	
2009:9	ER = alpha +beta (t-bill yield)	1.681	860.074
	ER = alpha +beta (t-bill yield) + gamma (DDO)	0.424	
	ER = alpha +beta (t-bill yield) + gamma (DD)	1.808	

Note: ER = Excess Reserves
   DDO = Demand Deposits and Other Checkable Deposits
   DD = Demand Deposits

A visual depiction of the predicted versus actual excess reserves, using

$$ER = alpha + beta(t - bill\ \ yield) + gamma(DD)$$

as the representative equation, is shown below.

Figure 35 Predicted vs. Actual Excess Reserves
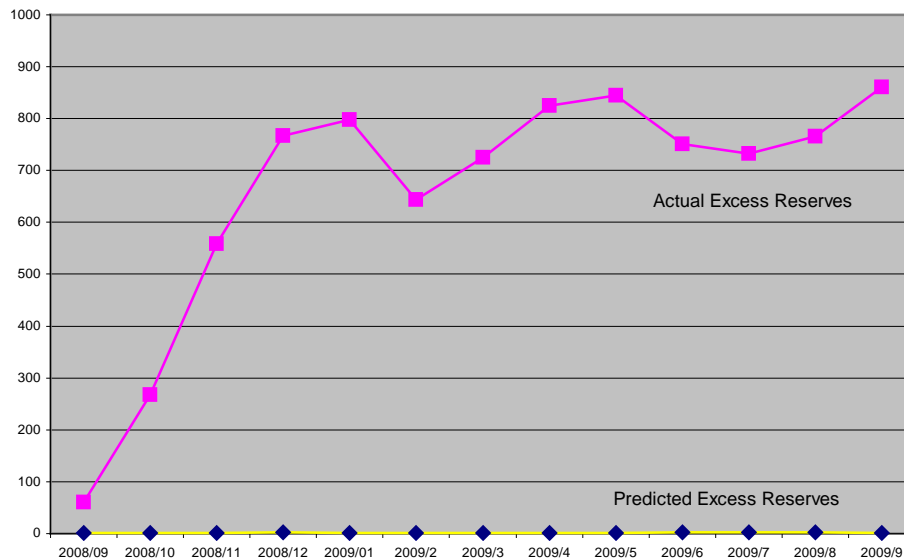
The above results suggest that the recent bank holdings of extreme amounts of excess reserves are likely overwhelmingly due to factors other than low interest rates. Treasury bill yields have typically been lower than 0.25 percent during the past year, explaining why banks may prefer to hold excess reserves rather than Treasury bills. However, various bank loan rates and longer-term Treasury bond yields are much higher than Treasury bill yields. Given the financial shocks of the past two years and the accompanying deterioration in capital accounts of many banks, bankers have severely tightened their lending standards. They are simply not making loans to many business and household borrowers that banks traditionally accommodate. Banks are holding excess reserves rather than extending credit. It appears that this, and to a

lesser extent, the extremely low yields on safe Treasury securities, accounts for the unwillingness of banks to use their excess reserves to purchase earning assets and extend credit.

To further explore the sensitivity of excess reserves to interest rates a graph plotting excess reserves and interest rates on the same timeline from January 1988 to August 2008 was created and is shown below.

Figure 36 Excess Reserves and Interest Rates

3-Month Interest Rates & Excess Reserves Jan 88 to Aug 08
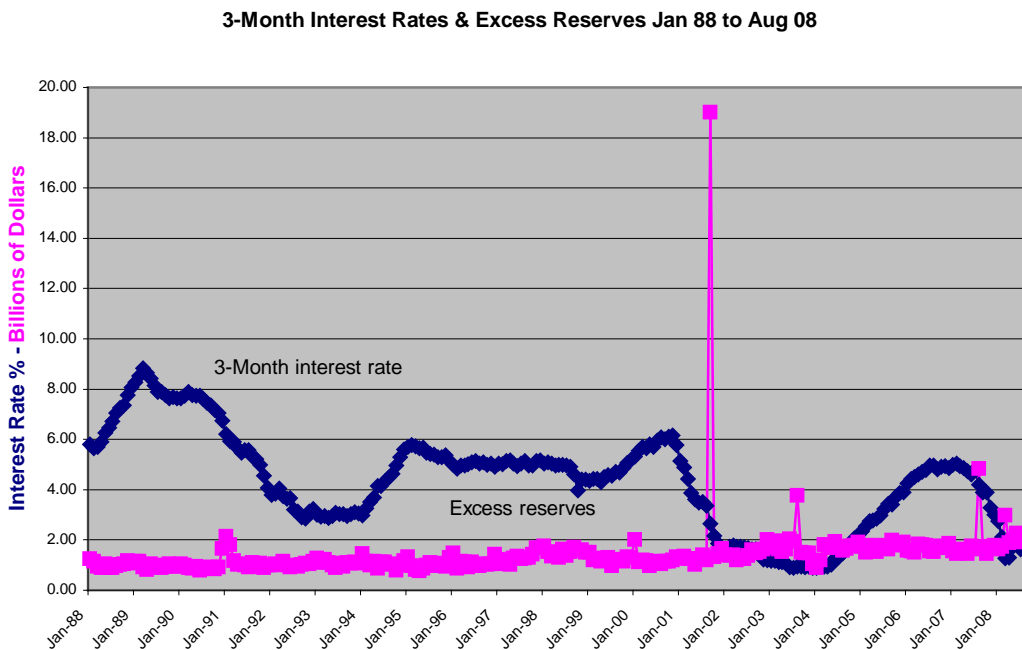
The spikes in excess reserves correlate to the times that the Federal Reserve pumped excess reserves into the economy to ensure liquidity. The six highest spikes that occurred when interest rates were relatively high were December 1990, January 1991, February 1991, January 2000, September 2001 and August 2007. The first three spikes are associated with the Persian Gulf War. The December 1990 spike is associated with the buildup of men and material for war, the January 1991 spike commenced with the beginning of the air war, and the February 1991 spike correlates to the start of the land war. The spike in January 2000 is associated with the turn of the millennium and fear of the "Y2K" crisis. The biggest spike occurred in September 2001 with the terrorist attacks on the World Trade Towers in New York City and the Pentagon in Washington D.C. The last point, August 2007, transpired when BNP Paribus was unable to

value mortgage backed securities and suspended calculation of net asset values (NAV) on funds. The Federal Reserve announced their readiness to provide liquidity as necessary. A scatter plot using the same points as in the graph above and another scatter plot with the six points removed are shown in the next two figures.

Figure 37 Scatter Plot 3-Month T-Bill vs. Excess Reserves/DDO
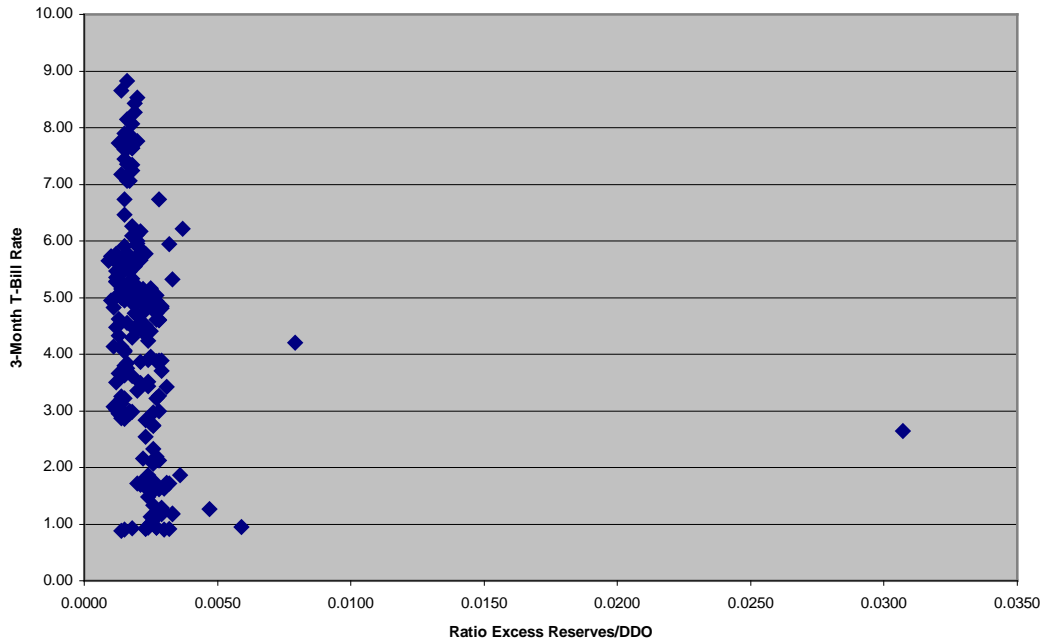
Figure 38 Scatter Plot 3-Month T-Bill rate vs. Excess Reserves/DDO with Pertinent Points Removed

Jan 1988 to Aug 2008 less Sept 01, Aug 07, Dec 90, Jan91, Feb 91 & Jan 2000
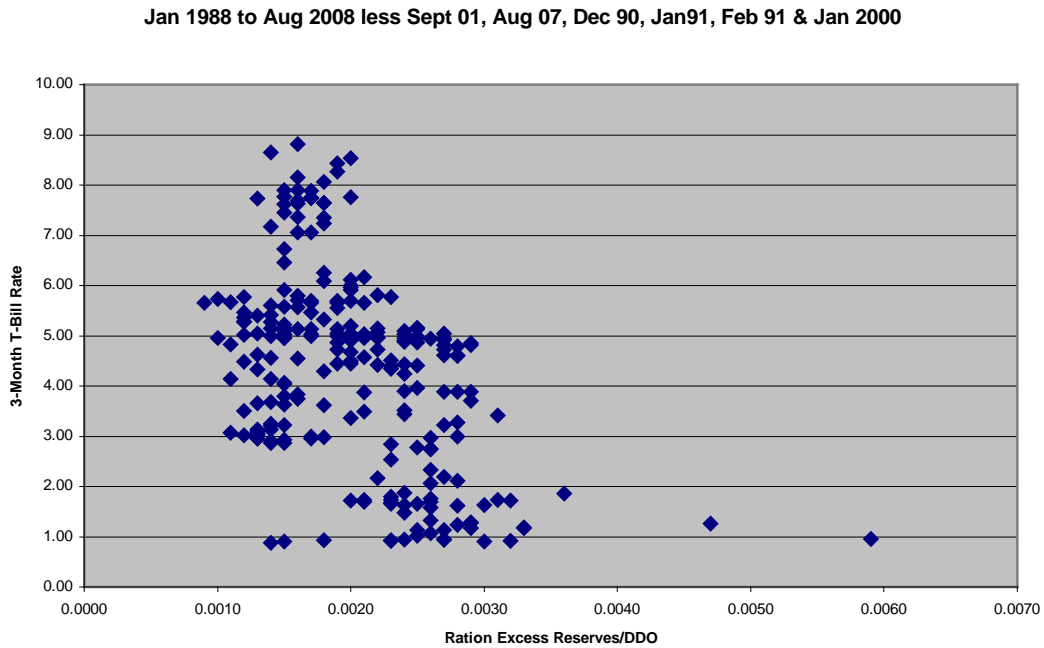
The above scatter plot with the six points removed results in a nonlinear bank demand for excess reserves curve that insinuates possibility of a bankers' liquidity trap. Regressions for tables 3 through 6 were redone in order to investigate this possibility. Tables 3-5 changed considerably but not as noticeably as Table 6. This table involved dates that allowed the removal of all 6 points. Old table 6, now labeled Table 8, and new table 6, now labeled Table 9 are shown below for comparison.

Table 8 Regressions from Jan 1970-Aug 2008

Excess Reserves = alpha + beta (t-bill yield) + gamma (deposits)						
	alpha	beta (t bill yield)	gamma (demand deposits & other checkable deposits)	gamma (demand deposits)	# obs	R^2
All	1.697 (12.43)	-.131 (-7.86)			464	0.133
Interest	.269 (2.45)	-.060 (-4.20)	.002 (20.84)		464	0.259
Rates	-.286 (-2.45)	-.076 (-6.60)		.005 (9.57)	464	0.246

Note: The numbers in parentheses are t-statistics calculated by using the Newey-West method.

Table 9 Regressions from Jan 1970-Aug 2008 less Dec 90, Jan 91, Feb 91, Jan 00, Sept 01, & Aug 07

Excess Reserves = alpha + beta (t-bill yield) + gamma (deposits)						
	alpha	beta (t bill yield)	gamma (demand deposits & other checkable deposits)	gamma (demand deposits)	# obs	R^2
All	1.547 (28.86)	-.115 (-15.64)			458	0.339
Interest	.186 (3.36)	-.047 (-8.22)	.002 (27.02)		458	0.721
Rates	-.235 (-2.62)	-.066 (-10.20)		.005 (21.77)	458	0.644

Note: The numbers in parentheses are t-statistics calculated by using the Newey-West method.

The dramatically improved results are clearly seen, particularly with the R^2s. With these positive results regressions for the above table were run for interest rates greater than 3 percent and 4 percent as well as less than 3 percent and 4 percent. The results are shown in the following table.

Table 10 Regressions from Jan 1970 – Aug 2008 less Dec 90, Jan 91, Feb 91, Jan 2000, Sep 2001, Aug 2007 for 3% and 4%

	Excess Reserves = alpha + beta (t-bill yield) + gamma (deposits)					
	alpha	**beta (t bill yield)**	**gamma (demand deposits & other checkable deposits)**	**gamma (demand deposits)**	**# obs**	**R^2**
Interest Rates $\geq$ 4%	1.278 (18.95)	-.080(-10.64)			352	0.176
	-.046 (-1.55)	-.021 (-7.09)	.0021 (28.81)		352	0.794
	-0.53 (-7.97)	-.031 (-6.86)		.0053 (25.73)	352	0.667
Interest Rates < 4%	2.10 (14.89)	-.292 (-5.33)			106	0.279
	1.03 (5.07)	-.247 (-5.05)	.0015 (8.05)		106	0.454
	.464 (1.68)	-.240 (-4.92)		.0047 (7.30)	106	0.452
Interest Rates $\geq$ 3%	1.30 (21.51)	-.083 (-11.79)			397	0.187
	-.031 (-1.07)	-.020 (-6.33)	.0020 (31.03)		397	0.763
	-.507 (-8.09)	-.034 (-7.72)		.0053 (27.19)	397	0.660
Interest Rates < 3%	1.99 (10.83)	-.213 (-2.56)			61	0.111
	1.98 (4.17)	-.214 (-1.91)	.00002 (0.03)		61	0.111
	2.25 (2.71)	-.205 (-2.04)		-.0008 (-0.28)	61	0.112

Note: The numbers in parentheses are t-statistics calculated by using the Newey-West method.

In this case beta is the value of interest. Beta for both 3 percent and 4 percent increases in absolute terms as interest rates fall. The highest value for beta in absolute terms is -.29 for interest rates less than or equal to 4 percent and -.21 for interest rates less than equal to 3 percent. The -0.29 value surpasses most previous results but still does not show empirically that there is a liquidity trap. Since Table 10 results looked promising, and to be consistent with much of the previous data another series of regressions were run. The data used were the same as in Table 10 but in log form. The results are shown below.

Table 11 Log Regressions from Jan 1970 - aug 2008 less Dec90, Jan 91, Feb 91, Jan 2000, Sep 2001, Aug 2007 for 3% and 4%

	alpha	beta ln (t-bill yield)	gamma ln (demand deposits & other checkable deposits)	gamma ln (demand deposits)	# obs	R^2
ln excess reserves = alpha + beta ln (t-bill yield) + gamma ln (deposits)						
Interest Rates ≥ 4%	1.080 (4.96)	-.900 (-8.43)			352	0.124
	-9.140 (-42.66)	-.213 (-4.49)	1.498 (47.97)		352	0.887
	-14.890 (-28.87)	-.226 (-2.96)		2.631 (32.60)	352	0.685
Interest Rates < 4%	.667 (9.07)	-.611 (-4.96)			106	0.203
	-7.972 (-17.55)	-.363 (-5.14)	1.328 (19.39)		106	0.796
	-14.193 (-13.50)	-.381 (-5.17)		2.558 (14.21)	106	0.750
Interest Rates ≥ 3%	.931 (5.31)	-.828 (-9.33)			397	0.132
	-9.139 (-48.57)	-.156 (-3.73)	1.479 (52.53)		397	0.883
	-14.908 (-33.35)	-.235 (-3.83)		2.638 (36.33)	397	0.707
Interest Rates < 3%	.542 (8.62)	-.191 (-2.07)			61	0.094
	2.825 (1.21)	-.160 (-1.53)	-.356 (-0.97)		61	0.104
	3.471 (1.19)	-.170 (-1.71)		-.508 (-1.00)	61	0.106

Note: The numbers in parentheses are t-statistics calculated by the Newey-West method.

Once again, the results do not confirm the existence of a liquidity trap. While the estimates of beta are uniformly negative and typically statistically significant at rigorous levels, the absolute value of these estimated interest elasticities are not consistently higher at lower interest rates than at higher interest rates. This is likely due to the fact that there is a threshold at some very low interest rate below which bank demand for excess reserves becomes highly elastic and we simply do not have enough observations when interest rates were extremely low to confirm existence of a banker's liquidity trap.

CHAPTER 3 - Actions Taken by the Federal Reserve to Increase Liquidity

As detailed in the previous sections, monetary policy becomes ineffective in a "liquidity trap" because of abnormal demand by the public and banks for liquidity. Individuals and businesses choose to hold onto money because the opportunity cost of doing so is negligible. Likewise, banks hold onto excess reserves because their opportunity costs of holding onto them also declines. This supports their acts of hoarding, while abetting the private sector's desire to borrow less. Can a central bank stimulate economic activity in the presence of a liquidity trap?

The tools that central banks use to provide liquidity during normal economic periods include open market operations and direct credit extension through standing lending facilities. In the United States open market operations have been the primary tool used to manage reserves in the banking system, thus controlling nominal short term interest rates, including the federal funds rate. The Federal Reserve's discount window is the standing lending facility serving as a source of reserves when individual banks experience short term funding shortfalls. Other typical tools used in normal times include changing the discount rate and changing the reserve requirement. However, during the current financial crisis the Federal Reserve concluded that new ways of providing liquidity were necessary.[41]

In quick succession, between August 2007 and May 2008, the Federal Reserve increased the term of discount lending from overnight to 30 days and again later to 90 days; created the Term Auction Facility (TAF); created swap lines with European Central Bank and the Swiss National Bank; created the Term Securities Lending Facility (TSLF); approved a loan to Bear Stearns through JP Morgan Chase; and created the Primary Dealer Credit Facility (PDCF).

Discount Window Lending

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[41] Ben Bernanke, "Liquidity Provision by the Federal Reserve", a speech given at the Federal Reserve Bank of Atlanta Financial Conference, Sea Island Georgia, May 29, 2008.

The Federal Reserve lends money to depository institutions (commercial banks, thrift institutions and U.S. branches of foreign banks) at the discount window. It has three lending programs – primary credit, secondary credit and seasonal credit programs. These programs are available as a backup source of liquidity on a short-term basis.

The Federal Reserve grants primary credit on a short term basis (normally overnight) to depository institutions that are financially strong and well capitalized. There are no restrictions on the use of primary credit.

The Federal Reserve offers secondary credit to banks that do not qualify for primary credit. Similar to primary credit, secondary credit is available on a short-term basis (normally overnight). Greater administrative requirements characterize secondary from primary credit, so that the Federal Reserve can ensure pay back of the loan.

Seasonal credit is given to small and mid-size banks whose needs fluctuate throughout the year. These banks are normally associated with agricultural communities.

Discount window loans are secured by collateral that exceeds the amount of the loans. The amount of collateral greater than the loan amount is known as a "haircut". In order to inject liquidity into the financial markets the Federal Reserve, in August 2007, changed the normal overnight lending practice for term financing to 30 days and made it renewable at the discretion of the borrower. Then, in March of 2008, in an effort to bolster liquidity, again the Board of Governors of the Federal Reserve System approved an increase in the maximum maturity of primary credit from 30 days to 90 days. These longer time frame borrowing provisions are still in effect as of November 2009, and per the Board of Governors will remain in effect until the Federal Reserve determines that market liquidity has significantly improved.

Term Auction Facility (TAF)

As described above, the Federal Reserve normally provides reserves through its open market operations and discount window. Banks in turn, lend to one another as well as to the general public based on the borrower's credit worthiness and the banks' own ability to access funds. During times of financial crisis, banks may scale back their lending, normally referred to as "term" lending. This may be because credit worthiness cannot be ascertained, or the banks' ability to raise funds may be in question which results in hoarding. Consequently, banks that

need funds may not have access to the term funds they desire. This situation emerged during the current financial crisis.

To resolve this situation, and in an attempt to increase liquidity, the Federal Reserve changed the operation of its discount window. The Federal Reserve decided to auction funds directly to banks by creating the Term Auction Facility (TAF). Through TAF banks can obtain funds for a longer period of time, at a market-determined interest rate in a competitive market format.

The auction approach of injecting liquidity into banks has three advantages over the traditional discount window and open market operation approach. First, auctions allow the Federal Reserve to control precisely how much, and when, liquidity would be injected into the market. Second, auctions avoid the stigma associated with using the discount window (in normal times banks tend to shy away from the discount window for fear of being seen as a troubled). Third, auctions allow the Federal Reserve to provide funds directly to a larger number of banks rather than the small number of primary dealers associated with open market operations.[42] The number of primary dealers is normally fluid. The latest list of dealers, which was issued July 27, 2009, numbered eighteen and hasn't changed (as of November, 2009).[43]

Swap Lines

A Swap line is also known as a temporary reciprocal currency arrangement. This arrangement "is a transaction where two parties exchange an agreed amount of two currencies while at the same time agreeing to unwind the currency exchange at a future date."[44] Currency swaps are used among businesses as well as banks. They were introduced by the World Bank in 1981 to obtain Swiss francs and German marks by exchanging cash flows with IBM.[45] With markets extending around the world, the Federal Reserve has established swap lines with other central banks to provide liquidity. There are two types of swap lines: dollar liquidity lines and foreign-currency lines.

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[42] Olivier Armantier, Sandra Krieger, and James McAndrews, "The Federal Reserve's Term Auction Facility", Federal Reserve Bank of New York Current Issues in Economics and Finance 14, No. 5 (July 2008), 5-6.
[43] Federal Reserve Bank of New York, "Primary Dealers List" effective July 27, 2009.
[44] Mike Hammil, "What's a Swap Line?" Federal Reserve Bank of Atlanta, macroblog, September 18, 2008.
[45] "Currency Swap", Encyclopedia Wikipedia, 2009.

Dollar Liquidity Swap Lines

In December of 2007, the Federal Reserve initiated dollar liquidity swap lines with the European Central Bank and Swiss National Bank to provide liquidity in U.S. dollars to foreign markets. Later, they initiated dollar liquidity swap lines with other central banks.

> "These swaps involve two transactions. When a foreign central bank draws on its swap line with the Federal Reserve, the foreign central bank sells a specified amount of its currency to the Federal Reserve in exchange for dollars at the prevailing market exchange rate. The Federal Reserve holds the foreign currency in an account at the foreign central bank. The dollars that the Federal Reserve provides are deposited in an account that the foreign central bank maintains at the Federal Reserve Bank of New York. At the same time, the Federal Reserve and the foreign central bank enter into a binding agreement for a second transaction that obligates the foreign central bank to buy back its currency on a specified future date at the same exchange rate. The second transaction unwinds the first. At the conclusion of the second transaction, the foreign central bank pays interest, at a market-base rate, to the Federal Reserve."[46]

Foreign-Currency Liquidity Swap Lines

The purpose of foreign-currency liquidity swap lines is to provide the Federal Reserve with the ability to offer liquidity to U.S. institutions in foreign currency. These lines are similar to dollar liquidity swap lines which, as stated above, provide foreign central banks with the ability to offer U.S. dollar liquidity to institutions in their respective countries.

Twenty-eight Day Repurchase Agreements

Repurchase agreements (repos) are the most common type of secured funding transaction. They are a sale of securities, coupled with an agreement to repurchase the same securities on a later date, but typically at a higher price. Repos are a tool of monetary policy through which the Federal Reserve can add or subtract bank reserves in order to influence short-term rates. The Federal Reserve uses repurchase agreements to make collateralized loans to primary dealers (institutions with a trading relationship with the Federal Reserve Bank of New York and not necessarily a depository institution). This action offsets temporary fluctuations in bank reserves. Repos are conducted by auction where primary dealers bid on borrowing the money. They are the most common form of temporary open market operation and normally can

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[46] "Central Bank Liquidity Swaps", Board of Governors of the Federal Reserve, Credit and Liquidity Programs and the Balance Sheet, 2009.

be bought and sold for terms from one to 65 business days, but rarely no longer than 14 days.[47] As a result of the financial crisis, in March 2008, the Federal Reserve announced the intention to conduct 28-day repos cumulating to an amount of $100 billion. This doubling of the normal time, by which primary dealers were lent money and by which the amount of bank reserves could be temporarily altered, was implemented to increase liquidity in the banking system.

Term Securities Lending Facility (TSLF)

The Federal Reserve announced the creation of the Term Securities Lending Facility (TSLF) in March 2008 to promote funding liquidity. The TSLF was established on a temporary basis under the Federal Reserve's emergency lending powers. TSLF is intended to ease liquidity pressures in the secured, or collateralized, funding markets relied on by primary dealers. The facility increases the ability of primary dealers to obtain cash in the private market, by enabling the dealers to pledge securities temporarily as collateral for Treasuries. It works as an auction. Dealers bid to borrow over time, up to $200 billion in Treasury securities from the Federal Reserve, for a term of twenty-eight days, with the dealers agreeing to provide other securities as collateral. As a result, the TSLF reduces the need for primary dealers to sell assets when markets are illiquid.[48]

Bear Stearns and JP Morgan Chase

The Board of Governors of the Federal Reserve, on March 14, 2008, announced that "The Federal Reserve is monitoring market developments closely and will continue to provide liquidity as necessary to promote the orderly functioning of the financial system. The Board voted unanimously to approve the arrangement announced by JP Morgan Chase and Bear Stearns this morning."[49] The announced arrangement was that, JP Morgan Chase would provide an unspecified amount of funding to Bear Stearns, for an initial period of 28 days, and those loans would be effectively insured by the Federal Reserve. This insurance by the Federal

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[47] "Repurchase and Reverse Repurchase Transactions" FEDPOINT, Federal Reserve Bank of New York, August, 2007.
[48] Michael J. Fleming, Warren B. Hrung, and Frank M. Keane, "The Term Securities Lending Facility: Origin, Design and Effects", Federal Reserve Bank of New York Current Issues in Economics and Finance 15, No. 2, (February, 2009), 1-2.
[49] Board of Governors of the Federal Reserve System, "Press Release" regarding JP Morgan Chase and Bear Stearns, March 14, 2008.

Reserve was again use of its emergency lending powers to inject liquidity into the markets, beyond day-to-day operations.

Primary Dealer Credit Facility (PDCF)

On March 17, 2008, in response to the ongoing financial crisis, including the collapse of Bear Stearns, the Federal Reserve announced the creation of another new lending facility, the Primary Dealer Credit Facility (PDCF). PDCF is an overnight facility that provides funding to primary dealers in exchange for a specified range of eligible collateral. It was intended to improve the ability of dealers to access liquidity.

PDCF is closely related to TSLF. Both are open to primary dealers as opposed to depository institutions, meaning non-bank institutions such as investment banks outside the regulation of the Federal Reserve. "A key difference between PDCF and TSLF is that PDCF is a standing facility whereas TSLF is an auction facility. As a standing facility, the PDCF offers the advantage of availability on a continuous, as needed basis. It also accepts a broader class of securities as collateral."[50]

Additional Actions

Subsequent to the actions just described, the Federal Reserve took additional steps by creating the following supplementary lending facilities to provide liquidity to other sectors of the financial markets: Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility; Commercial Paper Funding Facility; Money Market Investor Funding Facility; and a Term Asset-Backed Securities Loan Facility. In addition, the Fed began paying interest on bank required and excess reserves.

Asset-Backed Commercial Paper Money Market Mutual Fund Liquidity Facility (AMLF)

In order to enhance its attempts to provide liquidity to the markets, the Federal Reserve announced in September 2008 that it was creating the Asset-Backed Commercial Paper Money

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[50] Michael J. Fleming, Warren B. Hrung, and Frank M. Keane, p. 4.

Market Mutual Fund Facility (AMLF). This temporary lending facility provides funding, to U.S. depository institutions and bank holding companies, to finance their purchases of high-quality asset-backed commercial paper (ABCP) from money market mutual funds. The facility is intended to assist money market funds, which hold such paper, in meeting demands for redemptions by investors and to foster liquidity in the ABCP market and money markets in general.

Commercial Paper Lending Facility (CPFF)

The Federal Reserve created the Commercial Paper Funding Facility (CPFF) to provide a liquidity backstop to U.S. issuers of commercial paper. The CPFF is intended to improve liquidity in short-term funding markets and thereby increase availability of credit to businesses and households. Under the CPFF, the Federal Reserve will finance the purchase of highly rated unsecured and asset-backed commercial paper via primary dealers. It finances only highly rated, U.S. dollar-denominated three-month commercial paper.

Money Market Investor Funding Facility

The Federal Reserve created the temporary Money Market Investor Funding Facility (MMIFF) in October, 2008 to support a private-sector initiative to provide liquidity to U.S. money market investors.

In the fall of 2008, short-term debt markets were under considerable strain as money market funds and other investors had difficulty selling assets to satisfy redemption requests. The MMIFF was intended to facilitate the sales of money market instruments in the secondary market, thereby increasing the liquidity position of money market investors. The Federal Reserve thought that this would help money market funds meet investor redemption requests and encourage investors to continue investing in money market instruments. This would enhance the banks' ability to meet business and household credit requirements. This was accomplished by the Federal Reserve providing secured funding to finance U.S. dollar-denominated certificates of deposits and dollar denominated three-month commercial paper by money market mutual funds.

Term Asset-Backed Securities Loan Facility (TALF)

In November, 2008 the Federal Reserve created the Term Asset Backed Securities Loan Facility (TALF). This funding facility was initially intended to help market participants meet the

credit needs of households and small businesses. It was to help by supporting the issuance of asset-backed securities (ABS) collateralized by student loans, auto loans, credit card loans, and loans guaranteed by the Small Business Administration (SBA).

The Federal Reserve started this program because in September of 2008 the issuance of ABS declined severely and then stopped completely in October of 2008. This created a severe liquidity crunch because ABS markets support the substantial share of consumer credit and SBA-guaranteed small business loans. Consequently, trouble in these markets would have significantly limited the availability of credit to households and small businesses and in turn further weakened the U.S. economy. This program works by the Federal Reserve lending money to the holders of AAA-rated ABS backed by consumer and small business loans.

Initially the Federal Reserve limited the amount of money lent in support of TALF to $200 billion. However, in February 2009, the Federal Reserve announced that they were prepared to undertake a substantial expansion of the TALF program. The expansion has the potential of increasing the size of TALF to $1 trillion while also expanding the types of AAA-rated asset backed securities supported by the program, mainly commercial mortgage-backed securities (CMBS).

In May 2009, the Federal Reserve, did in fact, announce that CMBS and securities backed by insurance premium finance loans would be eligible for TALF funding. CMBS was added to the TALF program because the CMBS market came to a halt in mid-2008. CMBS accounted for almost half of new commercial mortgage originations in 2007. The Federal Reserve believed that this action would prevent defaults on economically viable commercial properties and facilitate the sale of distressed properties. It also anticipated that this action will help borrowers finance new purchases of commercial properties and the refinancing of existing mortgages.

Insurance premium ABS was included in TALF to facilitate the flow of credit to small businesses. Over 1.5 million insurance premium loans are extended to small businesses each year to enable them to obtain property and casualty insurance. These loans are often funded by ABS, but have been hard to obtain with the disruption in the ABS market.

Interest Paid on Required Balances and Excess Balances

The Financial Services Regulatory Relief Act of 2006 originally authorized the Federal Reserve to begin paying interest on balances held by, or on behalf of, depository institutions beginning October 1, 2011. The Emergency Economic Stabilization Act of 2008 accelerated the effective date to October 1, 2008. The Federal Reserve believes that paying interest on required reserve balances will eliminate the opportunity cost of holding required reserves, thereby promoting efficiency in the banking sector.[51] The Federal Reserve uses different formulas to determine the interest rate paid to depository institutions on required reserve balances and excess balances. The formulas have been altered twice since their inception. The Federal Reserve altered the formulas to foster trading in the funds market at rates close to the Federal Open Market Committee's (FOMC's) targeted federal funds rate.[52] This feature effectively puts a floor under the federal funds rate, to ensure that the Federal Reserve can hit its targeted federal funds rate. For example, if the Federal Reserve is paying 0.50 percent on excess reserves, banks will not lend in the federal funds market at less than 0.50 percent.

Special Liquidity Injections Summary

The following table summarizes specific aspects of the initiated programs.

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[51] Board of Governors of the Federal Reserve System, Press Release regarding Interest on Reserves, October 6, 2008.
[52] Board of Governors of the Federal Reserve System, Press Release regarding Interest on Reserves, November 5, 2008.

Table 12 Special Liquidity Injections Summary

	Announcement Date	Applies to	Pre-Crisis Maturity	Crisis Maturity	Termination Date w/changes	Current Term Date
Discount Lending	August 17, 2007	Depository Institutions	Overnight – 14 days	30-90 days		
TAF	Dec 12, 2007	Depository Institutions	N/A	28 days 84 days	For as long as necessary	For as long as necessary
Swap Lines	Dec 12, 2007	Central Banks			30 April 2009 30 Oct 2009	1 Feb 2010
Repurchase Agreements	March 2008	Primary Dealers	Typical 0 to 14 days	Typical 28 days		
TSLF	March 11, 2008	Primary Dealers	N/A	28 days	30 Jan2009 30 April 2009 30 Oct 2009	1 Feb 2010
PDLF	March 16, 2008	Primary Dealers	N/A	Continuous as needed	30 Jan 2009 30 April 2009 30 Oct 2009	1 Feb 2010
AMLF	Sept 19, 2008	Depository Institutions & Bank Holding Companies	N/A		30 Jan 2009 30 April 2009 30 Oct 2009	1 Feb 2010
Interest Rates Payable on Reserves	Oct 1, 2008	Depository Institutions	N/A			
CPFF	Oct, 14, 2008	Commercial Paper Issuers	N/A		30 April 2009 30 Oct 2009	1 Feb 2010
MMIFF	Oct 21, 2008	Money Market Mutual Funds & Investors	N/A		30 April 2009 30 Oct 2009	Expired 30 Oct 2009
TALF	November 25, 2008	ABS	N/A		31 Dec 2009 31 Dec 2009	31Mar2010
	May 1, 2009	CMBS	N/A		31 Dec 2009	30 Jun 2010

CHAPTER 4 - Have the Special Liquidity Injections Worked?

Whether these additional liquidity tools have worked is a matter of dispute. The Federal Reserve in 2009 reported that conditions in financial markets had improved in recent months. While at nearly the same time, others have commented that "just about every policy move to right the U.S. economy has been a bust."[53] So let's look at the results in terms of successes and failures. Failure would be defined as more programs needed to provide more liquidity, individual programs dollar amount increased, scope of program increased, borrowing time increased or termination dates extended to improve liquidity. The definition of failure evolves around the idea that the initial program was insufficient to resolve the liquidity problem and thus the program needed to expand in one form or another. It is noted that this definition is not ideal. A program may be extended because it was found to work and may be incorporated into the routine procedures of the Federal Reserve as may be the case for Term Auction Facility (TAF). Success is defined in just the opposite fashion. A decline in the program would indicate that the program worked because the liquidity injections were no longer needed or the need had been reduced.

Indicators of Failure

Liquidity Program Extensions

It is quite apparent from Table 8, Special Liquidity Injections Summary, that a majority of the programs have been extended, many several times, past their initial termination date. As of November, 2009 the last extension announced by the Federal Reserve was on August 17, 2009. It was regarding TALF. The Federal Reserve commented that the markets for asset-backed securities (ABS) backed by consumer and business loans and for commercial mortgage-backed securities (CMBS) were still impaired and it seemed likely that they would remain so for some time. Consequently, ABS was extended through March 31, 2010 and CMBS was extended through June 30, 2010, from their previously authorized date of December 31, 2009. This is an indication that the programs have not had the impact on the liquidity as initially thought, but may be useful and just need more time to produce results.

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[53] Andy Kessler, "The Bernanke Market", *The Wall Street Journal*, July 15, 2009 p. A15, cols 1-4.

Liquidity Program Scope

Since the crisis began there have been four major timeframes in which the Federal Reserve initiated liquidity programs, the fall of 2007, the spring of 2008, the fall of 2008 and the spring of 2009. Additionally in the fall of 2009 the Federal Reserve expanded the size and scope of the TALF program. It can be surmised that, as one set of programs failed to end the liquidity crunch, another set of programs was added to the growing list.

Liquidity Program Targets

The liquidity programs initially started by the Federal Reserve targeted the institutions normally under the Federal Reserve's purview, the depository institutions. As these actions failed to resolve the liquidity crisis, the Federal Reserve, using its emergency powers, targeted other financial institutions not typically under its control, the primary dealers. As this action failed to curtail the crisis, the Federal Reserve used its emergency powers again and targeted other financial institutions including, but not limited to, money market funds, issuers of commercial paper and those associated with asset backed securities.

Liquidity Program's Size

The dollar amount authorized in support of the TALF program increased from $200 billion to $1 trillion as the scope of the program increased.

Borrowing Time

Duration of programs has been lengthened. Discount lending went from the typical overnight-14 days to overnight-30 days and then even to 90 days for primary credit. TAF started with a 28 day auction, but was expanded with the addition of an 84 day auction. Repurchase agreements went from the typical overnight-14 days to overnight-28 days.

Swap Lines

Swap line arrangements were initially with the European Central Bank and the Swiss National Bank, but have expanded to include eleven other central banks. These are: the Reserve Bank of Australia, the Banco Cetral do Brasil, the Bank of Canada, Danmarks National Bank, the Bank of England, the Bank of Korea, the Banco de Mexico, the Reserve Bank of New Zealand, Norges Bank, the Monetary Authority of Singapore and Sveriges Riksbank.

Indicators of Success:

As of June 25, 2009, the Federal Reserve reported that conditions in the wholesale funding markets had improved in recent weeks to a point that changes could be made to several of its liquidity programs.[54]

TAF Auctions

The amount bid at TAF auctions was below the amount offered for several auctions. With the decreased need for TAF funding, the Federal Reserve reduced the amounts being offered from $150 billion to $125 billion in the biweekly auctions. In July 2009, the Federal Reserve again reduced the amount being offered to $100 billion. In August, they announced that the September auctions will be reduced to $75 billion for both the 84 day and 28 day auctions. Late September, the Federal Reserve announced that it will continue to offer $75 billion for its 28 day auctions through January 2010. However, it was going to lower its 84 day auction to $50 billion in October and to $25 billion in November and December. The Federal Reserve also announced at the same time that it will be assessing whether to maintain TAF on a permanent basis.

TSLF Auctions

The Federal Reserve reported that, since primary dealers had made considerable progress in deleveraging and since access to funding for repurchase agreements had improved borrowing at the TSLF had fallen markedly. As a result, the Federal Reserve suspended TSLF auctions backed by Schedule 1 collateral (Treasury, agency debt, and agency-guaranteed mortgage-backed securities). TSLF auctions backed by Schedule 2 collateral (Schedule 1 and investment-grade corporate, municipal, mortgage-backed, and asset backed securities) will be conducted every 4 weeks rather than every 2 weeks. Additionally, the total amount offered under TSLF is reduced to $75 billion from $200 billion.

MMIF

The Federal Reserve determined that there was no need to extend the MMIF program, so its authorization expired 30 October 2009.

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[54] Board of Governors of the Federal Reserve System, Press Release regarding extensions and modifications to its liquidity programs, 25 June, 2009.

AMLF

The Federal Reserve reported that usage of the AMLF had declined considerably. However, the Federal Reserve considered the markets still fragile and thus extended the authorization of AMLF until 1 February, 2010.

Indeed, there have been some improvements in liquidity, as indicated by the Federal Reserve, and everything has not been a bust, as seen through the eyes of others. But, I would fathom to say that the Federal Reserve has a long way to go to improve overall liquidity in the economy. Particularly, since the latest data in FRED, dated 21 October, 2009 shows total commercial and industrial loans still declining. In its November 4, 2009 press release, the FOMC stated that, although household spending appeared to be expanding, it remained constrained due tight credit among other things. Likewise, business was still cutting back on investment and the FOMC expected economic activity to remain weak for a time. Consequently, despite the special liquidity injections by the Federal Reserve, the economy is most likely still in a "liquidity trap", with interest rates near zero and the ability of monetary policy to boost economic activity questionable. Even so, the Federal Reserve does believe that its monetary stimulus in conjunction with fiscal stimulus will support a strengthening of economic growth over time.[55]

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[55] Board of Governors of the Federal Reserve System, Press Release of 4 November 2009.

CHAPTER 5 - Conducting Monetary Policy at Low Interest Rates

It was just presented that the country, in the fall of 2009, most likely remains in a "liquidity trap". With interest rates near zero and monetary policy possibly not very effective, is there anything further, the Federal Reserve can do to stimulate the economy? In 2004, before he became Federal Reserve Chairman and years before this financial crisis, Ben Bernanke espoused three monetary strategies that the Federal Reserve could follow to improve an economy that was not responding to a near zero interest rate policy. The strategies were: influence financial investors' expectations about future interest rates; change the composition of the Federal Reserve balance sheet; and increase the size of the Federal Reserve Balance sheet.[56]

Influencing Expected Future Interest Rates

The role of expectations evolves around convincing financial investors that short term interest rates will be lower in the future than they currently expect. This relates to the term structure of interest rates, which is the relationship between long term and short term interest rates at a given point in time. Long-term interest rates are determined by the current short term interest rate and expected future short term interest rates. Therefore, it is believed that the Federal Reserve can indirectly influence long term interest rates by directly controlling short term interest rates and influencing the expectations of future short term interest rates. Since long term interest rates sway consumption and investment decisions (low interest rates spur consumers to purchase durable goods, automobiles and houses), the Federal Reserve could increase aggregate spending and thus stimulate the economy by convincing the public that short term interest rates will remain low for a significant period of time. There is significant lack of consensus among economists about the ability of a central bank to do this.

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[56] Ben S. Bernanke and Vincent R. Reinhart, "Conducting Monetary Policy at Very Low Short-Term Interest Rates" Paper presented at the International Center for Monetary and Banking Studies Lecture, Geneva Switzerland, January 14, 2004. p.1.

Balance Sheet Composition

The Federal Reserve holds a variety of assets, which include: gold certificate accounts, Special Drawing Rights accounts, coins, loans to depository institutions, U. S. Treasury securities, cash items in process of collection and assets denominated in foreign currency and other assets. Each one of these different assets presents the possibility to shape monetary policy. For example, the Federal Reserve can buy any of the different types of "used" U.S. Treasury bonds with various maturities (four weeks to thirty years) that are offered in the secondary market. The Federal Reserve could influence term premiums, and thus overall yields, by shifting the composition of its holdings from shorter to longer dated securities.[57]

Balance Sheet Size

The Federal Reserve can also influence monetary policy by changing the size of its balance sheet. It can change the size of its balance sheet by buying and selling securities, which in turn, alters the amount of reserves and the money supply. Increasing the amount of reserves beyond what is needed to keep interest rates near zero is known as "quantitative easing". Quantitative easing impacts the economy in various ways or channels. One channel is, if it is assumed that money is not a perfect substitute for other financial assets, the increase in the money supply will cause investors to rebalance their investment portfolios, raising prices and reducing yields on non-money assets. Lower yields on long-term assets will in turn stimulate the economy.[58]

Federal Reserve Monetary Policy

Did Ben Bernanke follow his own advice? With respect to influencing expectations regarding interest rates the answer is a resounding, "Yes". As pointed out earlier, and reiterated in several FOMC statements, including its most recent one of November 4, 2009, the Committee stated that it will maintain the target range for the federal funds rate at 0 to 1/4 percent and continues to anticipate that economic conditions are likely to warrant exceptionally low levels of the federal funds rate for an extended period. With respect to the Federal Reserve's balance sheet, composition of it has changed dramatically. Prior to the financial crisis the largest asset

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[57] Ibid. p. 3.
[58] Ibid. p. 5.

holding by the Federal Reserve was U.S. Treasury securities, accounting for nearly seven-eights of total assets. As of April of 2009, U.S. Treasury securities totaled $780 billion, or about three-eights of Federal Reserve assets. Accordingly, other assets have expanded drastically.[59] Federal Reserve assets now fall into three broad categories. Ben Bernanke described these categories as: (1) short-term credit extended to support the liquidity of financial firms, such as depository institutions, broker-dealers, and money market mutual funds; (2) assets related to programs focused on broader credit conditions; and (3) holdings of high-quality securities, notably Treasury securities, agency debt, and agency-backed mortgage-backed securities (MBS).[60]

The short-term liquidity provided to financial institutions, as of August 2009, totaled almost $860 billion and represented nearly 45 percent of the assets on the Federal Reserve's balance sheet.[61] This short-term liquidity encompasses many of the newly instituted liquidity programs detailed in Chapter 3, such as the TAF, PDCF, and TSLF.

The second category of the Federal Reserve balance sheet, which includes direct lending to borrowers and investors, totaled nearly $255 billion or roughly 13 percent of the assets on the Federal Reserve's balance sheet as of August 2009. These assets also encompassed the newly instituted liquidity programs detailed in Chapter 3, mainly the CPFF and TALF.

The third category of assets consisting of high-quality securities, which was already mentioned to be in the amount of $780 billion, is made up of $490 billion in U.S. Treasury Securities and $290 in agency debt, as of August, 2009.

Accompanying the change in composition of the balance sheet has been the size of the balance. The Federal Reserve's balance sheet has "more than doubled, from roughly $870 billion before the crisis to roughly $2 trillion now (April 2009)." [62] The size of the balance is expected to grow larger. The FOMC announced March 18, 2009, that it was going to purchase an additional $750 billion of agency MBS, bringing its total purchase of these securities to up to $1.25 trillion this year. Additionally, it was going to increase its purchase of agency debt this year up to $100 billion to a total of up to $200 billion. The committee also made the

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[59] Ben S. Bernanke, "The Federal Reserve's Balance Sheet", Speech given at the Federal Reserve Bank of Richmond 2009 Credit Markets Symposium, Charlotte, North Carolina, April 3, 2009, p. 2.

[60] Agency debt, in this instance, is debt issued by Fannie Mae, Freddie Mac, and the Federal Home Loan Banks. Agency MBS are backed by Fannie Mae, Freddie Mac, and Ginnie Mae.

[61] Ben S. Bernanke, "The Federal Reserve's Balance Sheet", Speech given at the Federal Reserve Bank of Richmond 2009 Credit Markets Symposium, Charlotte, North Carolina, April 3, 2009, p. 2.

[62] Ibid., p. 2.

commitment to purchase up to $300 billion of longer-term Treasury securities over the following six months. On November 4, 2009, because of the availability of agency debt, the FOMC announced that it was reducing the amount of agency debt it was buying from $200 billion to $175 billion. It was also going to slow the pace of agency debt purchases to promote a smooth transition in markets, but that the transactions would be completed by the first quarter of 2010. As of October 28, 2009 the Federal Reserve Total Assets, as reported in FRED, were $2.16 trillion.

Results

In April 2009, Ben Bernanke stated that 30-year fixed mortgage rates, which responded very little to the Federal Reserve cuts to the targeted federal funds rate, declined 1 to 1.5 percentage points since the Federal Reserve began purchasing agency mortgage backed securities in November 2008. The November 4, 2009 Wall Street Journal reported 30 year fixed mortgage rate as 5.29% with a 52-week range from a low of 5.06% and high of 6.50% with a 3 year percentage change of -.59 percent. It does appear that long term interest rates have come down slightly over the past year and are lower now by a little over 1 percentage point from their highs for the year. This decline in long term interest rates, may have contributed to the positive third quarter GDP numbers reported by the Commerce department's Bureau of Economic Analysis report of October 29, 2009. However, in its November 4, 2009 statement, the FOMC still believes that economic activity will remain weak for some time and constrained by ongoing job losses. This statement by the FOMC is insightful in light of the fact that the unemployment rate increased to 10.2%, as reported by the Bureau of Labor Statistics of the U.S. Department of Labor, November 6, 2009 jobs report. This is the highest level of unemployment in twenty-six years. Subsequently, the December 4, 2009 jobs report stated that only 11,000 additional jobs had been lost in November, and that unemployment rate changed to 10 percent.

CHAPTER 6 - The Role of Inflationary Expectations

As previously stated, in the modern view of a "liquidity trap", monetary policy would still be effective when current nominal interest rates are zero. This is because monetary policies would work through future expected inflation and thus future interest rates. Accordingly, the only way out of a "liquidity trap" would be to raise inflationary expectations. This is possible, per Paul Krugman, by the government increasing deficit spending with fiscal policy or with "irresponsible monetary policy". In other words, convince the public that monetary expansion is not merely temporary and that the central bank will not reverse its policy of monetary expansion when prices begin to rise.

Irresponsible Monetary Policy?

Let's review current monetary policy to determine whether it is irresponsible. Has the Federal Reserve tried to convince the public that it will not reverse monetary expansion when prices begin to rise?

It was shown in Chapter 5 that current monetary policy is one of expansion. This has not changed according to several press releases by the Federal Open Market Committee. The committee has stated that it will maintain the federal funds target range between 0 and ¼ percent for a considerable period of time. The FOMC also has stated that it "will employ all available tools to promote economic recovery and preserve price stability."[63] This policy was reiterated by the FOMC at the conclusion of its meetings on August 12, September 23, and the latest meeting of November 4, 2009. However, both the September 23 and November 4 press releases included the comment that the committee "continues to anticipate that economic conditions are likely to warrant exceptionally low levels of the federal funds rate for an extended period."[64] The statement regarding preserving price stability implies that the Federal Reserve will not continue monetary expansion once prices begin to rise more rapidly in an economic recovery. It

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[63] Board of Governors of the Federal Reserve System, Press Release following the Federal Open Market Committee meeting of 23-24 June, 2009.

[64] Board of Governors of the Federal Reserve System, Press Release following the Federal Open Market Committee meeting of 3-4 November, 2009.

was also shown in Chapter 5 that the Federal Reserve's strategy to conduct monetary policy in a zero interest rate environment is to (1) increase liquidity to financial firms, such as depository institutions, broker-dealers, and money market mutual funds with new, innovative but short lived credit programs; (2) alter the composition of the Federal Reserve's balance sheet in order to impact monetary policy positively; and (3) increase the size of the Federal Reserve's balance sheet by purchasing high-quality securities, notably Treasury securities, agency debt, and agency-backed mortgage-backed securities (MBS). In other words, the Federal Reserve is not conducting "irresponsible monetary policy" in order to influence inflation expectations, as suggested by Paul Krugman.

Fiscal Policy

The other alternative for manipulating people's expectation regarding future inflation and interest rates is fiscal policy. Fiscal policy is directed at government spending and taxation. Government spending by itself wouldn't increase the public's expectations regarding inflation, but deficit spending by the government would.[65]

Deficit spending is defined as the difference between government expenditures and tax revenues. There are three ways to finance government deficits with each resulting in a differing degree of inflation: borrow money from the central bank; borrow money from the public; and raising taxes. Borrowing money from the central bank means that the Federal Reserve will increase the money supply to pay for the government spending. This is the equivalent of printing money and is highly inflationary. For that reason it is generally not done by industrialized nations. Borrowing money from the public is accomplished by the government selling bonds to the public. This borrowing allows for increased spending, which shifts the aggregate demand curve rightward, resulting in an increase in prices and thus inflation. There is no increase in the money supply, but there is an increase in the velocity of money through the equation of exchange and the demand for loanable funds increases, resulting in higher interest rates. This approach of financing government expenditures is not nearly as inflationary as the printing of money. The least inflationary method to pay for government spending is to raise taxes. Raising taxes reduces aggregate expenditures indirectly through consumption spending. Therefore, it is typically not an

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[65] Gauti B. Eggertsson, "Great Expectations and the End of the Depression", Federal Reserve Bank of New York staff report no. 234, December 2005.

appropriate way to pay for spending in weak economic times when the goal is to boost aggregate demand. Therefore, the most effective way of affecting inflation expectations through fiscal policy is for the government to issue debt and have the central bank monetize it.

Expectations and Japan's Liquidity Trap

Data from Japan's recent experience with a "liquidity trap" should provide evidence on whether raising inflation expectations are the way out of a "liquidity trap". Prior to the United States' current financial crisis, Japan experienced years of deflation, near zero interest rates, budget deficits, low output and expanding liquidity, as shown in Figures 39-44.

**Figure 39 Japan's Inflation Rate**
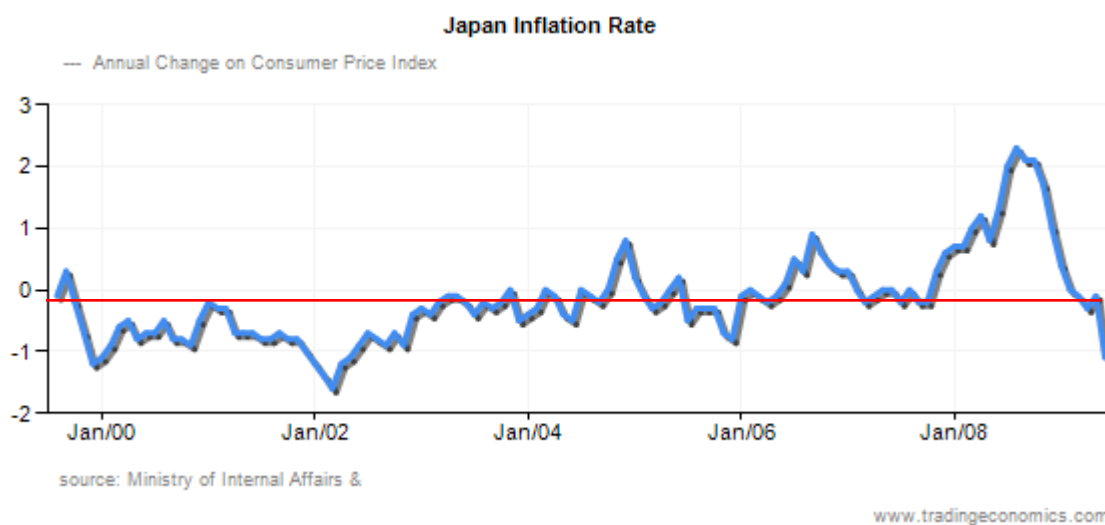
From January of 2000 until October of 2004, Japan's inflation rate was negative. During 2004 and 2005, the inflation rate was positive for only 4 of the 24 months. Japan's inflation rate became positive in May 2006 and remained positive through December 2006. In 2007, the inflation rate was mostly 0 percent or negative until October. It remained positive for the rest of 2007 and through 2008. Then, starting in February 2009, Japan's inflation rate became negative and has remained that way with a year-over-year decline of 0.1 percent, as recorded in April of 2009. It increased to a decline of 1.1percent in May, followed by declines of 1.8 percent and 2.3 percent in June and July, respectfully while recording a year-over-year decline of 2.2 percent for the most recent time frame that data were available, October 2009. This is shown above and reiterated more clearly, in the figure below.

Figure 40 Japan's Recent Inflation Rate
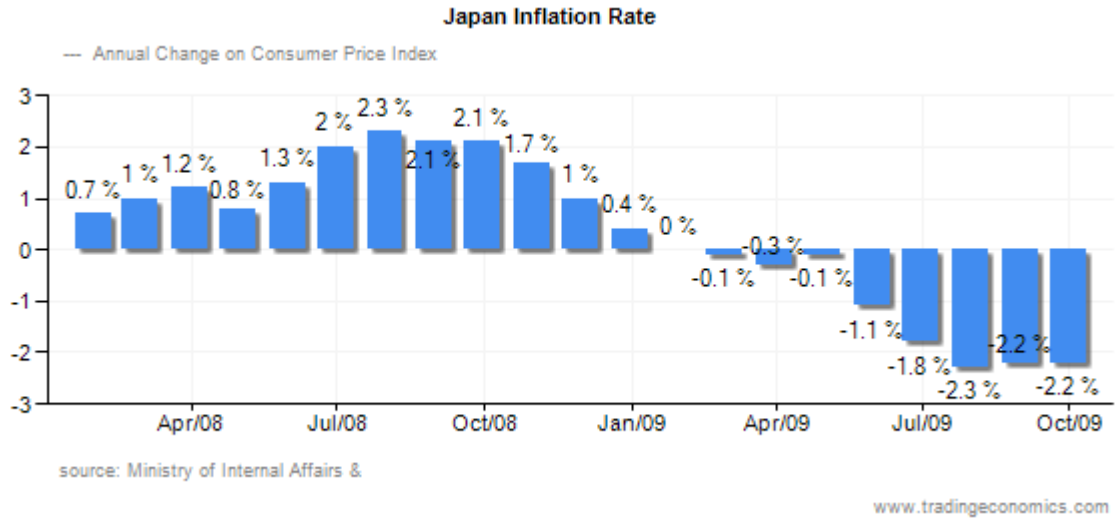

Figure 41 Japan's Interest Rate
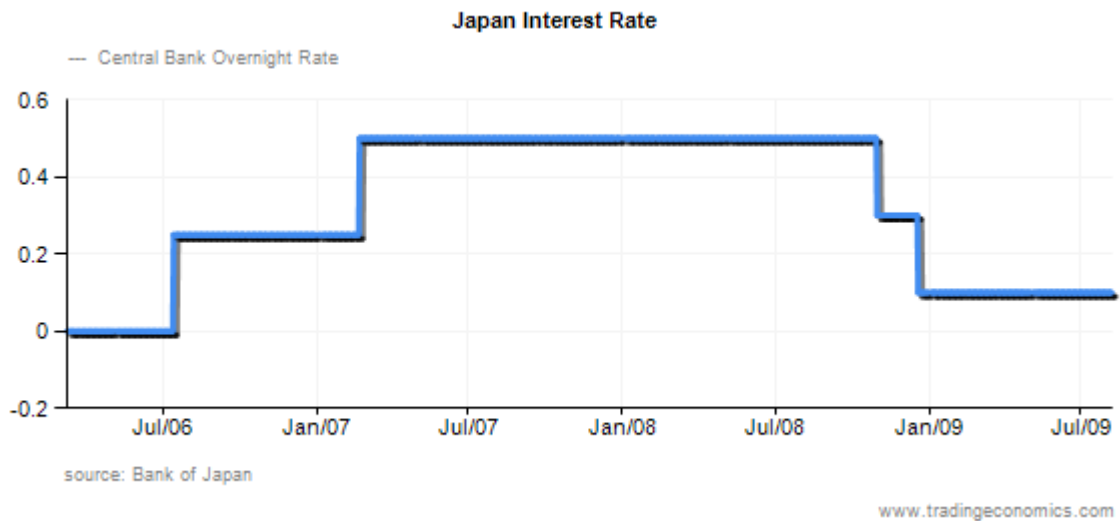
In Japan, decisions on interest rates are made by the Bank of Japan's Policy Board in its Monetary Policy Meetings. The Bank of Japan's official interest rate is the discount rate. Since March of 2006, Japan's interest rate has been between 0 and 0.5 percent. The interest rate has been 0.1 percent from January 2009 through October 2009.

Figure 42 Japan Government Budget
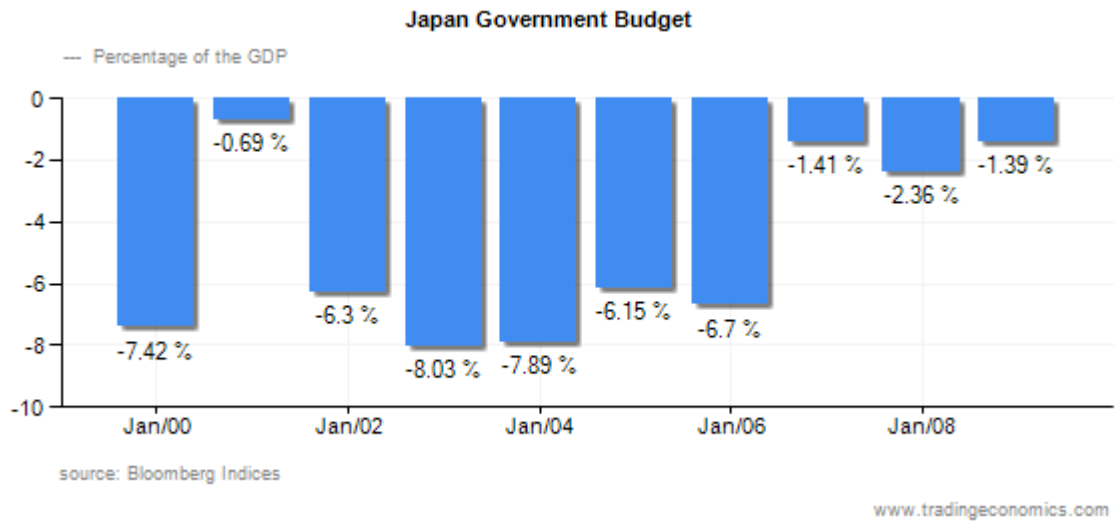
Government budgets are an itemized accounting of the payments received by government (taxes and other fees) and the payments made by government (purchases and transfer payments). A budget deficit occurs when the government spends more money than it takes in. As seen above, the government of Japan has been running a budget deficit for the entire decade. Six of the seven deficits from 2000 through 2006 exceeded six percent of real GDP.
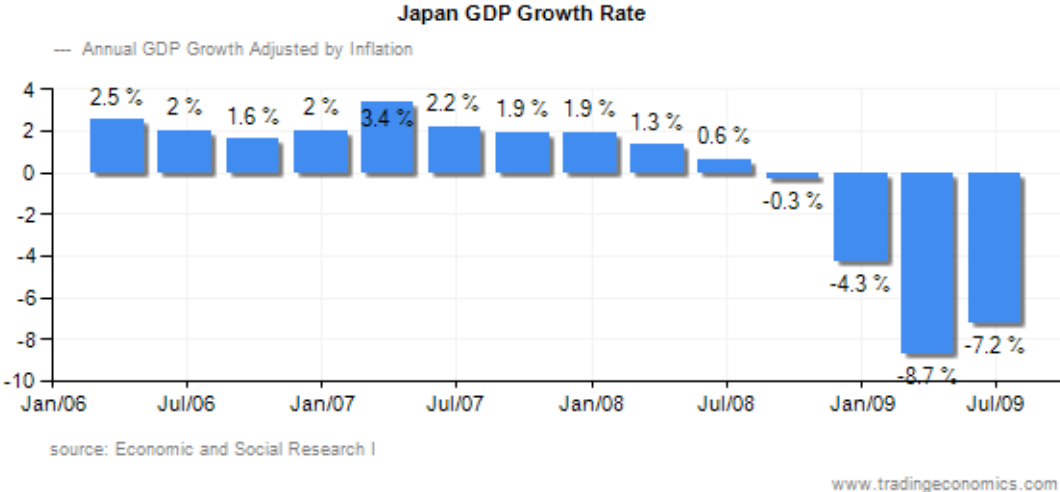
Figure 43 Japan Real GDP Growth Rate

Japan's real GDP growth rate has been very anemic in the last decade. The growth rate started to decline in 2000 and continued declining for almost 2 years before it started to rise in

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2002. It rose for almost 2 years before it started to decline again in 2004. For the next 3 years it rose and fell until it started a continuous decline in 2007 which continues today in 2009. The following graph shows a more detailed performance over the last three and a half years.

Figure 44 Japan's Recent Real Growth Rate

The following table shows the quarterly and yearly average real growth rate of Japan's GDP from March 2000 through June 2009.

Table 13 Japan Real GDP Growth Rate

Year	Mar	Jun	Sep	Dec	Average
2009	-8.70	-7.20			-7.95
2008	1.30	0.60	-0.30	-4.30	-0.68
2007	3.40	2.20	1.90	1.90	2.35
2006	2.50	2.00	1.60	2.00	2.03
2005	1.10	2.00	2.00	2.60	1.93
2004	4.20	3.20	2.90	0.80	2.78
2003	1.30	1.30	1.10	1.90	1.40
2002	-1.90	-0.20	1.50	1.70	0.28
2001	2.00	1.00	-0.30	-1.80	0.23
2000	3.30	2.50	3.00	2.60	2.85

The following graph shows the money growth rates for the European Monetary Union (EMU), United States, United Kingdom and Japan for comparable monetary aggregates year over year. Concentrating on Japan's monetary aggregate, it can be seen that Japan's money supply has not expanded as much as the other countries over the past decade. It hit its low point in 2006 and has since been in a very gradual accelerating trend.[66]

Figure 45 Selected World Domestic Money Aggregates
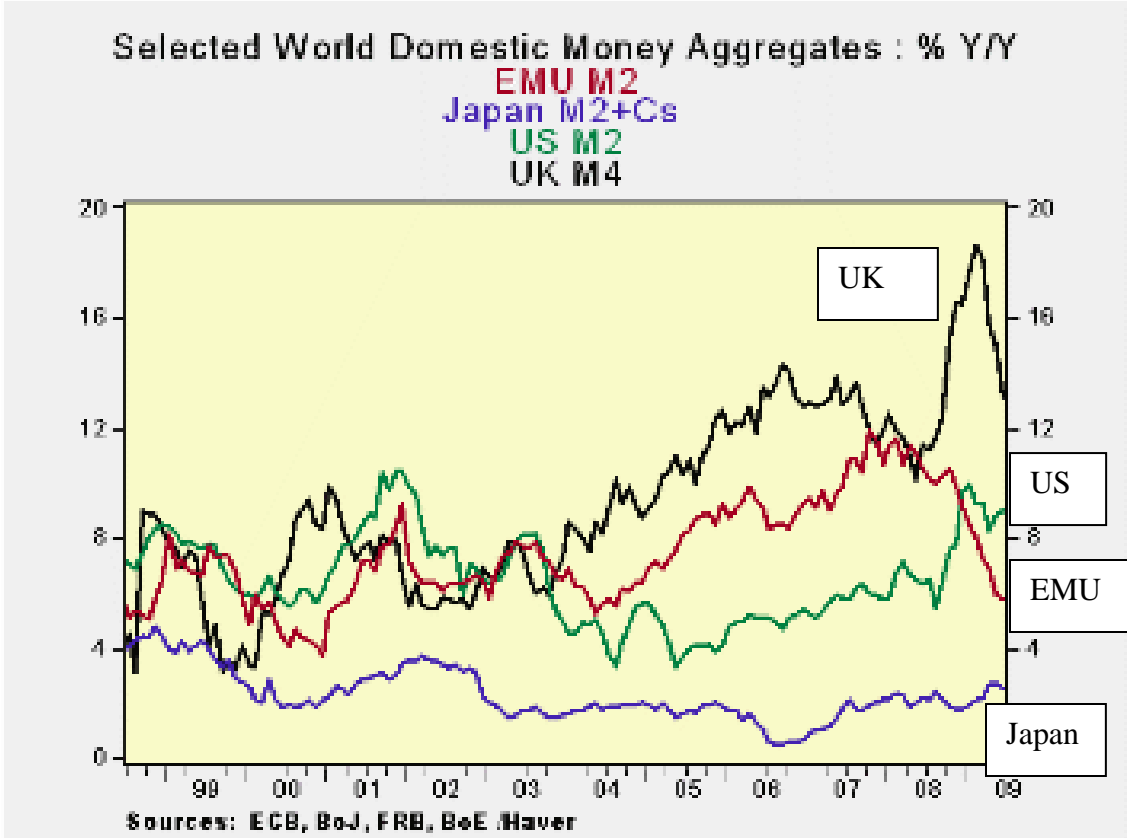
Japan experienced a classical "liquidity trap", with interest rates near or at zero and increasing money supply apparently having no significant effect on increasing prices or output. When near-zero interest rates had no effect, the Bank of Japan adopted a policy of "quantitative easing" by increasing the monetary base to the point that it nearly doubled in size since 2001. With monetary policy being ineffective, the Japanese policymakers attempted to increase demand by higher government spending. The Ministry of Finance ran up large budget deficits to

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[66] Robert Brusca, "Tight Money Isn't Funny: EMU Money Growth Continues to Decelerate" July 27, 2009.

the point that the ratio of gross debt to GDP reached 140 percent of GDP in 2003.[67] This, along with a comparison to other countries, is shown in Figure 46 below.

Figure 46 Gross Debt to GDP, Japan and Other Nations
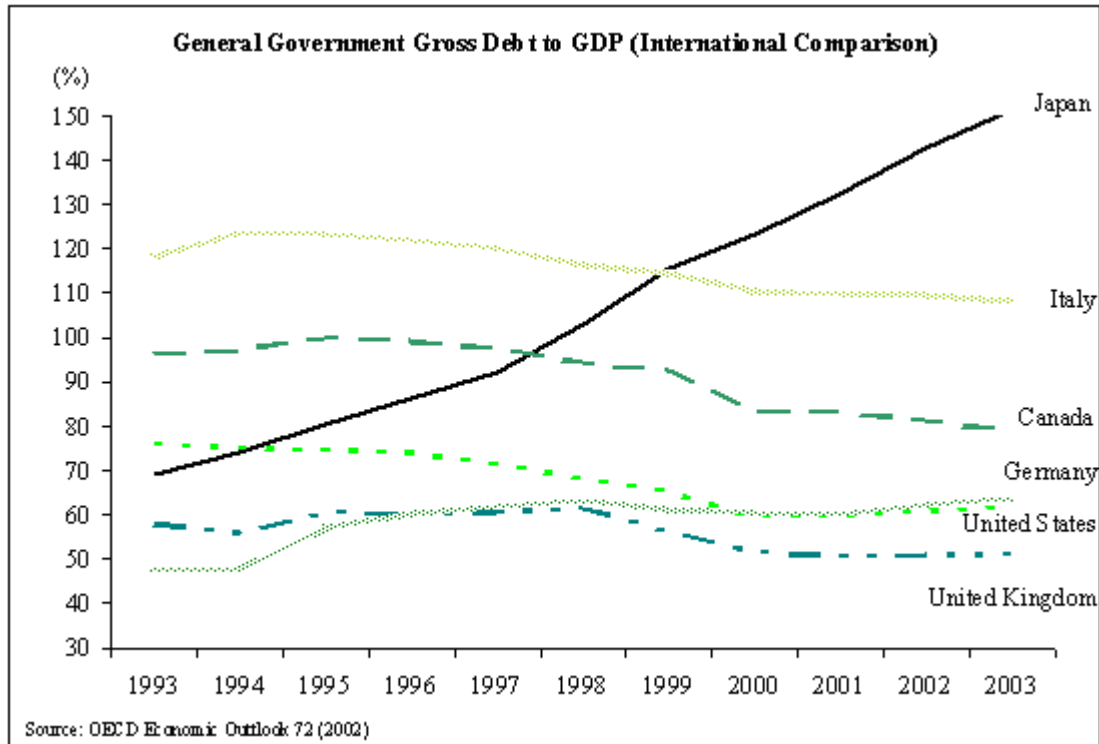
Despite these policy actions, including near-zero interest rates and deficit spending, the Japanese GDP barely moved and showed an increase above 1 percent only for a short period in 2008. Likewise, prices remained deflated except for a short period in 2008, as shown previously by the annual change in the CPI in the Japanese Inflation Rate in Figures 39 and 40. Deficit spending apparently did not work as expected. Deficit spending by Japanese policy makers did not shift the aggregate demand curve outward and thus did not boost output, prices and expected inflation. Why?

Using the modern definition of a "liquidity trap", where monetary policy would work through future expected inflation, one goal of deficit spending was to convince the private sector that there would be inflation in the future. It would therefore reduce ex ante real interest rates

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[67] Gauti B. Eggertsson, "Great Expectations and the End of the Depression", Federal Reserve Bank of New York staff report no. 234, December 2005, p. 32.

and encourage people to spend their money now before prices went up and their purchasing power declined. This, in turn, would shift the aggregate demand curve outward, increase output and prices and finally break Japan loose from the liquidity trap. But this did not happen. The reason, according to Eggertsson, was that Japanese policy makers' actions were not credible and therefore inflation expectations never rose. With low inflation expectations, real interest rates remained relatively high. The Fisher hypothesis, characterized by the equation $i = r + \pi^e$ (where i is the nominal interest rate, r is the real interest rate and π^e is the expected rate of inflation), indicates that nominal interest rates vary directly with the magnitude of expected inflation. Rearranging this equation algebraically, $r = i - \pi^e$, shows that real interest rate = nominal interest rate – expected inflation. Therefore, when expected inflation is negative, i.e. deflation is expected, real interest rates are higher than nominal interest rates. In this case the central bank may be powerless.

According to Eggertsson, deficit spending by Japanese policy makers failed to increase inflation expectations because "policy actions… have not been taken in the context of a clear commitment to inflate the price level … the BoJ (Bank of Japan) has been very reluctant to announce any goals for the price level or inflation."[68] Eggertsson's viewpoint is similar to that of Krugman, who states "In a liquidity trap the problem is that markets believe that the central bank *will* target price stability, given the chance – and hence that any current monetary expansion is merely transitory. The traditional view that monetary policy is ineffective in a "liquidity trap", and that fiscal expansion is the only way out, must therefore be qualified: monetary policy will be effective after all if the central bank can credibly be irresponsible, to seek a higher future price level."[69] The Japanese policy makers did not do this. Nor is the Federal Reserve trying to boost inflation expectations.

The Japanese experience with the "liquidity trap" is insightful. It reinforces the modern view of a "liquidity trap", where aggregate demand depends on both current and expected future real interest rates, as previously shown by the following equation

$$Y_t = E_t Y_{t+1} - \sigma (i_t - E_t \pi_{t+1} - r_t^e)$$

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[68] Ibid.

[69] Paul Krugman, "It's baaack! Japan's slump and the return of the liquidity trap. <u>Brookings Papers on Economic Activity</u> 1998 (2), 137-187.

with the caveat that policy must shape peoples expectations about future inflation in order to be effective.

CHAPTER 7 - Have U.S. Policy Actions Been Effective?

The case has already been made, that the United States is most likely in a "liquidity trap", using the traditional definition that interest rates are near or at zero and monetary policy is ineffective. What about the modern view where monetary policy can work through altering inflation expectations? The case has been made that the Federal Reserve is not conducting "irresponsible monetary policy" and is not trying to manipulate the public's expectations regarding future inflation. However, the Federal Reserve is conducting monetary policy that is attempting to increase liquidity and influence the public's expectations regarding low interest rates (both short term and long term) in order to stimulate the economy. It is doing this, along with changing both the composition and size of the Federal Reserve's balance sheet. Inflation expectations, on the other hand, can also be influenced by fiscal policy. Consequently, U.S. fiscal policy needs to be reviewed to determine if fiscal policy makers are trying to shape peoples expectations about future inflation.

Previously it was stated that deficit spending is one means of accomplishing this feat, as long as the action is credible. In February 2008, as signs of economic slowdown emerged, Congress passed a $168 billion package of tax cuts and tax rebates. As the economy continued to contract, another $789 billion stimulus package incorporated in the American Recovery and Reinvestment Act was signed into law by President Obama in February, 2009. The New York Times reported this as "the most expansive unleashing of the government's fiscal firepower in the face of a recession since World War II." This stimulus package of "targeted investments and tax cuts is designed to get Americans back to work and to get the economy growing again", according to Treasury Secretary Tim Geither. The stimulus package included federal tax cuts, expansion of unemployment benefits, and additional spending on education, health care, energy and infrastructure.

This unprecedented stimulus package, along with declining revenues due to the recession, has pushed the FY 2010 budget deficit to nearly $1.7 trillion, according to the Congressional Budget Office (CBO). The deficit was estimated to be 11.9 percent of GDP, the highest level

since World War II, according to CBO. CBO reported that by 2019, the cost of servicing America's debt will be $450 billion per year.[70]

Has this huge increase in debt influenced inflation expectations? There are different ways of estimating expected inflation. Typical ways are through surveys, models and yield curves. There is the survey of households regarding expected inflation by the University of Michigan and there is the survey of Professional Forecasters. The Federal Reserve uses a large macroeconomic simulation model, known as FRB/US to project inflation. The Federal Reserve also uses measures derived from yields on nominal and inflation-indexed Treasury securities. These different means of measuring expected inflation have the added benefit of determining expected inflation of different sectors of society. The Michigan survey of households reflects what consumers believe about future inflation. Modeling captures the viewpoint of the professional economist and comparing yields capture the market view in which investors back their views with real money, according to Ben Bernanke.[71] The most recent median expected inflation rate of households during the year ahead from FRED is shown in Figure 47 below.

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[70] Ron Scherer "Rebuilding the Economy", The Christian Science Monitor, March 20, 2009.
[71] Ben S. Bernanke, "Inflation Expectations and Inflation Forecasting" Speech at the Monetary Economics Workshop of the National Bureau of Economic Research Summer Institute, Cambridge, Massachusetts, July 10, 2007.

Figure 47 Expected Inflation Rate 1 Year Ahead
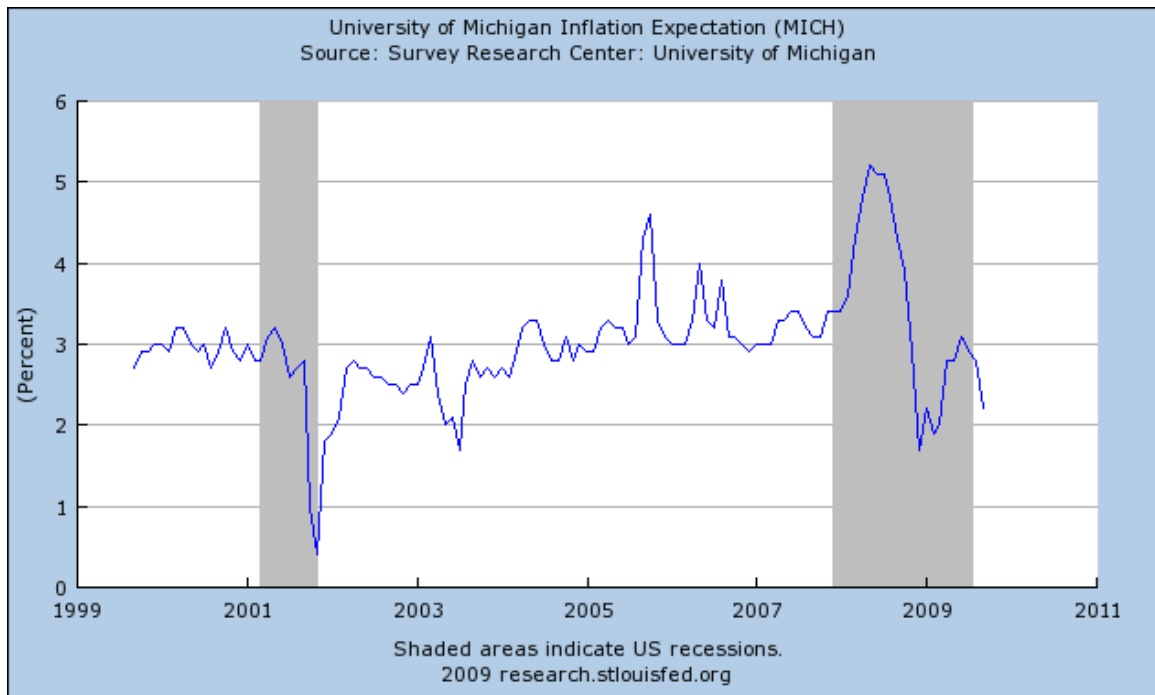
The following figure, with plotted data from the University of Michigan Survey of Consumers, shows the latest median expected annual inflation rate during the next five to ten years.

Figure 48 Expected Inflation Rate 5-10 Years Ahead

Median Expected Annual Inflation Rate During Next Five to Ten Years
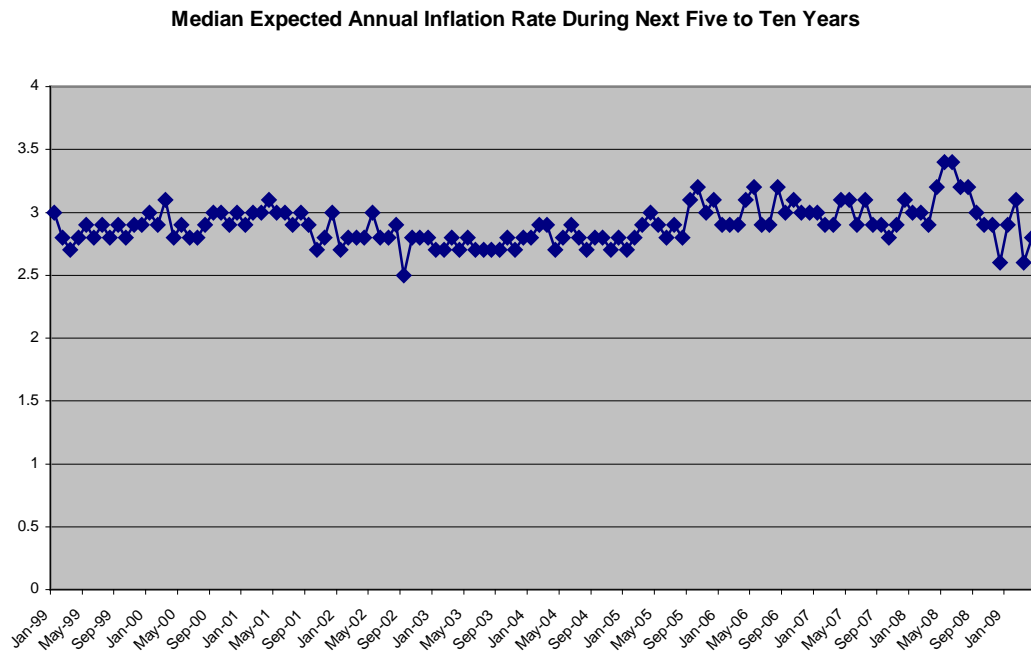
Both figures show how little expected inflation has increased, in spite of huge increases in actual and predicted deficits. Inflation expectations remain relatively low despite the 2009 fiscal year that ended September 30 with a budget deficit of 1.417 trillion dollars. This was 962 billion dollars over FY 2008 budget deficit. Inflation expectations averaged 2.5 percent from January 2009 to September 2009 and are approximately at their average level of the past 10 years.

Different snapshots in time of the nominal Treasury yield curve, from April 24, 2009 through May 22, 2009, are shown in the figure below. It shows an ascending or upward sloping yield curve. The chart indicates that not only do interest rates increase with maturity, but over the time period in question, the yield curve has shifted upward. An increase in forward rates is

typically due to expected future increases in the real interest rate, or expected future increases in inflation.[72]

Figure 49 Nominal Treasury Yield Curves

Source: Federal Reserve Board.

To determine whether expected inflation or expected interest rates are causing the shift in the yield curve, one can look at the information provided by inflation-adjusted treasury securities (TIPS) shown below. The figure shows that there is no increase in the implied forward real interest rates, suggesting that the shift in the curve is being caused by increasing inflation expectations.[73]
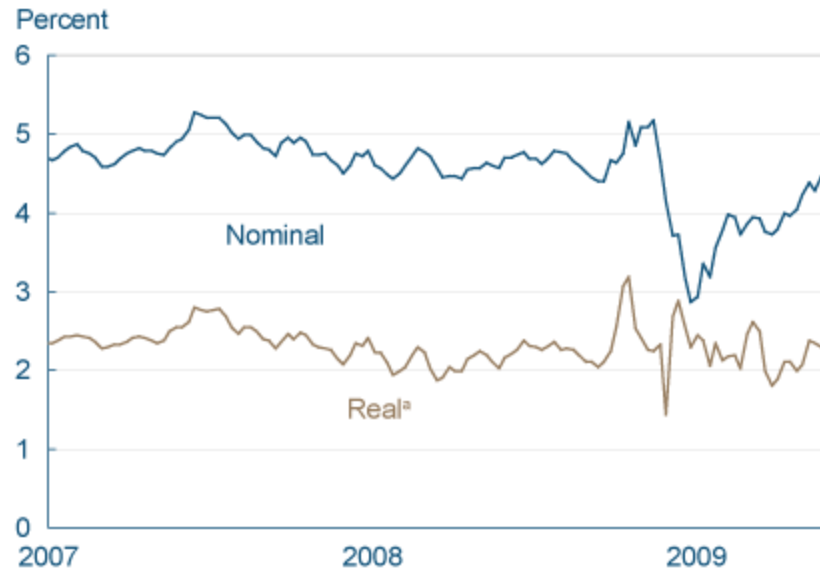
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[72] Charles T. Carlstrom and Kyle Fee, "Inflation Expectations and Monetary Policy", The Federal Reserve Bank of Cleveland, June 9, 2009, p.1.
[73] Ibid., p. 2.

Figure 50 TIPS-Estimated 5-10 Year Forward Interest Rate

TIPS-Estimated 5-10-year Forward Interest Rate

a. Calculated using TIPS data
Source: Federal Reserve Board.

Following the recent huge increase in government debt, it has been shown that there has been an increase, although small, in inflation expectations. Therefore, it would be expected that monetary policy may be effective in reducing ex ante real rates when accompanied by a large increase in expected federal budget deficits.

CHAPTER 8 - Conclusion

It has been shown that there are various meanings to the term "liquidity trap". If the term simply means the Federal Reserve, or any other central bank, is incapable of stimulating the economy out of a period of stagnation, then it has been shown that the United States is most likely in a liquidity trap. However, if it means that the interest elasticity of demand for money, or interest elasticity of bank demand for excess reserves is extremely large (in absolute value), then it has not been shown empirically that the U.S. is in a liquidity trap. Based on the data, the United States is most likely in a "liquidity trap" and it does matter. The economy has not responded to a policy of near-zero interest rates by the Federal Reserve.

No matter which meaning is used, it is implied that monetary policy is ineffective. Applying the modern view of a "liquidity trap", monetary policy will work if there is scope for boosting expectations of future inflation. This expectation of future inflation can be created through irresponsible monetary policy or fiscal policy. It was shown that the Federal Reserve is not conducting irresponsible monetary policy and is not trying to boost the public's expectation of future inflation. Fiscal policy makers are also not trying to influence inflation expectations, but they are conducting enormous deficit spending in an attempt to stimulate the economy. This has created only a slight increase in inflation expectations. Consequently, monetary policy appears to be having little effect as reported by the Federal Reserve. Credit is still tight, businesses are still cutting back on investment and the Federal Reserve expects economic activity to remain weak for a time. As a result, the Federal Reserve stated that it intends to keep the target range for the federal funds rate at 0 to ¼ percent for an extended period.

This brings into question the validity of the modern view of the "liquidity trap", where monetary policy will continue to be effective because of inflation expectations. This has been shown not to be the case. What does show promise in making monetary policy effective is the vast array of new programs the Federal Reserve has created to pump liquidity into the economy. However, even these programs are ineffective unless they are expanded beyond depository institutions. The lesson being, that monetary policy must encompass all financial institutions.

Monetary policy conducted in this manner, in conjunction with a highly stimulative fiscal policy, will most likely eliminate any "liquidity trap" and make monetary policy effective once again.

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