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The Global Credit Crisis Of 2007-2009: An Examination of Some of the Causes, Chronology, and Unconventional Monetary Tools Employed

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THE GLOBAL CREDIT CRISIS OF 2007-2009:
AN EXAMINATION OF SOME OF THE CAUSES, CHRONOLOGY, AND
UNCONVENTIONAL MONETARY TOOLS EMPLOYED

A Thesis

Presented to

The Faculty of Social Sciences

University of Denver

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

by

Mark P. Culver

June, 2010

Advisor: Dr. Tracy Mott

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Title: THE GLOBAL CREDIT CRISIS OF 2007-2009:
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Abstract

This paper will first examine some of the causes over many years and conditions that evolved that preceded the 2007-2009 credit crisis as well as some of the events that took place in the midst of the crisis. More importantly, this paper will examine how central banks applied the generally prescribed first line defense in the form of conventional monetary policy to its full extent without complete or adequate satisfaction or result. The bulk of the paper is directed at a description and analysis of the unconventional monetary tools, that which has come to be called quantitative easing, that central banks may employ in instances where the demand for liquidity and the accompanying panic essentially overrun the liquidity levels normally associated with conventional monetary policy.

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Chapter One: Introduction to Credit Bubbles and Liquidity Traps

This paper will examine how central banks may apply monetary policy in combating an economic crisis originating from the assumption of excessive leverage on behalf of financial intermediaries* that explodes into crisis-level liquidity demand. First, however, it will be important to discuss the nature of the financial services industry in general. I will then proceed to discuss the credit crisis of 2007-2009 and its impact on the financial industry and monetary policy.

The Nature of Financial Intermediaries and Debt versus Equity

In respect to the general nature of the financial industry, it is first important to distinguish between the two types of capital that a financial intermediary will possess. The first type of capital, that is debt, is comprised of customer deposits and for accounting purposes is considered a liability of the financial intermediary as such capital must be returned one day to the depositor. Debt capital for a financial intermediary consists typically of demand deposits (such as checkable deposits and savings accounts), time deposits (such as certificates of deposit), money market mutual funds, and insurance contract cash values. Debt that represents deposits will certainly always be leveraged very heavily, which is a key attribute of a financial intermediary. That is, the ability to create 100 dollars in loans from 3 dollars in deposits for the banking system as a whole,

* It should be noted that throughout this paper terms like “financial intermediaries,” “financial institutions,” “banks,” etc. will be used interchangeably to collectively refer to firms and institutions within the financial services industry.

which obviously implies a 3% reserve requirement. The main reason why financial institutions are unique in this respect is that by their very nature, the interest rate that they will pay out on deposits will ordinarily rise and fall in close conjunction with the rate they receive on loans and other such assets. Therefore, assuming the institution builds its term structure adequately, there usually is not much of a problem in meeting liabilities with maturing assets. In addition, the typically wide spread in the interest rate that such institutions will pay out versus what they can collect certainly allows for a wide margin of error if they fail to get their maturities lined up just right. Because of these unique advantages and the need to inspire great confidence amongst depositors, the deposits of a financial intermediary are typically government insured and heavily regulated.

Therefore, it is not likely this type of capital could be subjected to excessive leverage without violating securities and banking regulations. Therefore, this paper will not be concerned with this type of capital or the leverage associated with it.

The second type of capital that a financial intermediary will possess, that is equity, consists of assets owned by the financial intermediary. The sources of such capital might be retained earnings, shareholder equity, or subordinated and unsubordinated debt of the financial intermediary. Equity is considered an asset of the financial intermediary.

Typically financial intermediaries do not require much in the way of equity to operate. As such, it is common and perfectly acceptable for them to operate under fairly heavy leverage to begin with. For instance, a financial intermediary might normally operate under a 10:1 debt-to-equity ratio, implying fairly heavy debt. Within any other industry, such a ratio would be viewed as excessive and certainly moving towards insolvency. However, because most other industries will use debt to acquire capital

equipment (such as machinery or a factory) or land, leverage will only work to the extent the return on the debt exceeds principal and interest payments, which typically limits debt ratios in more traditional industries to around 2:1.

Because of the unique advantage described earlier of a financial intermediary, leverage on deposits will represent one of the primary sources of revenues and profitability in any financial institution. Again, that unique advantage is a financial intermediary's ability to coordinate the interest rate it pays on deposits (the banks liabilities) with the interest rate they typically receive on loans and other bank assets, which ordinarily rise and fall in conjunction with one another.

Additionally, the spread in the interest rate that banks pay out on deposits versus what they typically charge on loans is typically wide enough to allow for minor to moderate errors in aligning their term structure. However, as will be discussed in greater detail, this unique advantage of financial intermediaries can also be abused. An institution or possibly many institutions simultaneously, may find themselves over leveraged simply due to mistakes in structuring their maturing loans such that capital comes available as needed, or more likely in succumbing to a profit incentive to generate higher profit levels from a relatively fixed equity base. In either case, the problem of over leverage will become apparent when too much lending risk is pursued.

My point in drawing the distinction between these two very different forms of leverage in a financial intermediary is so the reader will understand that leverage built on deposits is not the concern of this paper and will not be reviewed in any capacity. Leverage built on the back of a bank's own equity is at the heart of this paper and the

central theme in instances where a bank, or an entire industry, over-leverages its own equity.

The Events and Chronology of the 2007-2009 Credit Bubble

The following general chronology outlines several instances where failing firms were not allowed to fail as well as a legislative culture more conducive to inadequate regulation. There is not anything particularly unique in my description or analysis of these events. For example, Roger Thompson of the Harvard Business School presented a similar explanation and sequence of events leading up to the credit bubble. (Thompson, 2009) However, and for the most part, these events are presented here from my own recollection and interpretation except where footnoted.

The Long-Term Capital Management L.P. rescue of 1998.

Long Term Capital Management, L.P. (LTCM) was a very large and notable hedge fund that began operations in 1994. By January 1, 1998, the fund had grown to \$4.8 billion in equity capital in only 4 years of operation. The firm was notable because it was managed by highly respected financial industry and academic leaders. The firm was organized and run by John Meriwether who had come out of the fixed income culture at Salomon Brothers. In addition, LTCM counted several math and economics PhD's and two Nobel Prize winners in its brain trust. (Lowenstein, 2000, p. xix)

LTCM employed a highly refined arbitrage strategy that utilized sophisticated computer models developed by its brain trust to exploit market inefficiencies under the presumption that “over time, all markets tend to get more efficient.” (Lowenstein, 2000, p. 12) Often the inefficiencies they pursued were so small that the only way to generate a reasonable profit was to employ very heavy leverage. According to Lowenstein, from the

start LTCM had planned to leverage its capital twenty or thirty times. (Lowenstein, 2000, p. 26) The fact that there were never any practical limitations placed on the firms leverage obviously figured into the explanation as to how LTCM became so leveraged. Apparently, the only limitation was provided by the firms' principals, "From their perspective, the desire to maximize returns (and management fees) on each dollar of invested capital naturally created an incentive to increase leverage." (Report of the President's Working Group on Financial Markets, April, 1999, p. 16) In the four years of its operation, LTCM regularly reported striking returns to its investors: 40% in 1995 and 1996, close to 20% in 1997. (Report of the President's Working Group on Financial Markets, April, 1999, p. 11)

The danger with leverage is that the return on the leveraged assets might fall below the cost of debt for a long enough period of time so as to completely erode away the investor's capital cushion, leaving them insolvent. Unable to meet the terms of the various debt agreements with existing liquidity, the investor is left illiquid. That is, the investor may have to declare bankruptcy as they have been stripped of everything except maybe some otherwise illiquid assets.

For instance, an investor who owns a particular holding long and completely paid for (that is, unleveraged) will have no sense of urgency as to when the investment might appreciate. On the other hand, a leveraged investment will need to appreciate at a rate in excess of the debt service costs, and before the terms of the leverage contract expire (in the case of options-type contracts) or before they run out of capital (in the case of credit-leveraged contracts). This can often create a frustrating paradox in that the investor might be correct in his or her initial assessment of the investment and the underlying

assumptions, but may not survive long enough if the investment goes awry and the investor has an inadequate capital cushion to meet the inevitable capital calls. In other words, just because an inefficient price presents itself today, what's to say it cannot become more inefficient before reverting back to a largely theoretical "efficient" price?

LTCM's problems began when several newly emerging countries began to devalue their currency in the summer of 1998, most notably Thailand followed by Russia. As the value of the debt tied to these devalued currencies dropped immediately and precipitously, capital calls were generated of all who held these contracts. Even though LTCM was not heavily exposed to the debt of these countries, they were heavily exposed to other more liquid securities, specifically long term US Treasury bonds, that came under heavy selling pressure as holders of the emerging country debt started selling whatever they could to meet the capital calls.

By September of 1998, LTCM had leveraged its \$4.8 billion in equity over 25 times into ownership of over \$125 billion in assets. (Report of the President's Working Group on Financial Markets, April, 1999, p. 12) Being heavily leveraged, it didn't take much devaluation of their bond holdings for LTCM to start generating capital calls of their own. In order to raise capital, LTCM tried to unwind its own debt positions. Obviously, trying to liquidate such large positions in an environment where bids were already highly overwhelmed with even more selling only further depressed the market price of the various debt instruments. This unfortunate reality is common when the collateral that secures the leverage for an asset purchase is indeed the asset itself. A death spiral (or concentrated liquidity trap of sorts) will ensue whereby in order to meet the capital call generated by falling asset prices, more and more of that same asset is

forced to liquidation thereby further depressing the asset price and likely generating more capital calls. (Morris & Shin, 2004, p. 2)

In addition, owing to the falling equity account at LTCM, credit arrangements that had been made with LTCM became much more rigid with greater demands for more collateral. Daily mark-to-market valuations by the counter-parties generated additional capital calls further constraining liquidity. (Report of the President's Working Group on Financial Markets, April, 1999, pp. 12-13) Essentially, as loose and free flowing as credit and money had been to LTCM while they were favored by the market when prices were inflating, credit and money became inversely constrained once the market suspected problems at LTCM.

Had the collapse of LTCM been contained to LTCM and maybe a few smaller firms, or possibly spread out amongst numerous firms such that no single firm would have been jeopardized, it's hard to imagine much concern at the Federal Reserve. After all, it's not likely that government regulators would normally really care about a few dozen otherwise wealthy individuals victimized by their own greed. However, LTCM was very integrated through its various creditors and counter-parties, which included over 60,000 trades booked through, among others, Goldman Sachs Group, LP; Salomon Smith Barney; Lehman Brothers Holdings, Inc.; UBS AG; Chase Manhattan Corporation; Merrill Lynch & Co., Inc.; and Bear Stearns & Co., Inc. As LTCM's liquidity evaporated, the Federal Reserve became very concerned that the sudden and massive liquidation of LTCM's positions "would have been disorderly and have adverse market effects on many other market participants." (Report of the President's Working Group on Financial Markets, April, 1999, p. 16)

On September 23, 1998, then New York Fed Chairman William McDonough called an emergency meeting of LTCM and its primary trading counter-parties and creditors. In order to prevent the possibility of market chaos and the potential spillover effect to the broad economy, McDonough convinced a consortium of fourteen firms to put up \$3.6 billion in new equity in exchange for 90 % ownership of LTCM. The original principals of LTCM were allowed to retain 10 % ownership. This quick action did arrest the panic and LTCM was gradually allowed to wind down in an orderly and quiet manner.

The LTCM case serves as an excellent microcosm of the workings and potential problems of excessive leverage. As long as the leveraged positions continue to inflate and remain liquid, tremendous gains can accumulate. Conversely, leveraged positions can quickly generate massive capital calls once the positions begin to deflate. In addition, a liquidity death spiral of sorts, very similar in nature if not in scope to a liquidity trap, is illustrated. In the context of this paper, LTCM might be viewed as a credit bubble that was contained to LTCM while the bubble was inflating and through the efforts of the NYFRB to coordinate the various creditors and counter-parties involved, was successfully absorbed and contained to LTCM and a few of its trading partners when the bubble collapsed.

Long Term Capital Management L.P. – symptomatic of a financial system with insufficient regard for risk assessment and moral hazard.

The two questions at hand in respect to LTCM's contribution to the 2008 credit bubble are: 1) did the NYFRB's effort to rescue LTCM help to condition investors and markets for more excessive risk and leverage and thereby contribute to the 2007-2009

credit bubble, and 2) did regulators fail to recognize the systemic risk that LTCM had created as it continued to aggressively leverage its expanding capital base?

Two observations from Haubrich's essay address the first question. (Haubrich, April 2007, p. 4) The first observation is that the coordination effort of the NYFRB may have produced a government sponsored (or at least brokered) arrangement that effectively crowded out "a very credible and secure" private investor in Warren Buffett. Buffet's bid for LTCM would have left the original principals with no stake in the reorganized firm, whereas the NYFRB brokered deal allowed the principals to retain a 10% stake. Certainly, in comparison to the wealth they had amassed in the LTCM buildup, a 10% stake may seem adequately pecuniary. However, that the principals were allowed to walk away with any capital at all would certainly have to be viewed as an affront to the principal of moral hazard and the right to go bankrupt.

Further support that the LTCM rescue contributed to an attitude of more risk taking and moral hazard comes from Papadimitriou and Wray in their description of "the Greenspan put." Among several components of the Greenspan put they describe is that the LTCM rescue "tipped the balance of sentiments from fear toward greed", they describe "a belief that the Fed would not allow bad things to happen, with evidence drawn from the arranged LTCM rescue." (Papdimitriou, 2008, p. xxiv) Another component of the Greenspan put were low interest rates in the wake of the dot.com bust and the 9-11 terrorist attacks, which will be addressed shortly.

The second and more significant observation of Haubrich was a statement by then Fed Chairman Alan Greenspan in Congressional testimony; "As far as I'm concerned, talking about institutions or such, I say nothing is too-big-to-fail. (However), there is an

issue here of too-big-to-liquidate-quickly.” (Haubrich, April 2007, p. 6) LTCM was never liquidated; rather its assets were assumed by a consortium of much larger institutions that were in a better position to hold the distressed assets until the markets stabilized. Greenspan’s statement could certainly be interpreted as recognition that given adequate capital and a favorable environment, there could be circumstances that would justify calling on a larger institution to absorb a firm with problematic assets that rise to the systemic level. Perhaps in circumstances where the underlying problem is temporarily panicked markets characterized by overwhelming selling of otherwise sound assets with intrinsic value, an institution such as the US Government might be justified in bringing to bear its virtually unlimited balance sheet and liquidity until such time as markets return to a more rational state.

The second question of whether regulators failed to accurately assess the systemic risk that LTCM created seems fairly apparent. At the time, regulators were really only concerned with investor protection from unscrupulous practices of financial intermediaries, which is addressed in the Securities Act of 1933 and the Investment Company Act of 1940 and their various revisions. In fact, at the time, even the Glass-Steagall Act of 1933 was still in effect. In respect to the regulation of financial intermediaries, Glass-Steagall was substantial in that it prevented financial firms from operating outside their respective and fairly narrowly defined industries. For example, commercial banks were prohibited from underwriting and selling insurance products or from underwriting and selling investment securities. Similarly, investment banks were prohibited from taking demand deposits and underwriting loans, and so on.

The Glass-Steagall Act made the whole issue of too-big-to-fail a much more remote possibility for two reasons. First, although firms could certainly grow and consolidate their specific industry, they obviously could not expand beyond that industry and consolidate additional functions. Essentially, firms were limited by the size of their specific industry of commercial banking, investment banking, or insurance.

Secondly, by limiting firms to a single specific and defined industry, the Glass-Steagall Act made regulation considerably more manageable as regulators could more easily focus on a single industry and the traits and nuances of that single industry. Prior to the repeal of the Glass-Steagall Act, the SEC and the NASD (National Association of Securities Dealers, an SRO) were very effective in regulating the investment banking industry and securities dealers. State insurance commissions effectively regulated insurance companies. State banking examiners and the Federal Reserve regulated the commercial banking industry. Each regulatory authority had very clear responsibilities and was reasonably familiar with their respective industry. In addition, there was no confusion over jurisdiction. Prior to its repeal in 1999, the Glass-Steagall Act did help prevent any single institution from rising to the level that they might pose a systemic risk. So it is understandable that regulators were not overly concerned about the impact to the economy or the financial system in general from the failure of any single institution.

In respect to hedge funds, which were open only to wealthy investors who were presumably sophisticated enough to assess the risk they were assuming and could bear such risk, these funds were largely unregulated at all. Nobody was really concerned about the systemic risk that hedge funds might possess. However, the swiftness of the NYFRB's recognition of the problems at LTCM and its efforts to arrest the problems,

which was largely outside of the institution's normal scope of responsibility and authority, is very admirable. It is hard to see how regulators failed in their stated responsibilities in respect to LTCM. However, given the magnitude of what could have happened without McDonough's leadership, it is discouraging that Congress never acted to at least regulate the systemic threat of hedge funds. In fact, only today - 11 years, 2 recessions, and a massive credit bubble later - is Congress finally contemplating the regulation of hedge funds and the deeper problem of systemic risk endemic to the financial industry.

Therefore, I would conclude that the failure of Congress to regulate the systemic risk posed by hedge funds in the aftermath of LTCM did greatly contribute to a culture that perhaps turned a blind eye to excessive leverage and greater moral hazard. In addition, a possibly tacit acceptance of the to-big-to-liquidate-quickly principal did contribute to a culture of greater leverage, higher returns and risk, and greater moral hazard. All of which certainly contributed to the credit buildup that (hopefully) climaxed in 2008.

That is certainly not to say or suggest that LTCM and the regulatory response or lack thereof single-handedly created the sub-prime credit crisis. While the LTCM episode and the regulatory response arguably contributed to the problem of irresponsible debt levels and inadequate regulation, it seems it is more symptomatic of a culture that has evolved in which risk will be rewarded, but failure is not if the institution is big enough. After all, the Savings and Loan crisis of the late 1980's was eerily similar in many respects to the banking and international credit crisis of 2007-2009 and obviously preceded even LTCM.

Deregulation of financial intermediaries and mortgage securitization.

The general regulatory environment in the US since the early 1980's has been towards a more relaxed environment across numerous industries; including airlines, telecommunications, utilities, and certainly financial services. The generally accepted theory being an attitude biased towards laissez-faire would lower production costs and therefore allow for more competitive and innovative products at lower costs to consumers. Where regulation was necessary to protect the consumer, as in the financial services industry, it seems the government was swinging more to favor self-regulation where possible and practical.

Riegle-Neal Interstate Banking and Branching Act of 1994.

The first piece of legislation aimed at deregulating the financial services industry in the run-up to the international credit crisis was the Riegle-Neal Interstate Banking and Branching Act of 1994. This act repealed the prohibition on interstate banking established under the Bank Holding Act of 1956. In the wake of that act, commercial banks began a frenzy of interstate mergers and acquisitions. Prior to passage of the Act, commercial banks were consolidating at a fairly stable rate of 3.51% per year with average total assets expanding by 6.74%. With passage of interstate banking, commercial banks were able to consolidate more aggressively (4.36% average consolidation from 1993-1998) and average total assets expanded at a rate of 12.51% (see Appendix A).

With banking deregulation, new innovations were quickly introduced as well, such as; branch banking, networked ATM's, and the securitization (or pooling) of loans, in particular mortgages. The Act was clearly successful at enabling commercial banks to

expand across state lines, many times absorbing smaller and long entrenched institutions. With this major expansion, truly mega-banking institutions began to emerge, including Bank of America, Wells Fargo & Co., Citibank, and Chase Manhattan Corp. Too, as the Act had intended, more competitive services were able to be delivered to more customers in virtually every region of the country.

Gramm-Leach-Bliley Act of 1999.

The second piece of legislation aimed at deregulation of the financial services industry during this era was the Gramm-Leach-Bliley Act of 1999 (GLBA), also known as the Financial Modernization Act of 1999. The key sponsor of the bill Senator Gramm stated the purpose of the legislation was “to expand both the volume and the quality of financial services and produce lower prices for the American consumer.” (Gramm, Opening Statement at August 3, 1999 Meeting of Conference on S. 900, 1999) By far, the most sweeping reform of GLBA was the repeal of sections 20 and 32 of the Glass-Steagall Act, which had prohibited commercial banks, investment banks, and insurance companies from operating outside of their respective industry. The intent was to create even more competition amongst financial institutions and more economies of large scale to ultimately “provide lower prices and one-stop shopping at financial supermarkets in every city and town in the country.” (Gramm, 1999) Perhaps the model for this new era in the post-GLBA period can be seen in the mega-merger of Citibank, Travelers Corporation, and Solomon Smith Barney in 1998 (actually prior to GLBA passage – but that’s another story). Just as Riegle-Neal had allowed commercial banks to consolidate across state lines, GLBA allowed even further consolidation across the various financial industries.

It seems fairly safe to say that these two Acts did successfully and dramatically expand banking services and banking innovation. Just as the “deregulation era” brought new innovations to telecommunications, airlines, utilities, and other industries; the financial services industry was no exception. Money market mutual funds, brokered CD’s, bank branded credit cards, and securitized mortgages allowed investors to achieve higher rates of return and more liquidity while at the same time creating vastly expanded access to markets and greater diversification.

The financial innovation of securitization.

One innovation in particular that needs to further examination in the context of the 2008–2009 credit crisis is the rise of securitized mortgages, and particularly securitized pools of subprime loans. The traditional model for securing a home loan was a fairly simple and bilateral contract. Typically, a borrower had to make a down payment of 10 – 20% of the purchase price, which certainly served as a reasonable deterrent to foreclosure if things got rough and also attractive collateral to the lender. Fixed rate mortgages were by far the most common loan, so the borrower was conditioned each month to the same payment. Finally, and probably most important, each loan was typically underwritten locally by a loan officer who was intimately familiar with the risk of the loan. After the loan was closed, the bank would typically sell the note to Fannie Mae or Freddie Mac, or perhaps a pool of private investors, thereby releasing the loan from the bank’s capital requirements. In the event the loan was sold to Fannie Mae or Freddie Mac, which was the case with the vast majority of loans, it was transferred to the virtually unlimited balance sheet of the quasi-government agencies. Fannie Mae and Freddie Mac were happy to buy the loans because their costs of capital are legislatively

held below market rates thereby assuring a higher return than what the bank could have achieved, but also because they were reasonably secure that the loans had been underwritten to Fannie Mae's and Freddie Mac's standards through a fairly exhaustive procedure by personal bankers.

As banks grew into monoliths, that traditional model became more and more inefficient and unworkable. First, the banks themselves in their expansion had either acquired or crowded out virtually every small to mid size institution that had the personal relationships with their depositors, who after all were ultimately the borrowers as well. Second, in order to achieve the efficiencies necessary to drive down their loan origination costs, the mega-banks had to adopt more streamlined and quantitative methods for determining creditworthiness. This led to the expanded use of FICO scores and Loan to Value (LTV) ratios as really the only considerations in the loan process. Once loans could be "categorized" into pools of similar loans, investors could easily acquire a highly diversified interest in a pool of loans that fit their personal risk criteria. These pools were called things like Asset Backed Securities, Collateralized Debt Obligations, and Mortgage Backed Securities.

At this point, it would seem that the deregulation process had worked out rather well. More capital had been brought to bear from individual and institutional investors through the securitization process, which had the effect of making more capital available from both banks and Fannie Mae/Freddie Mac and ultimately drove interest rates lower. However, insofar as capitalism and innovation will always move ahead faster than regulators can keep up, the great securitization wave was able to forge ahead largely unregulated. In order to feed the voracious appetite for more loans created by the new

liquidity, both from the innovation of loan securitization but also from likely artificially low interest rates (to be examined shortly), the financial services industry was able to expand the securitization process very aggressively into progressively more risky loan pools. Thus began the sub-prime craze in 2004-2006.

In their competitive fury, financial institutions began writing loans with more and more reckless underwriting standards. Loans without any income verification became common. Under the assumption that US real estate never lost value, 100% LTV loans and 125% cash out refinance loans became common. Finally, the so-called “teaser-rate” loans emerged. These loans clearly were intended only to get a loan written (and generate a commission for the originator of the loan) without any consideration for the borrower’s ability to make the payments. Frequently, the loan originator would keep initial payments low by amortizing a part of the principal back into the loan each month, thus creating a growing loan balance each month. As everyone (except the borrower) knew, these loans would be immediately bundled up into a subprime pool and sold to someone else. By the time the loans would begin to default, the loan originator and the original lender would be long gone. As one can see, there was no risk to those originating the loans. The risk was all passed on up the chain to an anonymous investment pool. Nouriel Roubini referred to this process as the “Originate to Distribute Model.” (Roubini, 2008) In fact, trading desks I worked with many years ago executing principal transactions would caustically refer to this type of recklessness as the “Bigger Sucker Theory.” You really didn’t care what price you paid for an asset as long as you knew there was someone else willing to pay more. Thus is the nature of every bubble – value becomes irrelevant.

The downside of all of the massive consolidation and innovation is now fairly obvious. First of all, as many firms consolidated into a few massive and concentrated institutions, the systemic risk to the entire financial system expanded exponentially from the potential failure of any single “mega-bank.” Second, regulators will always be at a distinct disadvantage in keeping their regulatory authority both current and effective in a period of rapid innovation and growing complexity. Finally, because asset securitization could create and readily distribute massive amounts of loan liquidity, the ill-conceived sub-prime wave was allowed to expand much faster than what anyone realized or could have been expected reasonably to regulate.

Unusually low interest rates in a recovery from 2002–2006.

The US economy was in an expansion that had begun in the fourth quarter of 2001 following a relatively shallow but extended 15 month recession. The conventional monetary prescription for dealing with an economic contraction through monetary easing had worked in textbook fashion (see Illustration 1 below). During that recessionary period, the Federal Reserve under Chairman Alan Greenspan aggressively cut the fed funds target rate from 6.5% in June, 2000 to 1.0% by March, 2003 to create monetary stimulus.

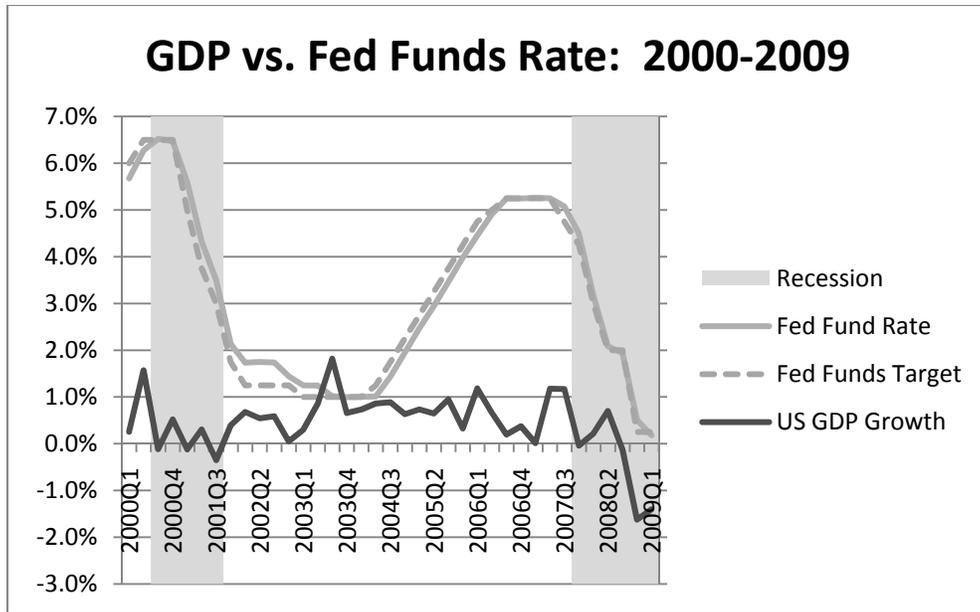


Figure 1 (US Bureau of Economic Analysis, Q1 2000 - Q1 2009)

By the fourth quarter of 2001, real GDP had started to expand and by the first quarter of 2002, it seemed on path for economic recovery as evidenced by two consecutive quarters of positive annualized GDP, 1.56% and 2.72% respectively. However, for reasons to be examined shortly, the Federal Reserve continued to hold the fed funds target rate at an unusually low level relative to economic output. It was not until the fourth quarter of 2004, nearly 3 years later, that the Federal Reserve commenced an aggressive campaign to raise the fed funds target. For reference, the average lag from the decided end of the prior six recessions (going back to 1956-57) until monetary tightening resumed has been 3.7 quarters (see Figure 2).

Recession Period	Lag to Monetary Tightening
1956-1957	1 quarter
1959-1960	3 quarters
1969-1971	1 quarter
1973-1975	4 quarters
1980-1982	2 quarters
1990-1991	11 quarters
2000-2001	11 quarters

Figure 2 (US Bureau of Economic Analysis, 1948 - 2001) (Federal Reserve Bank, 1948 - 2001)

The first question that needs to be addressed from this observation is a possible explanation for why the Federal Reserve felt compelled to maintain such an accommodative monetary policy for so long. The second and obviously more relevant question would be to determine whether the Fed's accommodative policy during that period contributed to the credit bubble in question.

Addressing the first question will necessarily require a good deal of speculation as FOMC meetings are closed to the public. However, a review of the relevant FOMC comments (March 19, 2002 – May 4, 2004) and accompanying minutes offer some explanation. Throughout the period in question, the Federal Reserve displayed only a token concern for price inflation with statements to the effect, “increases in core consumer prices are muted and expected to remain low.” (Federal Reserve Bank, 2002-2004)

At the same time, however, energy prices were beginning to trend higher. West Texas Intermediate Crude traded for \$19.33/bbl at the end of 2001, \$29.42/bbl at the end of 2002, \$32.15 at the end of 2003, and \$43.33 by the end of 2004. Ordinarily, being a component of the Consumer Price Index (CPI), higher energy prices would be viewed as

inflationary. Until recently, this appeared to be the view of the Federal Reserve as well as their policy for combating higher energy prices as evidenced by the observation that each oil shock back to 1971 was accompanied by higher fed funds rates. (Carlstrom, April 2005, p. 2)

However, because energy is also a staple of every developed economy, perhaps the Federal Reserve in 2002 chose to view rising energy prices as an alternative monetary instrument. This is certainly the view supported by the FOMC statement, “the hesitancy of economic expansion appears to owe importantly to oil price premiums.” (FOMC, March 18, 2003) During a period when energy prices were generally trending higher, the Federal Reserve elected to hold the fed funds target constant, perhaps to offset perceived constrictive monetary effects from higher energy prices. This monetary reaction would have been consistent with a study compiled by Bernanke, Gertler, and Watson where they concluded that “a non-responsive monetary policy suffices to eliminate most of the (negative) output effect of an oil price shock, particularly in the first 8-10 months.” (Bernanke, Gertler, & Watson, May 1997, p. 27)

In my opinion, the general flaw of using energy prices as a proxy for monetary policy is that energy use per capita is relatively inelastic. That is, most people's real consumption of energy is more or less static in a given period. In comparison, debt levels are extremely elastic given the prevailing interest rate. My sense is that, while using rising energy prices to moderate consumption might work reasonably well, it seems a weak argument that the same policy could effectively moderate or stimulate general investment and credit levels.

A second possibility exists as to why the Federal Reserve was so lagged in their conventional monetary response. The possibility exists that the Federal Reserve misinterpreted, either deliberately or through an oversight, the real inflation rate over the period by failing to fully consider rapidly escalating housing costs. Gjerstad and Smith discuss this possibility and the Bureau of Labor's tendency to understate real inflation by only considering the rental equivalent value of residential real estate in the housing element of the CPI. As rents were largely held in check by marginal increases in personal income, the underlying property values and accompanying ownership costs were allowed to escalate at rates far in excess of the stated inflation rate. Gjerstad and Smith estimate that the CPI was understated by 2.9 percentage points in 2004 alone, or 6.2% versus the stated CPI of 3.3%. Further, they estimate that over the period of 1999–2006, home ownership costs increased 151% while CPI over the same period increased a very modest 23%. (Gjerstad, 2009) I would submit that had the Federal Reserve given accurate consideration to the real inflation rate, surely they would have recognized inflation of 6.2% as well outside of any acceptable target and commenced conventional monetary tightening much earlier.

Turning to the second question, that being whether or not unusually low interest rates during the period in question (2002–2004) contributed to the credit bubble, the empirical evidence seems fairly convincing. During the period in question, home ownership in the US rose dramatically from a long term average and historically very stable rate of 64.7% through 2002 to a high of 69.0% in 2005 and 2006. Put in absolute terms, this surge in home building created an additional 4,672,000 homes based on US

census data of the size of the average American household (US Census Bureau, 1965-2006).

Through the ingenuity of the financial services industry and the competitive pressure of the market place, numerous financial institutions were either forced or incited otherwise to create very innovative mortgage structures to capitalize on the large spread described above between the nominal interest rate and the real inflation rate and write mortgages for 4,672,000 (more or less) households who arguably could not have qualified previously. Such vehicles as sub-prime mortgages, zero-down mortgages, no income verification loans, and 125% loan-to-value mortgages were created to provide affordable loans, affordable in the short term at least. The broad but erroneous assumption was that US home prices would always appreciate, therefore there would never be a problem repossessing the collateral if the over-leveraged homeowner fell behind in their payments.

Insofar as virtually all of these creative loans carried variable rates tied to some highly correlated variation of the fed funds rate (either through LIBOR, Prime Rate, or some other mechanism), it was obviously only a matter of time before mortgage payments would begin to escalate. Once the Federal Reserve finally did commence raising the fed funds target in late 2004, the trouble began almost immediately. Very similar in nature to the credit squeeze that wiped out LTCM, the mortgage defaults and related home sales started to peak above average in 2006 and really began to accelerate into 2007.

Home prices did not hold up as the lenders had expected. In certain of the more inflated markets (California, Phoenix, Las Vegas, and Florida), home values fell as much

as 50% or more. Nationally, home prices fell on average 31% from June, 2006 to April, 2009 (McGraw-Hill Companies, 2009). One could very effectively argue that the size of the bubble created could be calculated simply by multiplying 4,672,000 (presumably) bad mortgages by the average home price of roughly \$225,000 for a credit bubble in excess of \$1 trillion.

It is important at this point not to be too critical of the Fed for holding short term interest rates artificially low. The popular description at the time in the aftermath of the dot.com bubble and 9/11 terrorist attacks was that the Fed was engineering a soft landing. Arguably, had the Fed not held interest rates low at this time, it is pretty likely the recession of 2001-2002 would have resumed as the budding recovery was still rather tenuous and uncertain. Consequently, I believe that the Fed was faced with a “pick your poison” dilemma. Had they allowed interest rates to begin rising much earlier in the cycle, surely the housing bubble and sub-prime credit crisis could have been averted. However, unemployment would have certainly risen to some unacceptable level which, in the end, is really one of only two primary responsibilities of the Federal Reserve, the other being guarding against inflation. At the end of the day, recognizing that nobody has a crystal ball, I believe the Federal Reserve opted to defend against a sure and immediate opponent of rising unemployment had they promoted higher interest rates, rather than possibly a ghost opponent several years in the future from a credit expansion on the back of low interest rates.

Theoretical Explanations for the Credit Crisis

Theoretical support for the international credit crisis can be found in several of the business cycle theories. Schumpeter described the growth wave of the business cycle

where credit and financial innovation will be necessary to provide the financial resources for the new innovations to productivity of the cycle. However, he also emphasized the need for banks to supply credit only to those who are creditworthy warning that “the failure of bankers to exercise that ability accounts for most of the events which the majority of observers would call catastrophes.” (Leathers, 2004, p. 671)

Obviously, banks were very creative with the financial innovations they came up with to expand home ownership, but also extremely negligent in their failure to determine the creditworthiness of their borrowers. This failure, according to Schumpeter, had to result in “the creation of easy credit that drives speculative forces of the economy with each loan tending to induce another and each rise in prices inducing another rise. Great speculative manias develop in the financial markets, such as occurred in 1928-29.” (Leathers, 2004, p. 672)

Minsky described alternative phases of the business cycle with the Financial Instability Hypothesis. Center to the theory was that, contrary to the central theme of neoclassical theory, a capitalist economy cannot settle at some equilibrium of prices, wages, and full employment. Rather, certain “destabilizing forces” will exert themselves to prevent equilibrium. For instance, full employment will necessarily create an upward force on wages and prices. Conversely, policies seeking to maintain stable wages or prices will exert pressure on investment returns and profitability and force unemployment to move higher. (Minsky, 2008, pp. 11, 280)

In addition, like Schumpeter, Minsky advanced different phases of the business cycle consistent with the various stages of instability. He described the “hedge phase,” the “speculative phase,” and the “Ponzi phase.” During the hedge phase, economic units

(defined as individuals or firms) finance their entire debt service obligations from current income. As the destabilizing forces assert themselves, demand for investment begins to accelerate and economic units assume more debt. It would seem that partially because investment returns will begin to marginalize at this point and partially because borrowers become more leveraged, more creative or innovative financial tools will emerge. Minsky describes this phase as the speculative phase of the business cycle where economic units have to roll over debt in order to finance existing obligations, essentially selling new debt to retire old debt or effectively modifying debt provisions. These two phases would be considered periods of stability or “relative tranquility,” which would be the closest thing to equilibrium that Minsky allowed for. (Minsky, 2008, pp. 230-238)

It would seem that the period of 2002–2004 where the Federal Reserve continued to hold the fed funds rate artificially low would constitute a speculative phase. Although debt levels at this point were generally at a sustainable level, it was arguably only through very high level financial innovation at the Federal Reserve that this was made possible, as suggested previously by understating the real inflation rate.

It is during the Ponzi phase that investment bubbles are created. In both Minsky’s description and relevant to the international credit crisis theme of this paper, economic units either become so overly-optimistic about the prospects for future returns on investment or so completely over-committed that they engage incrementally more and more debt to the point that the debt service can only be met with the issuance of more debt. Financial innovation will take on ever more creative and very likely complex forms. (Minsky, 2008, p. 231)

Minsky's Ponzi phase is very reminiscent of the credit bubble in its late phase in 2007-2008. As described above, practically every reasonable mean for debt issuance had been abandoned in order to feed an exponentially expanding monster in the US housing market. As referenced above, the surge in home building and home ownership shortly thereafter followed by the inevitable wave of foreclosures is good evidence that many of the aggressive mortgages issued over this period were "Ponzi" in nature.

Unfortunately, the credit bubble was hardly contained to individual homeowners. Numerous institutions were simultaneously caught up in Ponzi-type debt finance. At the heart of virtually every collapse of a financial institution in 2008 was reckless debt finance, that is, excessive leverage. Both Lehman Brothers Holdings, Inc. (Lehman Brothers Holdings, Inc., 2/29/2008) and Merrill Lynch & Co., Inc. (Merrill Lynch & Co., Inc., 12/31/2007) had leveraged their asset capital 32:1 before they collapsed. Bear Stearns Companies, Inc. was leveraged 34:1 prior to their failure. (Bear Stearns & Co., Inc., 2/29/2008) In order to compete for investment capital and to satisfy shareholder demands for returns, as well as meet prior debt service demands, virtually every firm of a financial nature was forced to engage in Ponzi-type finance by securing more and more debt with the same collateral, that being their own relatively static equity.

In conclusion, it is fairly apparent that numerous events were put in play over a period of at least 25 years that created an environment ripe for the major credit crisis of 2007-2009. Although I only mentioned the Savings and Loan crisis briefly, that whole episode would certainly have to be characterized as an exercise in "too-big-to-fail." The engineered rescue of the counterparties of LTCM serves as further evidence of the

Federal Reserve's reluctant acceptance that certain institutions simply cannot be allowed to fail.

Simultaneously, the broad trend towards deregulation sparked a rapid consolidation of financial institutions. That is, during an era where firms were growing and consolidating into financial behemoths anyway, the Federal Reserve, at least through their actions if not their official statements, had unwittingly adopted an acceptance of the too-big-to-fail principal for certain very large and very integrated firms.

Finally, the Federal Reserve did hold nominal short term interest rates artificially low for an extended period. As discussed, the Federal Reserve was likely faced with a difficult dilemma and consequently had little alternative beyond maintaining a loose monetary policy. However, the fact remains that this policy did apparently heavily contribute to the massive expansion of credit and ultimately the housing bubble and sub-prime credit crisis.

Chapter Two: The Federal Reserve and Conventional Monetary Policy

Chapter two will briefly recount the events and turmoil of the credit crisis of 2007-2009 in order to build a level of familiarity for the reader and hopefully place in context the extreme conditions that prevailed at the time. As will be illustrated, the credit crisis climaxed in September, 2008 with such shock and panic that most every market around the world fell into freefall. It was in this extreme environment that central banks around the world, but primarily the Federal Reserve, were forced to accelerate their normal prescribed remedies for rising liquidity demand, which shall be referred to collectively as conventional monetary policy.

The Great Recession: 2007-2009

At the time that the sub-prime mortgage market began to roll over in 2007, most felt it would slowly deflate and be a largely over-hyped affair. In testimony to Congress as late as March, 2007, Fed Chairman Bernanke stated “the impact on the broader economy and the financial markets of the problems in the subprime market are likely to be contained.” (Bernanke, Testimony before the Joint Economic Committee of the US Congress, March 28, 2007) I think the truth is that very few people outside of the boardrooms of the financial institutions involved understood the complexity of the structures that had been put in place by these institutions. Nor did anyone on the outside realize how aggressively these institutions had pursued these Ponzi-type structures. However, inside the boardroom, in order to drive competitive earnings growth and for

fear of losing market share, and probably just plain ego, many of the biggest financial institutions in the country and around the world had approved the aggressive leverage of their firm's equity capital into subprime mortgages.

As discussed above, the Fed finally began raising the fed funds rate in late 2004. By 2006, the fed funds rate was back up to 5.25 where it held steady into early 2008 (see Figure 1). The higher interest rate was effectively the catalyst that caused the wholesale and massive default of many of the subprime loans written in only the prior three years. At the same time, however, GDP was expanding at sustainable and comfortable rates of around 2.0% for most of 2007 and into 2008. The general feeling was that the US economy was large enough and diverse enough to absorb the weight of these mortgage defaults.

Chronology of the Collapse

That sentiment changed literally overnight in September, 2008 with the failure of Lehman Brothers, Inc. Although several other firms had failed prior to Lehman Brothers, Inc., most notably, Countrywide Financial Corp., Fannie Mae, Freddie Mac, Bear Stearns & Co., Inc., and Merrill Lynch & Co., Inc., the system had proven resilient enough to absorb those institutions. Countrywide Financial Corp. and Merrill Lynch & Co., Inc. were each acquired by Bank of America Corporation. Fannie Mae and Freddie Mac, being quasi-government institutions to begin with, were seized by the Federal Housing Finance Agency (FHFA) and re-capitalized fairly quickly. Bear Stearns & Co., Inc. was acquired by JP Morgan Chase & Co.

It seems that Lehman Brothers, Inc. had the particular misfortune of being the "best" capitalized of the bad institutions, which put Lehman in the unenviable position of

being one of the last firms to fail. By the time they ultimately failed in September, 2008 there simply was not the physical capital necessary at any of the larger institutions to absorb Lehman or the political capital or appetite at the Treasury to rescue them. Fed Governor Bernanke and Treasury Secretary Paulson made the decision to allow Lehman Brothers, Inc. to file for bankruptcy on September 15, 2008.

Lehman's bankruptcy sparked a chain reaction of failed counterparty transactions, investor panic, and 21st century style bank runs. Essentially, that meant massive movements of money electronically into government insured deposits. In fact, in order to prevent a complete collapse of the money market industry, the Fed was forced to step up and guarantee these deposits as well when several large money market funds "broke the buck," the result of massive liquidations.

Without going into a great description of the intricate events and extensive transactions involved with Lehman's failure, which truthfully may never be fully understood, it is fair to conclude that Lehman's failure was ultimately the tipping point of a rather tenuous US economy. The system was under enough stress, both psychologically and financially, that the Lehman shock caused credit markets to simply freeze up. Large businesses could not access the commercial paper market for which they had grown very dependant for meeting short term demands for cash, such as payroll. Similarly, small businesses could not access their credit lines to facilitate their short term obligations, again such as payroll. Banks put the brakes on consumers by slashing credit limits on credit cards and suddenly adopting actual lending standards. Everything came to such an abrupt halt over the course of a few days that the media chatter turned overnight from debate over whether the US would successfully avoid a technical

recession to discussions of how deep the recession would be, how long it would be, and whether or not the entire financial system would simply collapse.

Conventional Monetary Policy

Recognizing that the US economy was slipping towards recession early in 2008, the Federal Reserve was quick to employ the more conventional tools of monetary policy at their disposal. At this point, the Federal Reserve was really dealing with a more conventional recession from the economic peaks of a fairly normal business cycle. Falling under the category of fed funds policy, the FOMC began aggressively cutting the fed funds target early in the year. At an unscheduled meeting on January 22, that rate was cut from 4.25% to 3.50%. Again, that rate was cut at the scheduled meeting a week later to 3.0%. By April 30, 2008, the fed funds rate stood at a historically low 2.0%. (Federal Reserve Bank , 2008, p. 3)

It seems fairly intuitive that the Federal Reserve had very little capacity left to stimulate the money supply through conventional means should that become necessary or desirable. In fact, that is exactly what materialized. By the summer of 2008, a relatively benign recession was complicated considerably by the international credit crisis. With the flurry of bank and investment company failures that climaxed in September, the Federal Reserve had very little capacity left to affect liquidity or stimulate investment further through interest rate reductions. After all, nominal interest rates can't go below zero. (Yates, 2003, pp. 27-37) The Federal Reserve did cut the fed funds target again finally to a range of 0.0% - 0.25% by year end, which was the lowest rate for the fed funds target in US history. (Yates, 2003, pp. 27-37)

In my opinion, the primary impact of the Fed's move in this respect was really more political and symbolic than anything else. Insofar as the financial institutions at this point were struggling to reduce their balance sheets and simply survive, they really were not interested in or actively pursuing the origination of new loans at any interest rate. I would argue that the real effect of taking the fed funds target to a range of 0.0% - 0.25% was simply to demonstrate to Congress that all that could be done conventionally had been exhausted and that more liquidity was still needed.

The second conventional tool of monetary policy available to the Federal Reserve, and arguably the much more powerful instrument, is the ability to affect the supply of money through Open Market Operations. According to the Federal Reserve's own statement, "Prior to mid-September (2008), the (FOMC) Desk had been able to offset the effect of the additional reserve balances provided through new or expanded liquidity facilities, and it relied upon its traditional framework and operating procedures to control the federal funds rate." (Federal Reserve Bank, 2008, p. 6) However, after September 15, the Fed was simply overwhelmed with liquidity demand from its member banking institutions. In Keynes' terminology, liquidity preference of banks and in turn banking customers had exploded and simply overwhelmed the available money supply from normal conventions.

Simply stated, banking institutions were caught in a liquidity trap and were forced to sell off assets very aggressively, thereby rapidly shrinking their balance sheets. Insofar as the credit markets were effectively frozen, the Federal Reserve had to step in as the buyer of last resort and purchase these assets from the banks, thereby injecting the necessary liquidity demanded by the banks. In effect, banking institutions were allowed

to transfer billions of reserves from their collective balance sheets onto the Federal Reserve thereby dramatically expanding the balance sheet of the Federal Reserve. It's important to recognize that at this point, the assets that transferred were primarily US Treasury obligations issued through the normal course of Fed Open Market Operations in prior periods, or simply the creation of the same in order to meet the overwhelming liquidity demand. At this point, none of the much publicized "toxic assets" of the banking institutions have been addressed.

The last tool of conventional monetary policy open to the Federal Reserve is adjustments to the required reserve ratio for banks. Nothing was pursued in this respect as it would have obviously been ineffective, both politically and in practice. The political uproar that would have certainly ensued had the Federal Reserve cut the required reserve ratio at a time when these same financial institutions had gotten themselves into so much trouble by largely ignoring their debt ratios anyway would surely have been enormous. In addition, it is very unlikely that the banks would have increased loan activity at all simply by leveraging a reduced ratio. As described above, these institutions were aggressively engaged in a massive deleveraging campaign at the time to shrink their balance sheets. In fact, the liquidity made available by the Federal Reserve largely was simply hoarded by the financial industry. According to Federal Reserve data, as the credit crisis climaxed, the banking industry amassed huge excess reserves, in sum totaling in excess of \$750 billion by December, 2008. For comparison, prior to the credit crisis and the Fed's liquidity push, total industry excess reserves stood at less than \$2 billion in any given period. (Federal Reserve Bank, 2010)

The extent to which these tools achieved the desired effect is mixed. It seems safe to assume that the Fed's massive balance sheet expansion through the Open Market Operations mechanism prevented an international run on the banks reminiscent of the 1930's. Depositors were allowed to access their money so at least the confidence that their deposits were secure was never much of an issue. Without the aggressive actions of the Federal Reserve, it is really not too difficult to imagine a panic situation where banks could have been forced to close their doors. Such a panic would surely have sparked an international crisis of confidence that could have taken down the entire international banking system very much reminiscent of the Great Depression. Therefore, I would argue that the expansive Open Market Operations that the Federal Reserve engaged in was very successful in arresting the liquidity crisis and the crisis of confidence.

The effect of rapidly cutting the fed funds target rate to a range of 0% - 0.25% was probably not so successful for a couple of reasons. First of all, it takes a long time for liquidity to matriculate through the monetary system, and we simply did not have a long time as evidenced by the sense of urgency displayed by Treasury Secretary Paulson and Federal Reserve Chairman Ben Bernanke during the TARP deliberations before Congress in late September and early October. Second of all, the overwhelming demand at the time was for liquidity of existing financial assets (which had been met with the Open Market Operations described above), not for investment related borrowing and its accompanying leverage, which is generally the aim of easing the fed funds rate to begin with.

In addition, the shortfalls of interest-rate targeting in monetary policy to stimulate investment and consumption is well documented. That is, the "pushing on a string"

dilemma, which is at the heart of the deflationary liquidity trap conundrum. Although the Federal Reserve can make monetary conditions conducive to lending, at the end of the day they cannot force financial institutions to actually lend, anymore than they can force investors to borrow. Very empiric evidence of this inadequacy of monetary policy was seen in late 2008 and 2009. Although the fed funds target was held steady at a very "conducive" level of 0.0% - 0.25%, lending activity was very anemic as demonstrated in Figure 3.

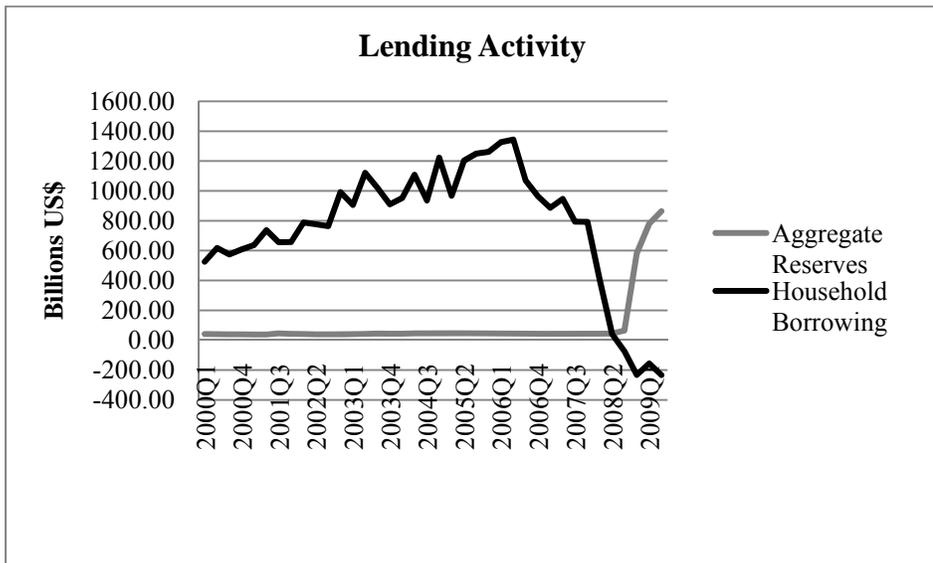


Figure 3 (Federal Reserve Bank, Q1 2001 - Q2 2009)

The reasons for the anemic loan activity virtually define the "pushing on a string" dilemma of monetary policy. On the one hand, liquidity preference in this environment was surging amongst investors; consequently money flowed almost exclusively into extremely short-term treasuries with virtually no demand for any other security or maturity. In fact, at the height of the crisis, short-term interest rates actually were

negative for several days. That is, credit supply from traditional institutional depositors was nonexistent.

At the same time, banking institutions were very likely engaged in heavy credit rationing as well, thereby further restricting credit supply. As discussed previously, the primary concern of financial institutions at the time was to raise liquidity thereby reducing their capital ratios. Once again, the liquidity provided by the Federal Reserve was simply used to raise bank reserves. Underwriting new loans, for which there was no demand anyway, at that point would simply have neutralized the bank's efforts to deleverage themselves.

With short-term interest rates cut to effectively 0% and the immediate liquidity needs of the banking system satisfied from aggressive Open Market Operations, the Federal Reserve had effectively exhausted all conventional monetary tools available. Yet even with that massive liquidity injection, it rapidly became apparent that conventional monetary tools alone would be inadequate to avert a deep recession, if not an outright depression. Minutes of the December 2008 FOMC meeting confirmed the deep concern of the Federal Reserve in this respect. (FOMC, 2008) It would seem that the FOMC was priming the markets as well as selling Congress on the need for a heavy push into the realm of highly stimulative "Quantitative Easing." The following excerpts from the December 2008 FOMC meeting suggest this idea.

With the federal funds rate already trading at very low levels as a result of the large volume of excess reserves associated with the Federal Reserve's liquidity operations (that is, Open Market Operations), participants agreed that the committee would need to focus on other tools to impart additional monetary stimulus to the economy in the near-term.

Meeting participants also discussed how best to employ the Federal Reserve's balance sheet to promote monetary policy goals.

Participants discussed the merits of purchasing large quantities of longer-term securities such as agency debt, agency mortgage-backed securities, and Treasury securities. The available evidence indicated that such purchases would reduce yields on those instruments, and lower yields on the securities would tend to reduce borrowing costs for a range of private borrowers, although participants were uncertain as to the likely size of such effects. (FOMC, 2008)

In response to these fears and deep concerns that threatened "sustainable economic growth and price stability," the Federal Reserve did embark down a nonconventional and fairly controversial path of quantitative easing, which will be discussed in the next chapter.

Chapter Three: The Federal Reserve and Unconventional Monetary Policy

Chapter three will discuss some of the tools that central banks might deploy within what would still be considered a “monetary” vein after the more conventional monetary tools have been exhausted without generating satisfactory stimulative effects. The reader will note the emphasis on “stimulative” effects, which obviously implies expansionary policy and efforts to ease or reverse an economic recession, rather than to curb the “irrational exuberance” that typifies a cyclical peak. I would argue that very little could be written in regards to unconventional monetary policy tools and their application to force a moderation of economic activity at a cycle top as conventional monetary policy tools have historically proven very effective at reigning in price inflation and excessive investment speculation to the extent they are applied timely and apolitically. This is largely due to the fact that there is no converse to the “zero bound for nominal interest rates” problem when reigning in inflation, that is, interest rates can be raised indefinitely. Therefore, this paper will only discuss the tools of unconventional monetary policy and their application to stimulate economic activity and inject money balances.

This section will discuss the primary tool of unconventional monetary policy; that which has come to be called “Quantitative Easing.” A second form of unconventional monetary policy likely exists which involves the manipulation or depreciation of currency exchange rates to favor domestic production and the domestic economy. This

paper will not go into much discussion of this strategy for two reasons. First, currency exchange rate depreciation is very similar in theory and in practice to most of the existing Import Substitution models readily available insofar as the general objective is to stimulate domestic production (and economic activity) at the expense of likely cheaper imported goods, that is, cheaper in the absence of synthetic barriers. Any discussion along these lines would likely result in simply restating the discussion and analysis of these models. Secondly, to the extent that trading partners of the central bank in question can pretty easily neutralize any currency depreciation by simply depreciating their currency as well, I would argue that this strategy would ultimately generate currency neutrality and therefore be deemed ineffective except in the very short term and only then with the coordination of other central banks.

Quantitative Easing

Quantitative easing is a term that has been thrown around quite frequently lately with different definitions depending on the source. For the purposes of this paper, quantitative easing is defined to be central bank activities, either independent or coordinated with other central banks, to facilitate the creation and injection of massive amounts of liquidity into the money supply through various unconventional avenues in order to satisfy overwhelming short term liquidity demands of the markets. The money supply, or the monetary base, follows a pretty conventional definition of currency in circulation plus bank reserves on deposit with the central bank. As discussed above, quantitative easing is a highly stimulative strategy that has been used rarely in the era of central bank coordinated monetary policy and only when conventional monetary tools have failed to bring about adequate stimulation in the face of some extraordinary shock.

The purpose, quite simply, is to rapidly inject necessary liquidity into the monetary base to a level where; first of all, extraordinarily high liquidity demand of both banks and borrowers is satisfied and, second, to hopefully take the next step in a recovery and sufficiently incent banks and investors to actively engage at least some of the newly formed capital into investment projects and create economic activity.

Two fundamental questions will be addressed. First, what is the likelihood that quantitative easing can succeed in stimulating economic activity where more tested and familiar conventional monetary policy measures failed? More specifically, given an economy that has fallen into a deflationary spiral, how effective can we expect quantitative easing to not only arrest the falling price environment and return some measure of pricing stability but also potentially spark a renewed level of economic expansion as measured by expanding production and higher prices? Secondly, given that the direct objective of quantitative easing is to neutralize a deflationary environment with highly stimulative inflationary programs, what is the likelihood that the central bank might overshoot the mark and unwittingly ignite an unacceptably high inflationary environment? Before addressing these questions, however, it is necessary to review more deeply the tools and mechanics behind quantitative easing as well as discuss the theoretical basis and empirical analysis of two historical quantitative easing efforts.

The Tools and Mechanics behind Quantitative Easing

Passive quantitative easing.

Pradhan differentiated between two different approaches to quantitative easing, that being passive quantitative easing and active quantitative easing. (Pradhan, March 5, 2009) Under normal economic circumstances where a central bank is charged with

maintaining an established monetary base from day to day, the central bank will offset, or sterilize, any activity that its member banks engage in to alter the monetary base. For instance, if a member bank writes a loan against its reserves thereby increasing the money supply by the amount of the loan, the central bank will typically sell a corresponding sum of assets from its balance sheet into the open market and neutralize the monetary effect of the bank loan. Passive quantitative easing is created when a central bank simply refrains from the sterilization process and allows the monetary base to expand “naturally” by the amount of the loan. Conversely, when a member bank engages in a transaction to reduce the monetary base, for instance by depositing with the central bank its excess reserves, the central bank might be inclined to sterilize that transaction by buying in the open market a corresponding amount of securities, thereby offsetting the transaction and maintaining the monetary base.

Two characteristics of passive quantitative easing are fairly apparent. First of all, it cannot afford the central bank much control over the actual size of the monetary base as the central bank will simply be reacting to the actions of its member banks and individual agents, thus is the nature of most passive acts. Second of all, economic agents tend to move slowly and cautiously, especially in periods of extreme deflationary economic inactivity. As we have seen in the 2007-2009 recession, nobody has been too inclined to invest in a new home, or anything else for that matter, when the likelihood is high that they can buy the same asset later at a cheaper price. In situations where the central bank wants to rapidly expand the monetary supply, it seems that passive quantitative easing might support the broad agenda, but would be too slow to meaningfully expand the monetary base quickly and would therefore be largely ineffective on its own.

Active quantitative easing.

Active quantitative easing can probably be most easily thought of as aggressive and unconventional efforts by the central bank very similar in nature to regular open market operations, but expanded both vertically to include broader and more risky assets and horizontally by expanding the central bank's balance sheet dramatically. To date, as will be seen shortly, central banks have employed two quantitative easing tools in a natural progression once they are satisfied that conventional monetary policy has created a sustained zero (or low) interest rate environment.

The first tool I will refer to as *central bank balance sheet restructuring*. As the name implies, this strategy is a vertically oriented strategy that a central bank can engage relatively easily by simply announcing its willingness to accept alternative asset classes as either loan collateral or that the central bank will buy outright from member banks. As was pointed out earlier in the description of conventional monetary tools, the central bank will typically only accept very limited types of very liquid collateral in exchange for cash reserves issued to member banks. Historically, that meant debt obligations originally issued by the central bank to begin with (that is, treasury securities in the case of the Federal Reserve). However, when a central bank engages in what I have deemed *central bank balance sheet restructuring*, the central bank will engage in progressively more aggressive purchases and exchanges of alternative assets that normally would not be accepted in order to facilitate much more liquidity. In this sense, the strategy is vertically oriented because the balance sheet of the central bank will become much more diversified beyond traditional excess bank reserves. However, it is important to emphasize that the size of the central bank's balance sheet is materially unchanged.

Because this strategy will not have a material impact on the size of the central bank's balance sheet, it can be engaged pretty easily without appealing to or approval from the government's legislative body. In fact, in the case of the Federal Reserve, which is a relatively private and secretive institution by nature, such asset purchases can be made without congressional knowledge. This advantage certainly would allow for quicker access to liquidity insofar as it is unnecessary to go through the time consuming and potentially contentious bureaucratic channels of legislation. This may be very important given the speed with which a troubled institution can collapse once word spreads in the markets that such an institution is potentially illiquid or potentially insolvent.

A second characteristic of simply restructuring the central bank balance sheet is that it can afford the central bank to very precisely target specific assets for purchase. Rather than relying on the low interest rate environment to provide liquidity to specific, presumably more troubled institutions, the central bank can quietly, very precisely, and in large volume buy up non-traditional assets of these more troubled institutions thereby injecting necessary liquidity. To the extent that such an injection can be done quietly and prevent a "bear raid" on such an institution by speculators or a bank run by depositors that might exceed FDIC limits or spill over into non-FDIC insured assets, I would argue that the central bank can prevent capital raids that create a self fulfilling prophecy of a bank failure.

The second tool of active quantitative easing I will refer to as *central bank balance sheet expansion*. Again as the name implies, under this strategy, the central bank will expand its balance sheet materially, possibly dramatically, in order to satisfy

liquidity demand even in excess of what could be supplied through the previous measures. Under this tactic, the central bank will use a more horizontal strategy by bringing its ability to expand its balance sheet virtually indefinitely and simply create the cash reserves necessary to satisfy liquidity demand. In a very real sense, the central bank simply “prints” fiat currency which is then used to buy real assets from distressed banks and investors.

When you think about it, the whole process really is a pretty good deal for the central bank and by extension the government. The central bank will book the asset purchases on its balance sheet while the member banks and depositors book the cash they received as assets on their books. In reality, the net impact on the overall balance sheet of everyone involved (central bank, member bank, depositor) is zero. The central bank merely created an amount of currency equal to whatever the original holder of the asset would settle for in order to satisfy their desire for liquidity, that is, cash. On the other side of the equation, the central bank really could think of the currency issued almost as a deed of trust on the assets they bought. The intent is that once the markets stabilize and greed or animal spirits return to investors, the central bank will sell the unconventional assets back in the marketplace, retire the currency issued, and get back into the business of conventional monetary policy. The currency issued was almost a placeholder. Unfortunately, as will be seen, quantitative easing in reality is not quite so simple.

This balance sheet expansion strategy, which will necessarily follow central bank balance sheet restructuring in a natural progression, is probably the most controversial tactic for one primary reason. The politics of merely mentioning “printing money” understandably conjures up images of the Weimar Republic or the 1970’s inflation spiral

in the US. However, a very important distinction is that the central bank in a quantitative easing campaign is printing money first of all to satisfy a panic stricken public that will not settle for any other asset. Second of all, the central bank is using the printed money to actually buy hard tangible assets that are presumably temporarily out of favor. In the case of the Weimar Republic, currency was simply printed and distributed to pay obligations of the government. The 1970's US inflation spiral, I would argue, was a considerably different and special situation tied more to the US dollar simply finding an equilibrium level against other foreign currencies after being decoupled from the gold standard in 1971.

The natural question that arises would be as to what asset classes should the central bank start buying in order to give quantitative easing the best chance of success. It would seem the central bank should consider two parameters in addressing this question. The first parameter, as Benford et al established, is for quantitative easing to be big and it must inject liquidity quickly. Therefore it is imperative that the central bank target a particular asset class with a sufficient supply of assets that can be readily liquidated. (Benford, Berry, Nikolov, & Young, 2009, p. 92) For example, the quantitative easing efforts of several central banks in 2007-2009 included the purchase of commercial paper and corporate bonds by the Bank of Japan as well as US Treasuries and mortgage backed securities of various government sponsored entities (GSE's) by the US Federal Reserve. (Benford, Berry, Nikolov, & Young, 2009, p. 92) In each case, the market for these securities is not only huge, but also very diverse. Consequently, central bank purchases of these securities effectively injected a huge amount of stimulus very quickly. In addition, that stimulus ran very deep and very broad across hundreds of

thousands, if not millions, of investors. Satisfying the vertical nature of central bank balance sheet restructuring, many new asset classes were purchased.

In addressing the second parameter, the central bank may be able to take very meaningful cues from the market to help determine what assets to purchase in order to reasonably expect to arrest a liquidity trap and an associated panic. As discussed above, active quantitative easing may become necessary in periods of extreme deflationary shocks where the “zero-bound” of nominal interest rates prevents conventional monetary policy from creating adequate loan activity and the associated monetary stimulus. It is therefore presumed, by virtue of the condition that nominal interest rates will have to be at or near zero before quantitative easing should commence, that investor demand for liquidity will necessarily be at an extraordinary premium. That is, credit markets and money markets alike will by definition be caught in an upside-down state consistent with a liquidity trap. Therefore, it would seem that targeting the purchase of assets caught up in such a liquidity trap would dramatically improve the chance for success. To the extent that such assets might hold an underlying intrinsic value (for instance, secured and collateralized notes), but due to the general nature of a liquidity trap (as detailed above), the market price in no way reflects the underlying intrinsic value, such assets might represent an excellent opportunity to not only arrest the liquidity trap, but might even provide an opportunity for the central bank to make some money for the taxpayer once things normalize and the assets can be sold back to the market possibly at higher prices.

In such an extreme environment as was seen in the autumn of 2008, with the exception of only the most secure and liquid government bills, prices of literally everything came unglued. Quite simply, liquidity preference at any cost had trumped the

banking industry's ability to issue more and more debt. As a result, normal risk/reward characteristics were replaced with an absolute rejection of any risk; whether it was default risk, credit risk, or inflation risk was immaterial. It is very important to realize that, whether the central bank comes forward with quantitative easing or not in such an extreme environment, investor panic and the herd mentality will dictate that everyone who wants to be liquid will be made so, regardless of price. If the principal and characteristics of deflation mean anything, it is that prices (or real inflation) can and will fall at rates far below zero, possibly for extended periods, until the panic subsides and the market can find a bid, natural or otherwise, for these securities.

Under this second parameter, aggressive active quantitative easing may be used to satisfy the massive liquidity demand without necessarily forcing investors of otherwise sound assets to sell into a market where there is no bid for their assets. Essentially, the idea is for the central bank to create a "bid" for certain asset classes to satisfy the massive call for liquidity in hopes of arresting the panic and the margin calls.

Theoretical Basis for Quantitative Easing

The theoretical justification for quantitative easing, to the extent that quantitative easing is really just a massive monetary response to extraordinary market conditions, can be found most readily in Keynes General Theory of the Rate of Interest. Keynes defined interest rates as "the price which equilibrates the desire to hold wealth in the form of cash with the availability of cash." (Keynes, 1964, p. 167) Keynes further described that higher long term interest rates and lower short term interest rates would be the result of higher levels of liquidity preference and that in such an environment money supplies would be inadequate to meet the demand for money.

Not only does Keynes theory provide the basis for monetarism and centralized monetary policy in general, it also seems to reasonably describe the circumstances that unfolded prior to the banking and international credit crisis of 2007-2009. In response to unprecedented liquidity demand, nominal interest rates were forced to near zero. In fact, possibly taking Keynes understanding of interest rates beyond even what Keynes allowed for, as mentioned previously, short term T-bills actually traded at levels to yield negative interest rates for brief periods. The scenario that played out seems to fit the Keynesian view of interest rates as a reward for illiquidity, or at least the natural reciprocal of that theory that people suddenly cared only about “return of their money, as opposed to return on their money.” As Keynes had stated, there simply was not enough money in circulation to meet the overwhelming liquidity demand as very few investors were willing to buy less liquid paper.

Finally, Keynes General Theory of the Rate of Interest provides a good theoretical illustration for monetary policy and its ability to meet liquidity preference. Keynes advanced the equation $M = L_a(r)$ where M is the monetary base, L_a is a function that describes liquidity preference (or demand for money as an asset), and r is the interest rate. Peterson and Estenson illustrated this relationship in Figure 4 below where P represents a normal business cycle peak; T represents a normal business cycle trough. (Peterson & Estenson, 1996, p. 160)

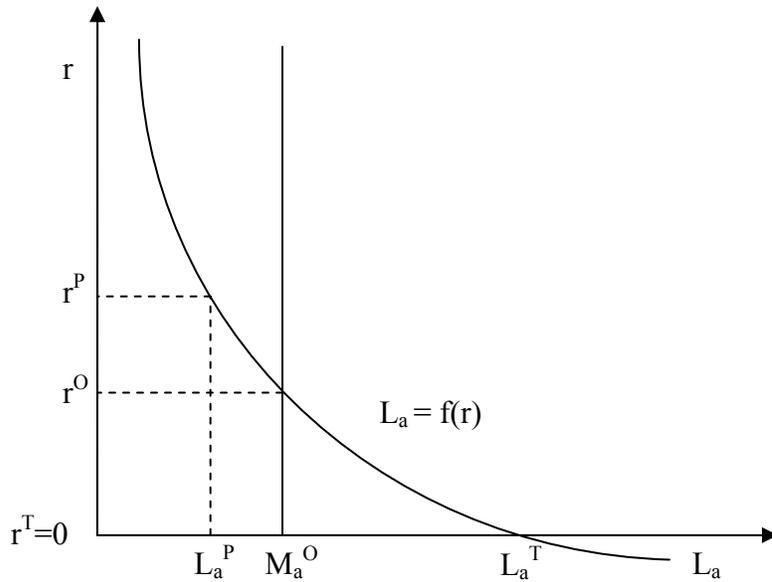


Figure 4 – Keynes General Theory of the Rate of Interest

The reader might note that I have modified the shape of the $L_a = f(r)$ demand curve by allowing it to intersect the L_a axis at $r = 0$. This is to illustrate the lower bound of zero for interest rates in periods of extreme liquidity preference. In addition, I have modified the same curve such that it never intersects r illustrating that interest rates have no upper limit as a monetary response to inflation or periods of extremely low liquidity preference. M_a^O represents Peterson and Estenson's depiction of the supply curve of money as an asset as autonomous to the interest rate. Under this Figure 4, the monetary base that can be controlled by the central bank through the conventional monetary tools discussed in Chapter 2 would be that area of the L_a axis where L_a intersects the axis up to L_a^T . In addition, the area of the L_a axis where L_a intersects between L_a^P and L_a^T represents normal fluctuations of the money supply in response to a normal business cycle. That area of the L_a axis where L_a intersects from 0 to L_a^P represents the monetary

base during periods of unacceptably high inflation where the central bank would be raising interest rates aggressively beyond what would be expected in a normal business cycle in order to dramatically contract the money supply. The area of the L_a axis where L_a intersects beyond L_a^T represents asset demand for money (liquidity preference) beyond what can be satisfied by conventional monetary policy and therefore the area of most interest for this paper.

It is important to understand that the M_a^O money supply curve is dynamic in that it can, or at least should, move in lock step with variations to L_a . That is, $M_a^T = f(L_a^T)$, $M_a^P = f(L_a^P)$, and so on. However, at points of the L_a axis beyond L_a^T , $r < 0$ is not possible, indicating the zero bound of nominal interest rates. Therefore, in order to satisfy demand for M_a at points beyond L_a^T , the liquidity required will necessarily be forthcoming from other sources. The argument presented herein is that the source of additional liquidity will be forthcoming from the various unconventional monetary policy tools described, primarily quantitative easing.

A possible shift in Keynes precautionary motive.

Digging a little deeper into Keynes General Theory of the Rate of Interest, he further identified three divisions of liquidity preference; the transactions motive, the precautionary motive, and the speculative motive. Keynes suggested that the transactional motive and the precautionary motive would most likely remain insensitive to interest rates and therefore remain relatively determined by income over time, but that the speculative motive would account for the overwhelming stress on the money supply in periods of disequilibrium. (Peterson & Estenson, 1996, pp. 170-171) The precautionary motive Keynes defined as the desire for security as to the future cash

equivalent of a certain proportion of total resources. (Keynes, 1964, p. 170) Ordinarily, this component is bound into a culture and determined by very sticky things like savings rates, public safety nets, and confidence about the future, which arguably are normally very static characteristics.

However, it seems plausible that a sudden and fundamental shift in the general population's precautionary motive likely took place in the autumn of 2008. At that time, the crisis of liquidity and the absolute rejection of risk altogether arguably transformed the precautionary demand for liquidity into a wildly dynamic and unpredictable component overnight. This possibility could offer another explanation as to why conventional monetary policy was limited by the zero-bound of nominal interest rates and more aggressive tools became necessary. It would seem that conventional monetary policy is generally aimed at satisfying the more conventional speculative motive for liquidity preference, that is, central bank sterilization of speculative transactions, as well as the more predictable aspects of the transactions motive and the precautionary motive. If it indeed transpired that suddenly the precautionary motive shifted dramatically, it is very understandable how the money supply and the central bank were simply unprepared and ill-equipped to meet the overwhelming liquidity demand that previously had never really been expected or accounted for.

Empirical Analysis of Quantitative Easing: Japan 2001-2005

The first concerted and relatively complete example of quantitative easing can be seen in the efforts of the Bank of Japan (BoJ) during the period 2001-2005. The impact of the collapse of the Japanese asset bubble in 1998 on the banks was enormous as much of that bubble had been financed with inflated stock and real estate assets pledged as

collateral on bank loans. Very similar to the international credit crisis of 2007-2009, as the bubble began to deflate and the value of the underlying assets began to collapse, Japanese banks suddenly realized they were holding massive amounts of bad loans for which the collateral had “evaporated.” Strong and secure collateralized loans morphed overnight into unsecured non-performing loans. As described above, individual banks were deeply degraded and their own solvency came into question, which genuinely threatened the entire Japanese banking system with collapse. The initial response to the liquidity problem by the BoJ was to adopt a zero interest rate policy very similar in character to the conventional monetary policy discussed in Chapter 2 in the sense that the stated intent was to encourage investment as much as possible within the generally accepted conventional monetary framework.

A key difference in the BoJ’s conventional response to the Federal Reserve’s response a few years later may be that the BoJ formally adopted a zero interest rate policy, which may be effective in raising confidence of the markets that the central bank will remain committed to a zero interest rate for a considerable time period and until prices and economic activity satisfy a predetermined standard. In this case, the standard was set at price stabilization as measured by the Japanese CPI. (Baba, Nishioka, Oda, Shirakawa, Ueda, & Ugai, February 2005, p. 72) In contrast, the Federal Reserve has never formally adopted a zero interest rate policy. Rather, it seems to prefer perhaps a more elusive policy by making accommodative statements without necessarily painting themselves into a corner with absolute statements and formal policies. Only after the zero interest rate policy failed to produce the desired investment and private sector

activity did the BoJ advance the idea of further stimulus in the form of quantitative easing.

The quantitative easing policy set in place by the BoJ consisted of three coordinated strategies. (Ugai, March 2007) First, the BoJ set a liquidity target to guard against perhaps injecting too much stimulus while still providing sufficient liquidity to fund investment and exports. This was accomplished by replacing a standardized interest rate target, in this case the uncollateralized overnight call rate, with a money stock or balance as measured by the Japanese current account balance (surplus) in excess of BoJ required reserves.

Secondly, the BoJ widely communicated its intent to continue its quantitative easing policy for as long as necessary until the Japanese CPI registered zero or a year-over-year increase. Obviously, this action provides markets and investors with a higher level of certainty and confidence that low to zero interest rates will prevail for as long as a deflationary environment persists.

Finally, the structure of the quantitative easing was defined. The BoJ would aggressively step up its purchase of long term Japanese government bonds beyond and in addition to what it had committed to under the zero interest rate policy. The ceiling was set essentially to the entire outstanding inventory of Japanese government bonds. In addition, the BoJ announced it would commence purchasing certain asset-backed securities as well in order to provide additional liquidity, but also to start facilitating a more functional market for such securities.

An empirical analysis of the impact of quantitative easing to the Japanese economy will follow in order to assess the first question posed of quantitative easing; that

being, whether or not quantitative easing might likely have a stimulative impact, and therefore a likely successful impact, on an otherwise failing economy. In making such a determination, I will make two observations. First, the degree to which it can be determined that quantitative easing can be credited with arresting the deflationary spiral prematurely and therefore prevented prices from falling to some “natural” level. This first observation will clearly attempt to assess how well quantitative easing might satisfy extraordinary liquidity demand and therefore reinstitute a level of price stability and general economic stability, albeit it at lower levels. Second, the degree to which quantitative easing could be credited with actually sparking and/or financing an economic recovery. Each of these relatively independent assessments is temporal in nature and follows a natural progression in the business cycle. It is therefore not necessary for quantitative easing to be deemed successful on both counts to be deemed an appropriate device in a central bank’s toolbox for dealing with deflationary pressures and liquidity shortages.

Following Keynes Liquidity Preference Theory of Interest, the primary determinant of interest rates is the willingness of savers to part with liquidity. (Keynes, 1964, p. 167) As already discussed, in a deflationary spiral, liquidity demand will exceed the supply of liquidity available in the monetary system. Absent quantitative easing or some other such subsidy, selling of illiquid assets must therefore ensue in order to satisfy exceedingly high liquidity demand, which necessarily generates price discounts.

Therefore, if the optimal interest rate* could be reasonably determined, it would most

* For the purposes of this paper, the *optimal interest rate* is a largely theoretical interest rate somewhat similar to the Wicksellian natural rate of interest in the sense that it is that rate of interest that would equate the supply of capital with the demand for investment.

assuredly be negative. However, owing to the lower bound of zero for nominal interest rates, the presumably negative optimal rate of interest cannot be expressed accurately in a familiar nominal term. In order to satisfy the overwhelmingly high demand for liquidity, individuals become more agreeable to steeper and more severe price discounts of asset prices in order to generate any amount of liquidity. In this respect, although the optimal interest rate cannot be stated in a traditional nominal interest rate quote, it is nevertheless still realized in the form of falling prices. In other words, liquidity demand over and above what can be generated by simply rotating into ultra short maturity t-bills will be met by selling off more illiquid assets.

If it can be demonstrated empirically that quantitative easing created by the BoJ created a price floor or even a strengthening price environment, one would have to credit the quantitative easing effort with calming a panic stricken public and with easing liquidity demands by postponing panicked or forced asset sales. In addition, firming price levels would certainly indicate that the negative optimal interest rate was trending less negative and back towards parity with the nominal rate of zero. Under those conditions, I would argue that quantitative easing in Japan was successful in arresting the deflationary spiral.

Baba et al analyzed the empirical effects of the BoJ's extraordinary monetary policy efforts, specifically the zero interest rate policy and the quantitative easing program. (Baba, Nishioka, Oda, Shirakawa, Ueda, & Ugai, February 2005, pp. 72-80) In their analysis, Baba et al estimated the shape of a theoretical term structure of interest rates in the absence of the BoJ monetary policies, which I will henceforth label the Real Yield Curve. By comparing a real yield curve to the nominal yield curve, Baba et al were

able to derive two very useful conclusions. First, they could compare the current short-term yield against the anticipated short-term yield at future intervals to determine an anticipated rate of price inflation/deflation. Secondly, by simply subtracting the anticipated short-term yield at the various future intervals from the nominal yield on government bonds of corresponding maturities, they were able to observe the risk premium the market had built into the various maturities.

To estimate the current short-term interest rate, they simply used the BoJ's commitment to zero interest rates or zero. To estimate the anticipated short-term rates, they used a "macro-finance expectations model" to estimate the short-term interest rate anticipated by the market in 3 years, 5 years, and 10 years. Specifically, they used a weighted average of historical short-term interest rates as their dataset and then ran Monte Carlo simulations to determine the most likely estimate for future rates. (Baba, Nishioka, Oda, Shirakawa, Ueda, & Ugai, February 2005, p. 73) The difference between the anticipated short-term rate estimate in the future and the actual current short-term rate (zero owing to the BoJ's ZIRP) they reasonably deemed to be a good proxy for the real rate of price inflation/deflation and therefore the anticipated Japanese CPI, which after all would ultimately be the target set by the BoJ for assessing the effectiveness of its monetary policy activities and when such monetary stimulus would conclude. The difference between the anticipated short-term rate estimate and the actual current short-term rate (zero) they labeled the "Threshold Rate." The intervals they used for assessing the anticipated future short-term interest rates were at 3 years, 5 years, and 10 years. Obviously, these intervals were chosen to coincide with readily available market data of nominal yields for 3-year, 5-year, and 10-year Japanese government bonds and proved

very useful in quantifying the risk premium built into the respective maturities. The results of their analysis of three-year maturities in respect to the effect on the threshold inflation rate are reproduced in the Figure 5.

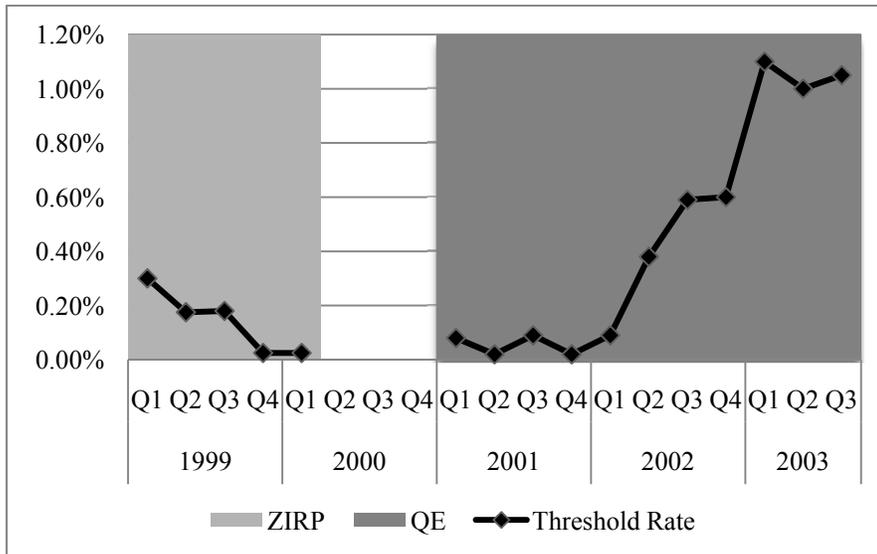


Figure 5 (Baba, Nishioka, Oda, Shirakawa, Ueda, & Ugai, February 2005, p. 74)

Based on this analysis, Baba et al did determine that the zero interest rate policy did bring down the threshold rate over the period 1999/Q1 to 2000/Q1, which implies that the zero interest rate policy did successfully ease the expectation for higher short-term rates in the future. In respect to the period 2001/Q1 thru 2003/Q3, Baba et al were less forthcoming with any conclusions as the Japanese economy had begun a mild recovery by 2002 which obviously would have caused sharp changes to interest rate expectations and term structures irrespective of the BoJ's policies.

To derive the second observation, that being a comparison of the nominal yield curve against a derived real yield curve, they then subtracted the anticipated short-term rate at the various maturities from the nominal long-term rate reasoning the difference to be exclusively risk premium built in by the market. Their reasoning was that shocks to

aggregate demand and supply; or more accurately, the fear or possibility of shocks, account primarily for the difference between long-term rates and short-term rates. For purposes herein, I will use their risk premium derivative as a reasonable proxy and estimate of the demand for liquidity. The results of these calculations are reproduced in Appendix B.

It seems fairly apparent, particularly in 3-year maturities, but also in 5-year maturities, that risk premium during the quantitative easing period was virtually eliminated. However, and also acknowledged by Baba et al, the recovering Japanese economy beginning in 2002 likely contributed much more to this observation than the quantitative easing policies of the BoJ. During an economic expansion, inflationary pressures will build naturally. In anticipation of likely rising inflation and typically at the first indications of recovery, markets will begin to bid up the longer end of the yield curve by selling longer term maturities knowing that if inflation heats up, those same maturities can be replaced with new issues at higher rates, thereby pushing yields up. In this instance, that natural tendency makes an independent assessment of quantitative easing virtually impossible.

Therefore, I would conclude that the zero interest rate policy did successfully arrest the liquidity trap in Japan and contribute to creating an environment of price stability. This is significant as confidence by investors in a relatively static state in respect to interest rates and prices are very important prerequisites for new capital formation and investment. Whether or not quantitative easing, or merely the announcement of the same, helped the BoJ lend even more credibility to its zero interest rate commitment is inconclusive simply because the Japanese economy began to recover

from recession at about the time the quantitative easing campaign might have generated more conclusive empirical results.

In addressing the second observation of Japan's efforts, that is whether quantitative easing can effectively stimulate a resumption of economic activity; Baba et al again were inconclusive. To their credit, they did label their study as a preliminary analysis. (Baba, Nishioka, Oda, Shirakawa, Ueda, & Ugai, February 2005, p. 48) However, they did conjecture that "the effects of a favorable shift in the yield curve on prices and output have been limited because the reduced net worth of both lenders and borrowers offset the effect of low interest rates, and therefore an increase in lending and fixed investment was not realized." (Baba, Nishioka, Oda, Shirakawa, Ueda, & Ugai, February 2005, p. 95) In other words, although the investment environment was made conducive to lending and investment, aggregate demand was so anemic that new investment decisions and capital purchases simply could not be justified. Thus, the stimulus that the BoJ created apparently just sat idle in excess bank reserves. While very large excess banking reserves certainly helped Japanese banks to shore up their capital ratios and ultimately escape widespread insolvency, it is not apparent that the mere availability of excess reserves accelerated or even sparked a recovery.

In respect to the second question posed of quantitative easing, that being whether or not quantitative easing will inevitably ignite an unacceptably high inflationary environment after the crisis is past, it seems the BoJ was cognizant of this concern. The fact that the BoJ used the Japanese CPI as its barometer to determine when to cease its quantitative easing policy certainly supports that conclusion. Here again, because the Japanese economy began to recover before a full assessment of quantitative easing can be

made, it seems that the most that can be concluded in this respect is that quantitative easing will not necessarily or inevitably spark unacceptably high inflation. That is, in the Japanese case, quantitative easing did not spark unacceptably high inflation as even through the early stages of the economic recovery inflation rates never rose above zero and aggressive monetary contractions were never necessary. (Bank of Japan, 2000-2005) All that can really be concluded on this front is that inflation rates remained within a low to acceptable range, but that the full magnitude of quantitative easing was likely never released and therefore the full impact was never realized either.

Empirical Effects of Quantitative Easing: US Credit Crisis 2007-2009

The aggressive and coordinated efforts of the Federal Reserve, the Bank of England, the European Central Bank, and the Bank of Japan in response to the 2007-2009 international credit crisis provides a second example of central bank coordinated quantitative easing. It will likely be premature to draw any concrete empirical conclusions as to the ultimate effectiveness of the efforts or what possible consequences might be. Although as an observer at the time of this writing, it should be possible to draw some intermediate empirical conclusions. In addition, in drawing from the Japanese experience discussed above as well as some current observations, I will attempt a conjecture as to the likely outcome of these efforts in respect to the two primary questions of quantitative easing presented in this thesis. Those being, first, can quantitative easing be expected to restore price stability in a rapidly deteriorating deflationary setting and, if so, could it also be expected to go the next step and restore aggregate demand and growth? Second, will the massive liquidity created inevitably spark a period of unacceptably high price inflation?

For reference, a brief chronology of the quantitative easing efforts that have been engaged to date will be discussed. As described in Chapter 2, the Federal Reserve and the US Treasury had broadcast to the markets and the legislature the need as well as their intent to aggressively expand the monetary base, both vertically and horizontally, as it became fairly apparent that the liquidity crisis would vastly exceed the capability of and really even the design of conventional monetary policy tools. Specifically, the Federal Reserve was lobbying for expanding its open market operations and zero interest rate policies into the realm of quantitative easing. (FOMC, 2008)

Consistent with Cecchetti's and Disyatat's description, as well as the two phase convention described previously, the quantitative easing efforts surrounding the international credit crisis of 2007-2009 will be broken down into two phases. (Cecchetti & Disyatat, February 19-20, 2009) During the first phase, the Federal Reserve engaged in the vertically oriented strategy I have described as "central bank balance sheet restructuring" and encompassed the time period from when subprime mortgage problems began to surface and credit facilities began to freeze up in July 2007 through September 2008. This first phase began with the failure of two subprime mortgage related hedge funds underwritten and managed by Bear Stearns and Company, Inc., the Bear Stearns High-Grade Structured Credit Fund and the Bear Stearns High-Grade Structured Credit Enhanced Leveraged Fund.

During the first phase, several central banks coordinated their efforts to reposition their existing balance sheets from traditional secure and liquid assets, primarily sovereign debt and excess bank reserves, into more aggressive and less liquid assets in order to provide specific and targeted assistance to troubled institutions. The Bank of England

extended loans, at least initially, to Northern Rock, PLC to allow that institution to meet its liquidity requirements. The Federal Reserve did the same in assisting Bear Stearns & Co., Inc., AIG, Inc., and Citigroup, Inc. Essentially, these loans constituted a repositioning of the central bank's balance sheet from exclusively sovereign debt into loans and guarantees to the various institutions while holding central bank balance sheets more or less constant. (Cecchetti & Disyatat, February 19-20, 2009)

It was during this period that the discussion of moral hazard and too-big-to-fail really began to shape central bank policy. However, because the various central banks and regulatory authorities were simply caught off guard, as is the nature of any external shock, they really did not have adequate time or adequate institutions in place to discuss the merits of moral hazard and whether firms should be rescued, wound down, or allowed to fail. Very simply, over the prior twenty year period predisposed to deregulation, numerous firms had grown into systemically important firms with likely catastrophic consequences in the event of their failure. By repositioning their balance sheets to extend life-line loans to these various institutions, the central banks attempted to quietly assist these distressed firms and buy some time until alternatives could be explored and regulatory authorities could hopefully intervene. Obviously, the hope was that the new liquidity would prevent the firms from failing, which would create even greater liquidity demands on the central banks and distress in the markets.

One of the perceived advantages of central bank balance sheet repositioning mentioned above, that being the central bank's ability to quietly and discreetly target specific assets of specific institutions in order to avoid predatory-like speculation and depositor panic. In hindsight, that effort obviously failed. For instance, the deal made by

the Federal Reserve to assist, some would argue entice, JP Morgan Chase & Co. to acquire Bear Stearns & Co., Inc. in March, 2008 was hardly discreet as the terms of the deal were published in numerous publications, including the New York Times, as the deal unfolded. (Sorkin, 2008)

Not to be critical of the Federal Reserve, as the problems at Bear Stearns & Co., Inc. were well publicized as, in response to the firm's hedge fund failures, Bear Stearns & Co., Inc. had committed \$3.2 billion of the firm's own capital only a few months prior to liquidate the two failed hedge funds previously identified. (Creswell & Bajas, 2007) However, the fact that the Federal Reserve did not or could not act more candidly did contribute, I would argue, to a speculative bear raid on virtually every financial firm in the ensuing months. Publishing the terms of the JP Morgan Chase & Co. acquisition of Bear Stearns & Co., Inc. effectively advertised the template favored by the Federal Reserve for bank rescues. Obviously, if speculators are reasonably assured that the Federal Reserve is prepared ultimately to come to the rescue of the banking system, they will be emboldened to act more aggressively than what they might otherwise.

There is some compelling evidence that speculators did contribute heavily to the collapse of the banking system by piling on short sales of bank shares, perhaps illegally in some instances, to drive prices down. (US Securities Exchange Commission, March 18, 2009, pp. 15-16) As discussed in Chapter 1, heavy short selling caused bank share prices to plummet. As share prices fell so too did bank equity, which naturally created the inevitable capital shortages and the associated death spiral of financial firms. Although the banking institutions largely ignored moral hazard in the buildup of the credit bubble, I would also submit that speculators were equally guilty of the same in the

bust cycle by knowing that the Federal Reserve would ultimately come to the rescue and prevent the whole system from collapse.

The second phase of quantitative easing efforts encompasses the time period of September 2008 though the current period which began with the mass failures of numerous financial institutions, most notably the bankruptcy of Lehman Brothers Holdings, Inc. It was the failure of Lehman Brothers Holdings, Inc. that really signaled to the monetary authorities that the Federal Reserve would need to drastically expand its balance sheet, in addition to all of the other strategies already in play, if the liquidity crisis were going to be contained. Thus, consistent with my definition earlier, the Federal Reserve engaged in the horizontally oriented strategy of “central bank balance sheet expansion.”

What materialized was a veritable alphabet soup of programs designed to inject liquidity aggressively into the monetary system. The following is a brief description of some such programs that ensued:

Primary Credit Dealer Facility (PDCF).

The PDCF was originally initiated in March, 2008 in order to allow expanded access to the Federal Reserve liquidity facilities by primary dealers (the “Fed discount window”). Consistent with central bank balance sheet repositioning, the PDCF was expanded to allow all eligible repo assets as collateral, which includes US Treasury securities, US agency obligations, and certain Mortgage Backed Securities. (Federal Reserve Bank, 2009) In addition, it was through this facility that previously ineligible financial institutions (such as GE Capital, Ford Motor Credit, Goldman Sachs, and many more) were permitted to re-charter themselves into bank holding companies in order to

access directly the Federal Reserve discount window. Although it was accessed somewhat sparingly prior to September, use of the PDCF ballooned in the weeks following the Lehman Brothers Holdings, Inc. failure. By September 29, borrowing against the PDCF spiked to \$155.8 billion. (Federal Reserve Bank , 2008, pp. 20-21)

Term Securities Lending Facility (TSLF).

The TSLF program essentially allowed primary dealers to exchange certain more risky collateral for US Treasury securities with no haircut or penalty, except a 0.0010% fee. By September 14, 2008 the TSLF had been expanded to allow as collateral: US Treasury securities, US Agency debt, highly rated residential and commercial mortgages, US Agency collateralized mortgages, highly rated asset-backed securities (ABS), and finally investment grade corporate debt. By December 31, 2008, the program had expanded to \$165 billion. (Federal Reserve Bank , 2008, pp. 21-22)

Asset-Backed Commercial Paper Money Market Mutual Fund Lending Facility (AMLF) and the Commercial Paper Funding Facility (CPFF).

The AMLF and the CPFF, introduced in September and October, 2008, were designed to provide liquidity relief to money market mutual funds. As referenced earlier, numerous money market facilities and mutual funds had “broken the buck” in response to redemption requests that exceeded the various funds available cash. In response, these funds were forced to liquidate holdings prior to maturity. These programs effectively allowed these institutions to exchange assets, primarily commercial paper and certificates of deposit of a short duration anyway, for liquidity to meet their redemption requests. The AMLF initially extended \$152 billion in loans. The CPFF had extended \$334 billion by December 31, 2008. (Federal Reserve Bank , 2008, pp. 23-24)

Term Asset-Backed Securities Loan Facility (TALF).

In order to facilitate the flow of credit to households and small businesses, TALF was introduced in November, 2008 to encourage lenders to issue high quality asset backed securities (ABS) with a variety of otherwise inadequate assets as collateral, such as; student loans, auto loans, credit card loans, and SBA loans (Small Business Administration). The Federal Reserve set aside up to \$200 billion to help span the gap between the AAA-rated ABS issued and the less than AAA-rated collateral pledged. (Federal Reserve Bank , 2008, p. 24)

Term Auction Facility (TAF).

The TAF was designed to allow primary dealers to bid for loans of funds from the Federal Reserve in a regularly scheduled auction to meet liquidity requirements with the interest rate determined by the auction. As collateral, the Federal Reserve accepted a wide range of assets consistent with those detailed above under the Term Securities Lending Facility. \$900 billion was made available under the TAF and by December 31, \$450 billion of credit had been issued. (Federal Reserve Bank , 2008, p. 24)

Reciprocal Currency Arrangements with other Central Banks (currency swap arrangements).

In order to facilitate dollar demand around the world during the credit crisis, the Federal Reserve expanded its direct swap arrangements with other central banks from two (European Central Bank and Swiss National Bank) to thirteen (Australia, Brazil, Canada, Denmark, England, Japan, Korea, Mexico, New Zealand, Norway, Singapore, and Sweden). This accommodation resulted in the creation of \$550 billion in new currency swapped for other currencies. (Federal Reserve Bank , 2008, p. 25)

The net impact to the monetary base of these actions can be seen below in figures 6 and 7. The phase 1 central bank balance sheet repositioning program had a nominal impact to the overall balance sheet of the Federal Reserve in that it only expanded \$29 billion (3.2%) between December 31, 2007 and September 10, 2008. (Federal Reserve Bank , 2008, p. 28) However, the construct of the balance sheet changed dramatically as demonstrated in Figure 6.

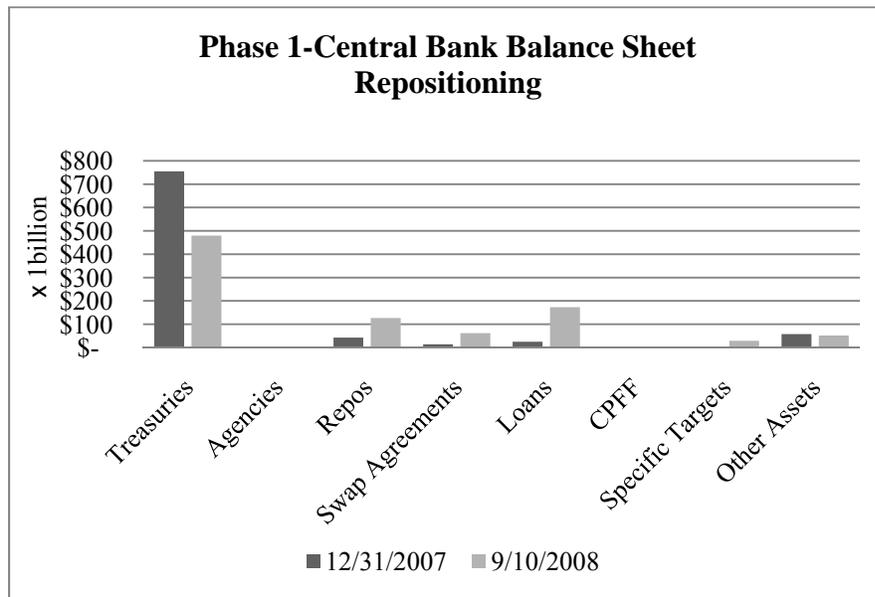


Figure 6 (Federal Reserve Bank , 2008, p. 28)

The net impact of the phase 2 central bank balance sheet expansion program, as one would expect, was tremendous. In three months, the Federal Reserve's balance sheet expanded by \$1,340 billion (145%) to \$2.263 trillion and also continued the dramatic shift into more unconventional and more risky assets, as illustrated in Figure 7.

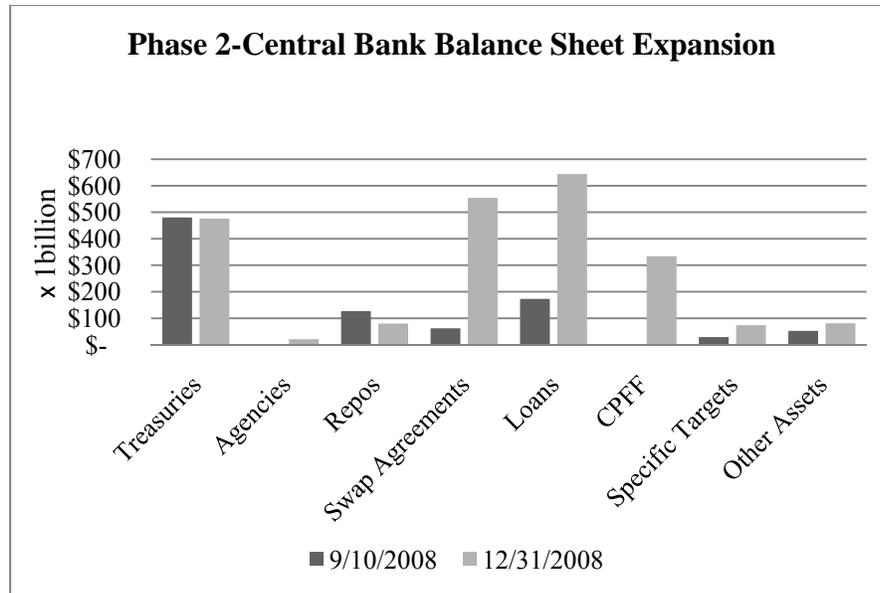


Figure 7 (Federal Reserve Bank , 2008, p. 28)

The well publicized and equally controversial Troubled Assets Relief Program (TARP) is not included in this paper as it was a fiscal tool created under the Emergency Economic Stabilization Act of 2008. Although some of the TARP was used to fund some of the above referenced monetary programs, specifically \$20 billion to the TALF program, the vast majority of liquidity provided under TARP was used by the US Treasury to shore up bank capital. (Congressional Budget Office, January 2009)

As was the case with analyzing empirically the Japanese quantitative easing effort described above, the degree to which this massive liquidity expansion has been effective will be analyzed. In order to make an assessment of the phase I (central bank balance sheet reposition) and phase II (central bank balance sheet expansion) monetary efforts of the Federal Reserve, I will attempt similar assessments to those made by Baba et al. (Baba, Nishioka, Oda, Shirakawa, Ueda, & Ugai, February 2005) For review, these assessments will be aimed at making a determination as to whether or not the Federal

Reserve's efforts successfully assisted in bringing about an improved level of price stability in an otherwise rapidly deteriorating deflationary spiral. Second, these assessments will attempt to establish whether or not the phase I and phase II monetary efforts at least assisted in establishing an environment of improving output and aggregate demand. Finally, the degree to which quantitative easing might be expected to ignite a period of unacceptably high inflation will be examined.

I will use a similar method to that employed by Baba et al in their analysis, but will rely on a different measure of price stability and sentiment. In order to ascertain the anticipated rate of inflation at future intervals (that is expected prices) a much simpler and hopefully more accurate mechanism is available in evaluating the US price environment than what was available to Baba et al.

In 1997, the US Treasury introduced a special class of treasury securities designed to give bond investors absolute protection against future inflation rates. These securities, known as Treasury Inflation Protections Securities (or TIPS), have another obvious and particularly useful application. From the Federal Reserve Bank of Cleveland, "TIPS also promise economists and policymakers a potential way to tease out the market's expectations for the future course of inflation. In principle, subtracting the real yield on TIPS from the nominal yield of Treasury notes of the same maturity should give a market-based measure of expected inflation (at the various maturities)." (Carlstrom & Fuerst, January, 2005)

As Carstrom & Fuerst discuss, there are a couple of problems in assessing future inflation rates from TIPS yields that need to be considered before accepting this method purely on faith as a reasonable measure of anticipated inflation rates. First of all, owing

to the nature of inflation risk and perhaps investors' natural tendency to want to hedge against such a prospect, it is expected that the TIPS method would overstate actual or realized inflation rates. In my experience, investors with a concern for future inflation tend to be rather exuberant in their fear and would therefore likely sway TIPS yields accordingly. One could argue that an efficiently operating market would attract contra trades from those without such a concern for future inflation and neutralize the market to reflect an accurate yield. However, in reality, those contra trades are typically directed to the traditional treasury market because of its much higher liquidity characteristics thereby exaggerating the spread between TIPS yields and traditional bonds yields.

Secondly, certainly in respect to the market for traditional treasury securities, the TIPS market is infinitely smaller and therefore much more illiquid. One characteristic of an illiquid market for debt securities in general is investors' tendency to simply hold their security to maturity rather than accept a discount for illiquidity if they sold their bond prior to maturity. For example, if inflation concerns were to ease, many holders of TIPS would simply hold their TIPS investments anyway rather than realize an illiquidity discount upon selling the TIPS. The natural effect of this tendency would be to understate the actual anticipated inflation rate simply because the TIPS price would be artificially higher than it would be in a more liquid market.

Carlstrom & Fuerst did argue that these two problematic characteristics of TIPS were in fact countervailing and would therefore act to some degree to cancel each other out. (Carlstrom & Fuerst, January, 2005) In light of these pitfalls of TIPS yields, it is important to be careful about using TIPS yields to make assessments regarding future inflation rates.

I believe these pitfalls are largely irrelevant for the purposes herein as I am simply attempting to observe changing market sentiment in regards to liquidity demand over a relatively short period. Any error between actual inflation rates and those predicted by TIPS yields would most likely be constant (or static in magnitude) and therefore irrelevant when measuring market sentiment. I am simply attempting to measure the direction of investor sentiment towards future inflation rates and pricing in order to assess whether or not the stimulus from quantitative easing is effective or not. Whether or not this TIPS method can accurately predict actual inflation rates is not important for the purposes of this assessment.

Employing this “TIPS method” allows a simple assessment of prices and price stability. Under this method, the real interest rate (r) is simply set at the TIPS yield. This assumption allows the following basic equation:

$$\pi = i - r \text{ Where } \pi = \text{anticipated inflation rate (prices), } i = \text{(nominal) treasury yield, } r = \text{(real) TIPS yield.}$$

In order to make this assessment as realistic as possible, I have chosen to analyze 5 year maturities in so far as that is the earliest maturity of TIPS that the US Treasury issues. Illustrated below in figure 8 are representations of price stability during the credit crisis based on this TIPS method. The data used is reproduced in Appendix C.

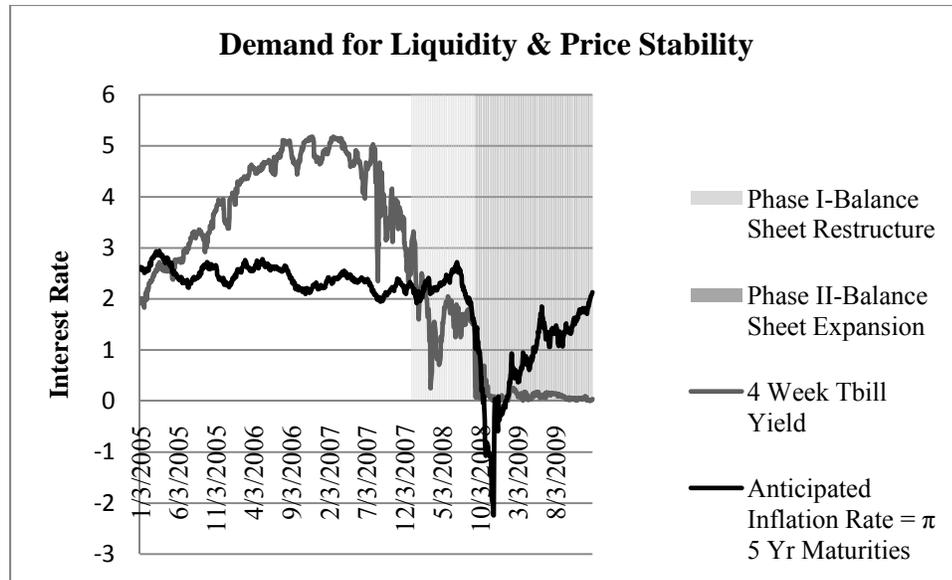


Figure 8 (Federal Reserve, 2005-2009)

For reference and effect, I have elected as well to illustrate the best available representation of the extreme demand or preference for liquidity during this period by also plotting the yield on the 4 week US T-bill, which is certainly considered the most short term and liquid security available. The extreme demand for only the most liquid securities can be seen convincingly as the yield on the 4 week US T-bill fell from 5.07% in July, 2007, which marks the commencement of the Phase I quantitative easing, to basically zero by the climax of the crisis in mid September, 2008. In fact, as the chart illustrates as well, the demand for liquidity had been rising for some time prior with the 4 week T-bill yield declining for several months, albeit in fits and starts, even prior to the Phase I efforts. This additional liquidity demand would certainly, at least in part, have been attributable to the conventional monetary policy measures in effect at the time. Though not illustrated in figure 8, the fed funds rate was cut from 5.25% in July, 2007 to 3.18% by the time the Phase I quantitative easing began in January, 2008.

The net effect in respect to price stability can be seen in a relatively stable Anticipated Inflation Rate (π) through July, 2008. Referencing my statement from Chapter 1 that “the Federal Reserve’s conventional monetary easing worked in textbook fashion” is further supported in this respect in figure 8, at least through July, 2008.

However, as the events of the credit crisis of 2008 began to unfold and financial institutions began to fail in March 2008, as described in detail earlier, the demand for liquidity as represented by the 4 week US T-bill yield began to accelerate beyond levels that the Federal Reserve could accommodate or absorb. It was in September, 2008 when the wholesale failure of the financial institutions described earlier so frightened and shocked the markets that the demand for liquidity climaxed. In order to satisfy the excessive liquidity demand, net “selling of illiquid assets ensued in order to satisfy exceedingly high liquidity demand, which necessarily generated price discounts.”

Utilizing the TIPS method for estimating price stability, rather instability, generated a -1.40% rate of inflation (that is price deflation) by November, 2008 (figure 8). It seems reasonable to conclude that the demand for liquidity at any price had trumped any reasonable valuation metric for the underlying assets. Thus is the essence of “panic selling.” Furthermore, I would argue that without the Phase II quantitative easing campaign that commenced at the absolute peak of liquidity demand and trough of price deflation as seen in figure 8, prices most certainly would have continued to deteriorate until the market cleared itself naturally. In the vacuous pricing environment at the time, I fear that realization quite literally meant that everyone who wanted or needed liquidity was liquidated, which in this context is synonymous with bankrupted.

As the Federal Reserve poured liquidity into the system by means of its phase II monetary efforts, it can be seen in figure 8 the nearly immediate relief to pricing expectations, and therefore price stability as measured by π . Simultaneously, the Federal Reserve held nominal short term fed funds rates at near zero while the pricing/inflation environment improved. Thus, according to the equation for determining real interest rates ($r = i - \pi$), the demand for liquidity also dropped dramatically over the same period. As further evidence supporting the success of the phase II quantitative easing campaign, the deflationary pricing spiral immediately reversed course and by December, 2009 had more or less resumed an anticipated inflation rate of 1.91%, which is certainly more in line with the long term trend in the US, generally considered to be 2-3% CPI growth.

Therefore, in respect to the first assessment of quantitative easing, and based on this evaluation of price stability and the general demand for liquidity, it seems fairly apparent that quantitative easing did successfully arrest the most destructive period of pricing instability since the Great Depression. The effort did successfully restore confidence to the market place with a very large and very credible “buyer of last resort” that effectively placed a bid in the market where no other sufficient bid was forthcoming.

The degree to which these aggressive liquidity measures of the Federal Reserve can be credited with sparking a recovery is somewhat more elusive. As was the case with the Japanese analysis, at the time of this writing, the US economic recovery is still somewhat tenuous even 20 months after the phase II quantitative easing was initiated. Certainly, most economic measures are now improving with the exception of employment. However, consistent with the conclusions drawn of the Japanese analysis as well as the well known “pushing on a string” dilemma, I suspect that the US

quantitative easing campaign will mostly be credited with shoring up the banking system, and nothing more. That suspicion is certainly supported by statistics from the Federal Reserve that show bank reserves ballooning during the period that quantitative easing was employed (figure 3 reproduced).

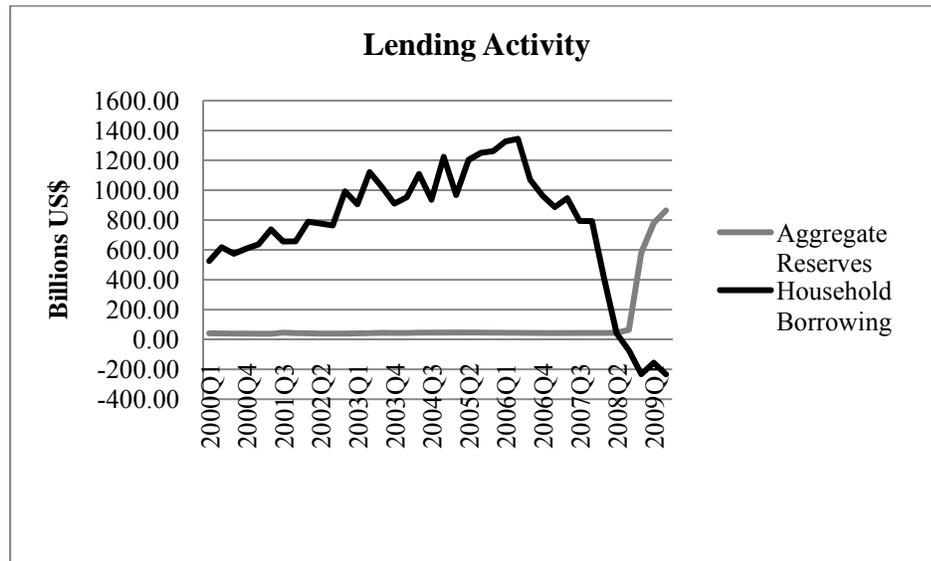


Figure 9 (Figure 3 reproduced)

Obviously, a healthy banking sector is a prerequisite to any capital-centric economy in order to direct capital from savers to borrowers and from investors to innovators. More specifically, banks need to be adequately capitalized in order to foster lending and the general flow of credit. So to the extent that phase I and phase II quantitative easing accelerated a recovery in the balance sheets of the US banking and financial industry, I would argue that it should be credited with at least partially accelerating the recovery of a much more solvent and liquid banking and financial sector. It should therefore be presumed that an eventual resumption of aggregate demand and lower unemployment built on the back of a healthy flow of credit and investment underwritten by these same financial intermediaries would most certainly take place

much sooner than it would have otherwise, that is in the absence of quantitative easing where the whole system had been allowed to clear naturally in a laissez-faire free market purge.

To be sure, numerous other factors would need to be considered and credited when doling out credit for an eventual recovery of the broad economy, not the least of which would be the massive fiscal stimulus package of the Obama administration. However, in deference to the aforementioned “pushing on a string” dilemma that is apparently a characteristic of monetary easing in general, both conventional and unconventional, until a genuine appetite for risk resumes and individuals, institutions, and businesses collectively can justify investment projects, as was the case with the Japanese analysis, the mountains of excess reserves created will simply sit by idly in bank vaults. In the case of the US, banks have been criticized almost daily by both the Obama Administration and the financial press in their perceived unwillingness to lend. The reality, I would argue, is that these banks and financial institutions are in the business of making sound loans and investment decisions.

Obviously, that statement will raise some eyebrows in light of the reckless behavior of banks lending practices the past few years, but generally speaking and for several hundred years, banks and financial institutions have been prudent stewards in this respect. As several banks have argued, the investment climate is simply not conducive to lending right now, especially relative to the massive amounts of liquidity that have been created and are now sitting on reserve. (Department of the Treasury, 2009, p. 10) There is quite simply too much excess capacity, both labor and capital, to warrant new investment.

Therefore, in respect to the ability of quantitative easing to actually spark an economic recovery, I would conclude that it is a warranted practice under extreme conditions that can restore the credit environment and make lending and the extension of credit more conducive. Ultimately, however, a real recovery will depend on the restoration of the flow of real transactions such as; consumption, investment, inventories, and employment. Unfortunately, these things just take time. Excess inventories have to be taken down or depleted before they can be rebuilt and excess manufacturing capacity has to be reemployed or depreciated before anyone will consider any new investments or rehiring.

My final analysis of quantitative easing will center on the much publicized concern that the mountains of liquidity created will inevitably create a hyperinflationary environment. I will assume a minor liberty in this respect as a popular criticism and concern voiced regularly in the media is in respect to the inevitable inflationary impact of quantitative easing. Insofar as engineering an inflationary price environment is actually the stated goal in combating and reversing the deflationary environment, I am going to assume that an unacceptably high level of inflation is really more the concern.

The first step in this analysis is to recognize that a deflationary environment where aggressive quantitative easing is in effect will by definition generate a rising real interest rate. In reviewing the calculation for the real interest rate:

$$r = i - \pi \text{ where, } r = \text{real interest rate, } i = \text{(nominal) treasury yield, and } \pi = \text{anticipated inflation rate (prices)}$$

The problem arises in that a deflationary environment where π is negative, the above equation will require subtracting a negative number from the nominal interest rate,

which is assumed to be at or near zero to begin with. Therefore, the equation will generate a positive real interest rate in a deflationary environment, which is not particularly useful or accurate in trying to assess the actual pricing environment or the impact of quantitative easing.

Therefore, it is necessary to revise the equation in a deflationary environment to measure instead the optimal interest rate as described earlier as a largely theoretical interest rate similar in character to the Wicksellian natural interest rate. It is an interest rate that, if attained, would clear the supply of money with the demand for investment capital from investors. As the 2007-2009 deflationary spiral pointed out, where π was negative, the above equation would need to be modified to prevent subtracting a negative number in order to generate the optimal interest rate. Thus, I have modified the equation as follows to correct that problem:

$$r' = i - |\pi| \text{ where, } r' = \text{optimal interest rate, } i = \text{(nominal) treasury yield, and } \pi = \text{anticipated inflation rate (prices)}$$

This revised equation will generate an interest rate, defined here as the optimal interest rate, which would effectively clear the market. In a deflationary environment, the optimal interest rate is obviously negative as was experienced during the 2007-2009 credit crisis. An interest rate environment where the prevailing optimal interest rate is negative obviously implies that subsidies are necessary in order to attract investment capital. In this case, the subsidies were provided through quantitative easing and a commitment to a zero rate conventional monetary policy.

The purpose in placing so much emphasis on the optimal interest rate is that it may very well help to equate r' in a deflationary environment to what Keynes described

as the schedule of the Marginal Efficiency of Capital, defined by Keynes as “the aggregate generalization of the schedule for the *expectation* of yield and of the current supply price of an asset.” (Keynes, 1964, pp. 135-137) Simply stated, anticipated investment returns (the expectation of yield) simply have to justify the optimal interest rate expense, as well as some other risks, costs, and hassles (the current supply price of the asset), before any demand for capital can be expected to resume. In an extremely distressed pricing environment, such as was experienced during the 2007-2009 credit crisis, instances where $|\pi|$ generated the expectation of negative investment yields or a negative optimal interest rate occurred regularly. That is, anticipated investment returns were negative and therefore no investment demand was forthcoming, which is another way of describing the pushing on a string dilemma discussed above.

Krugman discussed this elementary prerequisite for investment demand as well in a more contemporary context. (Krugman, 2010) He pointed out that as long as anticipated investment returns are negative, which he defined as the real/optimal interest rate less GDP, there really is no danger of excessive price inflation simply because no investment capital will be forthcoming. Essentially, Krugman argues that there is no economic reason why the central bank could not assume an even more aggressive posture in its quantitative easing strategy and continuously flood the market with liquidity until it runs up against debt service limitations. So long as longer term interest rates remain low, the central bank could take advantage of that environment and subsequently service that debt out of a correspondingly low percentage of GDP. The only real limitation to such a maneuver would be the political uproar.

Therefore, in respect to the issue at hand of whether or not quantitative easing will inevitably create an unacceptably high level of inflation, given the revised equation for deriving the optimal interest rate, I would argue it is not a very likely scenario for the following reason. Once a recovery takes hold and a positive optimal interest rate returns, which is after all a market determined measure of the demand for investment capital (or a Marginal Efficiency of Capital that is conducive to investment), the market has the built in capacity to successfully determine a corresponding nominal interest rate that will prevent an excessive inflation situation from developing. Here again, as there is no reciprocal to the lower bound of nominal interest rates, the nominal interest rate will be free to rise as much as necessary in order to stem a potentially high inflation rate. Thus, the question at hand becomes one more concerned with what the upper bound for interest rates that might be necessary to contain any anticipated inflation and whether or not such a rate acceptable.

For two reasons, the Federal Reserve should be able to contain nominal interest rates within what was defined earlier (figure 4) as a normal range through primarily conventional monetary policy. First of all, and at the same time, as the market derived optimal interest rate rises naturally, so too should the synthetic fed funds rate. Reflecting conventional monetary policy, much of the liquidity created during the crisis will simply be bought back and retired by the Federal Reserve thereby contracting naturally its balance sheet. It is difficult to speculate how much of an impact on the Fed's balance sheet that normal "rate hikes" might have, but I would certainly expect it to be substantial.

Secondly, and potentially even more powerful, the Federal Reserve will be in a position to start selling much of the assets that were purchased in the fire sale. Not only should demand for these same assets have returned by virtue of the higher interest rate/higher Marginal Efficiency of Capital environment, but in selling these assets, the Federal Reserve will be accepting as payment the very liquidity they created, which they would simply retire. As the demand for liquidity subsides and the demand for risk returns, the Federal Reserve will once again be in a position to satisfy the market with asset sales. I recognize that such activity does fall outside of what would be considered conventional monetary tightening; however, it does represent a return or a move back towards conventional methods.

Therefore, I would submit that the only real risk for excessive inflation is whether or not the Federal Reserve will allow policy to set the optimal interest rate that clears investment demand with investment supply at some sustainable level and summarily take its own monetary clues from these reliable sources. As discussed in Chapter 1, they failed rather remarkably in this regard throughout 2002 – 2004. Consequently, it cannot really be determined with any degree of confidence how the Federal Reserve will behave in this respect. Unfortunately, this is where the story and the analysis begin to become more political in nature. Certainly, the Federal Reserve has the power of independence from political forces to allow natural market forces to reabsorb the excess liquidity. The extent to which they will heed these market based clues, however, is another question I cannot begin address.

Therefore, in respect to the likelihood that quantitative easing will necessarily generate excessive inflation once the business cycle starts up again, I would conclude that

for two reasons, it is not very likely. First, the market for interest rates is naturally very well equipped to absorb the excess liquidity through higher interest rates once the investment climate improves. The Federal Reserve will, or at least should, be ready to aggressively begin absorbing and retiring liquidity as well through conventional monetary rate hikes and, for lack of a better term, unconventional quantitative tightening.

Secondly, insofar as there is no reciprocal to the lower bound for nominal interest rates in an inflationary environment, the nominal interest rate will be free to rise to whatever level is necessary to stem inflation. Because there is generally a realistic level that one can expect from investment returns, that is under normal and unsubsidized conditions, price inflation and nominal interest rates should be bound within normal and long term average ranges.

Chapter Four: Conclusions

Under ordinary circumstances and for decades, conventional monetary policy measures have proven to be very effective tools at a central bank's disposal for stimulating or moderating economic activity. However, under extraordinary circumstances such as those exhibited in the recent global credit crisis these conventional tools will have limited effect. Where a credit crisis is characterized by extraordinary liquidity demand that exceeds even what can be generated by a zero interest rate policy, the apparent optimal interest rate must certainly be negative. Therefore, conventional monetary policy tools will fall short simply because the central bank cannot cut nominal interest rates below zero.

After all conventional tools are exhausted without fully satisfying liquidity demand; a central bank may move to engage in more aggressive and controversial monetary tactics which have been referred to herein as unconventional monetary tools. Within this paper, the primary unconventional tool under examination has been quantitative easing. Two such instances have been attempted in recent history to a complete enough degree to draw some analysis and conclusions. The Bank of Japan used quantitative easing coordinated with a stated zero interest rate policy to combat a persistent and grating deflationary environment from 2001-2005 with mixed results. Again, but in reaction to a much more climatic and distressed environment, the Federal

Reserve engaged its own brand of quantitative easing during the global economic crisis of 2007-2009, again with mixed results.

It was consistent in both the Japanese case as well as the United States case that quantitative easing did successfully arrest the deflationary spiral, thereby preventing a complete collapse of prices and the accompanying spread to the financial sector and the economy in general. This was accomplished first by expanding the types of assets that central banks would either accept as collateral or by purchasing outright from member banks progressively more risky asset categories. Second, as liquidity demand required, the central bank expanded its balance sheet, in the case of the United States very aggressively, to accept as collateral or to purchase outright huge sums of illiquid bank assets.

However, just as the “pushing on a string” dilemma renders conventional monetary policy rather ineffective in actually generating economic growth, so too it appears equally difficult to spark a recovery from quantitative easing alone. The conditions necessary for economic recovery will necessarily require, as Keynes described, a Marginal Efficiency of Capital that is conducive to investment. The availability of capital and a renewed and recapitalized banking sector is certainly a prerequisite to recovery, but until an outright demand for investment capital returns, the massive reserves available in the banking sector will undoubtedly sit idle. Until investments in general can reasonably be expected to return a positive absolute yield, there will simply be very little demand for investment capital.

Finally, it does not seem too likely that quantitative easing will spark unacceptably high inflation. Although the Japanese case ended before a complete assessment of the potential for high inflation could be made, it certainly should be noted that inflation was never a problem in the aftermath of Japanese quantitative easing and therefore will not necessarily create unreasonably high inflation. In review of the US quantitative easing case, it should be understood that no reciprocal to the lower bound of nominal interest rates exists. Therefore, in such a highly developed and liquid market for interest rates, conventional monetary policy should prove perfectly capable of withdrawing the necessary stimulus through conventional means long before inflation can accelerate to an unacceptable level.

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Appendix A

Select US Banking Statistics

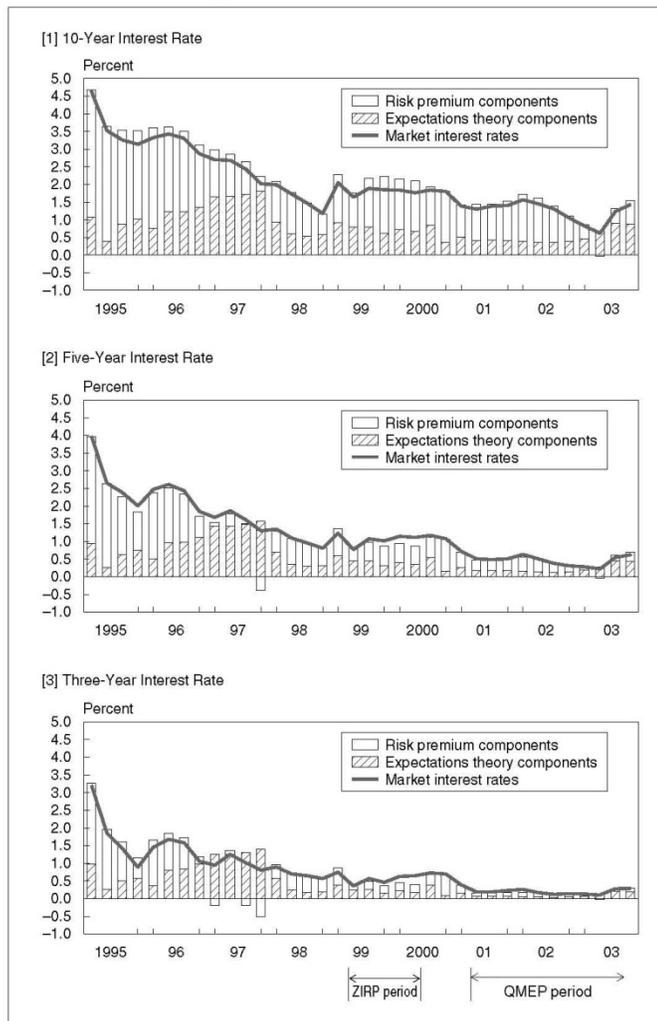
	Banking Institutions	Rate of Consolidation	Total Assets x 1mm	Average Total Assets x 1mm	Average Assets Growth Rate
1980	14434		\$ 1,854	\$ 0.13	
1981	14414	-0.14%	\$ 2,026	\$ 0.14	9.43%
1982	14451	0.26%	\$ 2,193	\$ 0.15	7.97%
1983	14469	0.12%	\$ 2,342	\$ 0.16	6.66%
1984	14496	0.19%	\$ 2,508	\$ 0.17	6.89%
1985	14417	-0.54%	\$ 2,730	\$ 0.19	9.45%
1986	14210	-1.44%	\$ 2,940	\$ 0.21	9.26%
1987	13723	-3.43%	\$ 2,999	\$ 0.22	5.63%
1988	13137	-4.27%	\$ 3,130	\$ 0.24	9.02%
1989	12715	-3.21%	\$ 3,299	\$ 0.26	8.90%
1990	12347	-2.89%	\$ 3,389	\$ 0.27	5.79%
1991	11927	-3.40%	\$ 3,430	\$ 0.29	4.77%
1992	11467	-3.86%	\$ 3,506	\$ 0.31	6.32%
1993	10961	-4.41%	\$ 3,707	\$ 0.34	10.61%
1994	10453	-4.63%	\$ 4,012	\$ 0.38	13.49%*
1995	9943	-4.88%	\$ 4,315	\$ 0.43	13.07%
1996	9530	-4.15%	\$ 4,582	\$ 0.48	10.79%
1997	9144	-4.05%	\$ 5,018	\$ 0.55	14.14%
1998	8777	-4.01%	\$ 5,442	\$ 0.62	12.98%
1999	8582	-2.22%	\$ 5,735	\$ 0.67	7.78%
2000	8315	-3.11%	\$ 6,245	\$ 0.75	12.39%
2001	8082	-2.80%	\$ 6,552	\$ 0.81	7.94%
2002	7888	-2.40%	\$ 7,076	\$ 0.90	10.65%
2003	7770	-1.50%	\$ 7,601	\$ 0.98	9.05%
2004	7631	-1.79%	\$ 8,415	\$ 1.10	12.73%
2005	7526	-1.38%	\$ 9,040	\$ 1.20	8.93%
2006	7401	-1.66%	\$ 10,091	\$ 1.36	13.51%
2007	7283	-1.59%	\$ 11,176	\$ 1.53	12.55%
2008	7086	-2.70%	\$ 12,310	\$ 1.74	13.21%

*Riegel-Neal Act

(FDIC)

Appendix B

Estimation of Expectations Theory and Risk Premium Components of Medium-/Long-Term Interest Rates



(Baba, Nishioka, Oda, Shirakawa, Ueda, & Ugai, February 2005, p. 75)

Appendix C

Yield Data in TIPS Method for Calculating Anticipated Inflation

	5 Yr T-note Yield = i	5 Yr TIPS Yield = r	Anticipated Inflation Rate = π	Optimal Interest Rate = r'
Jan-06	4.35	1.93	2.42	1.93
Feb-06	4.57	1.98	2.59	1.98
Mar-06	4.72	2.09	2.63	2.09
Apr-06	4.90	2.26	2.64	2.26
May-06	5.00	2.30	2.70	2.30
Jun-06	5.07	2.45	2.62	2.45
Jul-06	5.04	2.46	2.58	2.46
Aug-06	4.82	2.27	2.55	2.27
Sep-06	4.67	2.38	2.29	2.38
Oct-06	4.69	2.51	2.18	2.51
Nov-06	4.58	2.41	2.17	2.41
Dec-06	4.53	2.28	2.25	2.28
Jan-07	4.75	2.47	2.28	2.47
Feb-07	4.71	2.34	2.37	2.34
Mar-07	4.48	2.04	2.44	2.04
Apr-07	4.59	2.12	2.47	2.12
May-07	4.67	2.29	2.38	2.29
Jun-07	5.03	2.65	2.38	2.65
Jul-07	4.88	2.60	2.28	2.60
Aug-07	4.43	2.39	2.04	2.39
Sep-07	4.20	2.14	2.06	2.14
Oct-07	4.20	2.01	2.19	2.01
Nov-07	3.67	1.35	2.32	1.35
Dec-07	3.49	1.27	2.22	1.27
Jan-08	2.98	0.86	2.12	0.86
Feb-08	2.78	0.65	2.13	0.65
Mar-08	2.48	0.23	2.25	0.23
Apr-08	2.84	0.62	2.22	0.62
May-08	3.15	0.79	2.36	0.79
Jun-08	3.49	0.97	2.52	0.97
Jul-08	3.30	0.84	2.46	0.84
Aug-08	3.14	1.15	1.99	1.15
Sep-08	2.88	1.55	1.33	1.55
Oct-08	2.73	2.75	-0.02	2.71
Nov-08	2.29	3.69	-1.40	0.89
Dec-08	1.52	1.76	-0.24	1.28
Jan-09	1.60	1.59	0.01	1.59
Feb-09	1.87	1.29	0.58	1.29

Mar-09	1.82	1.23	0.59	1.23
Apr-09	1.86	1.11	0.75	1.11
May-09	2.13	1.07	1.06	1.07
Jun-09	2.71	1.18	1.53	1.18
Jul-09	2.46	1.18	1.28	1.18
Aug-09	2.57	1.29	1.28	1.29
Sep-09	2.37	1.03	1.34	1.03
Oct-09	2.33	0.83	1.50	0.83
Nov-09	2.23	0.48	1.75	0.48
Dec-09	2.34	0.43	1.91	0.43

(Federal Reserve, 2005-2009)