

Looking Back at Lehman: An Empirical Analysis of the Financial Shock and the Effectiveness of Countermeasures

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ABSTRACT (243 words)

This paper uses a daily measure of U.S. financial conditions called the Bloomberg Financial Conditions Index to assess the financial shock associated with Lehman's bankruptcy and the effectiveness to date of the strong countermeasures initiated by policymakers. In contrast to the analysis of Lehman skeptics such as John Taylor (2008, 2009) and John Cochrane and Luigi Zingales (2009), the evidence we present supports the view of many practitioners that the decision not to rescue Lehman represented an immediate and massive shock to the financial system that was larger by an order of magnitude than anything seen over nearly two decades. Since this shock came against the backdrop of already highly stressed financial conditions and an ongoing recession, it lends support to the view of many economists that the Lehman decision was a significant policy error. The paper also illustrates how the Bloomberg index can be used to conduct an event analysis to help gauge the effectiveness of particular countermeasures and focuses on measuring the largest movements in overall financial conditions on a one-day and three-day basis during the critical period of September through October 2008. Finally, the paper uses a standard VAR model and Granger causality tests to demonstrate that the Bloomberg Index can be a useful leading indicator of both bank lending conditions and overall GDP growth, and that such analysis can help calibrate the degree of effectiveness of unconventional policy measures in restoring growth in the aftermath of a significant financial shock.

Keywords: credit crisis, recession, prediction, macroeconomics, monetary policy, financial markets, business cycle, Lehman bankruptcy

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Looking Back at Lehman: An Empirical Analysis of the Size and Timing of the Shock and the Effectiveness of Countermeasures

“...identifying the decisions over the weekend of Sept 13 and 14 as the cause of the increased severity of the crisis is questionable. It was not until more than a week later that conditions deteriorated.”

John Taylor, November 2008

“Research shows the failure to rescue Lehman did not trigger the fall panic.”

John Taylor, February 2009

“...main risk indicators only took off after Treasury Secretary Henry Paulson and Fed Chairman Ben Bernanke's TARP speeches to Congress on Sept. 23 and 24—not after the Lehman failure.”

John Cochrane and Luigi Zingales, September 2009

1. Introduction

For most participants in financial markets, and probably for most casual observers, the decision by policymakers not to rescue Lehman Brothers in September 2008 clearly triggered the global financial panic. Almost immediately, it seemed, equity markets went into a free fall, credit markets seized up, and the global economic outlook darkened dramatically. From this viewpoint, the authorities' decision to let Lehman fail looks with hindsight to have been a major policy error that imposed enormous and perhaps unnecessary costs on the global economy.

As in Kurosawa's classic movie *Rashomon*, however, different observers can witness the same event from such vastly different perspectives that even key facts about the event may come into doubt. So perhaps it should be no surprise that a number of influential economists have made a case that the Lehman decision did not trigger the fall panic, which they see as having its roots in many other failures of government. These include the loose monetary policy that was a catalyst for the housing boom and what they perceive as panicked, ill-conceived, and unnecessary responses to the Lehman bankruptcy including the original vague proposals for the Troubled Asset Relief Program (TARP). For convenience, we will call proponents of this viewpoint “Lehman skeptics,” with some of the most prominent Lehman skeptics including John Taylor, John Cochrane and Luigi Zingales as illustrated in the above quotes.

In this paper, we will argue that the facts are clear: the Lehman bankruptcy represented a massive financial shock that was clearly the trigger for the fall 2008 panic. As Senator Daniel Patrick Moynihan once said, “everyone is entitled to his own opinion, but not to his own facts.” We will argue here that a broad-based assessment of financial conditions, rather than a selective focus on some potentially misleading indicators, supports the conventional wisdom about the Lehman shock. Specifically, using a daily measure of financial conditions that spans nearly two decades we show that the immediate market reactions to the Lehman event represented the most severe shock to financial conditions in the history of the database. Although there remains ample room for different opinions about root causes and appropriate responses to the fall 2008 panic, we believe there is little

reason to dispute the severity of the financial shock and attendant economic costs associated with the decision to let Lehman fail.

Our analysis is based on a composite index of financial conditions called the Bloomberg Financial Conditions Index (BFCIUS Index) provided daily by Bloomberg LLP, a well-known provider of financial news, data, analytics and New York City mayors. The plan of this paper is as follows: First, we will describe the Bloomberg index, the rationale behind its construction, and summarize key statistical characteristics of the data. Second, we will review trends in the data both before and after the Lehman shock and contrast the message of that data with the message of data emphasized by the Lehman skeptics. Third, we will explain why a composite financial index such as the Bloomberg index is likely to provide a superior assessment of the multiple impacts of the Lehman shock than the data emphasized by the Lehman skeptics. In particular, we will use normalized scores of one-day and three-day changes in the Bloomberg index to identify major shocks and turning points in the critical September through October 2008 period and associate those with significant market and/or policy events. Finally, we will document the usefulness of the Bloomberg index for assessing the likely impact of changes in financial conditions on both bank lending conditions and future economic activity. We will conclude with some suggestions for further research.

2. The Bloomberg Financial Conditions Index

In recent years, researchers at most of the world's major investment banks have developed various types of financial conditions indexes to try to gauge the potential impact of monetary policy on subsequent economic and financial outcomes. Many of these indexes use data with monthly frequency, which reduces their usefulness during a rapidly unfolding financial crisis.

In response to the financial crisis in 2008, Bloomberg LLP developed the Bloomberg Financial Conditions Index (BFCIUS Index) which is updated on a daily basis.¹ The index was launched in August 2008 and is based on daily data going back to the beginning of 1991. Its creator, Michael Rosenberg, has indicated that the index was inspired by then Federal Reserve Governor Frederic Mishkin's January 2008 analysis of how a central bank should respond to serious financial disruptions which stressed the importance of monitoring financial conditions in times of financial disruptions. According to Mishkin, "when financial markets are working well, monetary policy can respond primarily to the incoming flow of economic data about production, employment and inflation. When a financial disruption occurs, however, greater consideration needs to be given to indicators of market liquidity, credit spreads and other financial market measures that can provide information about changes in the magnitude of tail risks to the macroeconomy."²

In launching the Bloomberg index, Rosenberg referred to a speech by Federal Reserve Chairman Ben Bernanke on March 2, 2007 which also highlighted the interaction of monetary policy and overall financial conditions as follows:

¹ Rosenberg (2008)

² Mishkin (2008)

“Monetary policy works in the first instance by affecting financial conditions, including the level of interest rates and asset prices. Changes in financial conditions in turn influence a variety of decisions by households and firms, including choices about how much to consume, to produce, and to invest.”³

A flow chart illustrating the role of financial conditions in the transmission of monetary policy is shown in Figure 1.

With the analysis of both Mishkin and Bernanke in mind, Rosenberg’s team at Bloomberg set out to create a daily index of financial conditions to track the overall stress in the U.S. money markets, bond markets, and equity markets. The goal was practical rather than academic: “to keep market participants abreast of the changes in financial conditions that might have a direct impact on their investment decisions.” The fact that the index was created before the Lehman shock and with such a practical intent may lend credence to its usefulness for making an objective assessment of whether the decision to let Lehman fail was a significant policy error. In other words, since the index was created prior to the Lehman shock, it cannot be argued that it was created with the benefit of “20/20 hindsight” to bias the assessment of the Lehman decision in any particular direction.

The Bloomberg index is a weighted average of ten components shown in Figure 2 that include three money market indicators, five bond market indicators, and two equity market indicators. The index is based on normalized scores for the 1991-to-mid-2007 period for each indicator, with the entire index also normalized and expressed as a Z-score (standard deviations from the norm for the entire period). In August 2008, a Bloomberg research publication documented that a wide range of indicators suggested at that time – ahead of the Lehman shock – that financial market conditions were already at “extremely depressed levels” with the Bloomberg index roughly 2.2 standard deviations below its 19-year norm at that time. That was reflected in elevated money-market spreads (such as the Libor/OIS spread), bond market spreads (such as the Baa-Corporate/Treasury spread), and the sharp decline in U.S. equity prices.

The low reading on the Bloomberg index was also consistent with the IMF’s *Global Financial Stability Report Market Update* of July 28, 2008 which stated that “credit risks remain elevated and systemic strains in funding markets continue despite official action, while the low level of risk appetite remains unchanged.”

3. Tracking Major Trends in the Bloomberg Index and Other Measures of Stress Following the Lehman Decision

In Figure 3, we show a simple time series representation of the Bloomberg index since its inception on January 2, 1991. We have added a vertical dotted line on Friday, September 12, 2008 to indicate the last trading day before Lehman’s bankruptcy filing the following Monday. This graph makes it clear that some type of seismic financial event occurred around the time of the Lehman bankruptcy, with the Bloomberg index moving from an already “extremely depressed” level of -2.2 on September 12 to a dramatically negative -11.5 less than a month later when it

³ Bernanke (2007)

bottomed out on October 10. Note that the Bloomberg Index is a standardized measure expressed in standard deviations relative to the 1991-to-mid-2007 norm. The limits of using standardized measures for financial data is evident since a reading of -11.5 on the index is simply not supposed to occur in the neat, theoretical world of Gaussian bell curves. In a Gaussian world, the probability of an 11.5 standard deviation event would be something close to 1 in 10 octillion (where 1 octillion can be represented as 1 followed by 27 zeros). Of course it is by now well known that financial data distributions are frequently characterized by “fat tails” so that such probability calculations are more entertaining than enlightening. But suffice it to say that the deterioration of financial conditions following the Lehman shock was immediate and massive compared to anything seen in the prior period of nearly twenty years, a period that Mr. Bernanke and others have referred to as the “Great Moderation.”

Lehman skeptics do not deny that financial conditions deteriorated severely in the wake of the Lehman bankruptcy. Instead, the argument is that Lehman’s failure itself was not necessarily the trigger since certain measures like the 3-month Libor-Overnight Interest Rate Swap (OIS) spread did not move immediately in response to the Lehman news. An influential Lehman skeptic, John Taylor of Stanford University, put the argument this way:

“Recall that for the year previous to the events in Figure 4, the spread had been fluctuating in the 50 to 100 basis point range which was where it was through the first half of September 2008. You can see that the spread moved a bit on September 15th, which is the Monday after the weekend decisions not to intervene in Lehman Brothers. It then bounced back down a little bit on September 16 around the time of the AIG intervention. While the spread did rise during the week following the Lehman Brothers decision, it was not far out of line with the events of the previous year.

“On Friday of that week the Treasury announced that it was going to propose a large rescue package, though the size and details weren’t there yet. Over the weekend the package was put together and on Tuesday September 23, Federal Reserve Board Chairman Ben Bernanke and Treasury Secretary Henry Paulson testified at the Senate Banking Committee about the TARP, saying that it would be \$700 billion in size. They provided a 2-1/2 page draft of legislation with no mention of oversight and few restrictions on the use. They were questioned intensely in this testimony and the reaction was quite negative, judging by the large volume of critical mail received by many members of the United States Congress. As shown in Figure 4 it was following this testimony that one really begins to see the crises deepening, as measured by the relentless upward movement in Libor-OIS spread for the next three weeks. Things steadily deteriorated and the spread went through the roof to 3.5 per cent.”⁴

We have reproduced Taylor’s event study chart as Figure 4 (and changed the above quote to refer to our Figure 4 instead of Figure 13 as it appeared in his paper). John Cochrane and Luigi Zingales made a very similar argument to Taylor’s, using the

⁴ Taylor (2008)

same data on the Libor-OIS spread and adding data on Citigroup CDS spreads, which reflect the cost of buying insurance against the default of Citigroup's bonds. We have reproduced their data, in Figure 5, which led them to the following conclusion:

“Which of these events set off the financial and economic crisis by freezing lending to commercial banks? The nearby chart shows that the main risk indicators only took off after Treasury Secretary Henry Paulson and Fed Chairman Ben Bernanke's TARP speeches to Congress on Sept. 23 and 24—not after the Lehman failure...

“... Why? In effect, these speeches amounted to "The financial system is about to collapse. We can't tell you why. We need \$700 billion. We can't tell you what we're going to do with it." That's a pretty good way to start a financial crisis.”⁵

In short, in the view of the Lehman skeptics it was not the decision to let a systemically important institution fail that was the proximate trigger to the financial crisis. Instead, it was subsequent mistakes in how policymakers handled the issue that were primarily at fault.

One way to rebut this view is to question the validity of the data series they used in tracking financial market responses to the Lehman news. This has been done forcefully by hedge fund manager and Columbia University professor Richard Robb, who questioned specifically whether data on Libor rates or OIS rates were actually meaningful at a time when markets had seized up and little trading activity was occurring in those markets.⁶ A similar observation could be made with respect to the Citigroup CDS spread: trying to buy insurance on Citigroup bonds at that time would have been the equivalent of trying to buy home insurance on a home that was already on fire. As Robb notes:

“But a better definition of Libor under the circumstances was ‘the rate at which banks said they can borrow’. Libor is the result of a survey, not a measure of actual transactions. In the week of September 15 last year, big banks refused to settle foreign exchange with each other. They were not lending interbank for three month terms, so Libor during that week tells us little.

“We could say the same thing for OIS. Volume was light to nonexistent in the week of September 15 last year. What we do know is that three-month T-bills traded at 0.04 per cent on September 17, down from 1.47 per cent on Friday September 12. These are real data that ought to impress the professors that the market was breaking down as fast as it knows how.

“John Taylor, the father of the Lehman-was-no-big-deal thesis, wrote in a Wall Street Journal op-ed last year that spreads between T-bills and Libor ‘remained in that range [of the previous year] through the rest of the week’ after Lehman’s demise. In fact, in the year prior to Lehman’s collapse, the

⁵ Cochrane and Zingales (2009)

⁶ Robb (2009)

peak spread was 2.05 per cent; on September 17, 2009 it reached 3.00 per cent. (Of course, any conclusions based on Libor that week are equally unreliable.)”

4. An Event Study of the 2008 Fall Panic Using the Bloomberg Index

Although we agree with Robb that the data used by Taylor and other Lehman skeptics was misleading, we do agree with Taylor that rigorous empirical studies of financial markets’ reactions to events associated with the fall panic are important. Taylor framed the argument as follows:

“Many commentators have argued that the reason for the worsening of the crisis was the decision by the U.S. government (more specifically the Treasury and the Federal Reserve) not to intervene to prevent the bankruptcy of Lehman Brothers over the weekend of September 13 and 14. It is difficult to bring rigorous empirical analysis to this important question, but it is important that researchers do so because future policy actions depend on the answer. Perhaps the best empirical analyses we can hope for at this time are “event studies” that look carefully at reactions in the financial markets to various decisions and events.”⁷

For the purpose of such event studies, we believe that the Bloomberg Financial Conditions Index represents reasonable time series evidence for assessing the overall reaction of financial markets to Lehman-related events because its indicators span multiple markets including money, government and municipal bond, corporate bond and equity markets. While it does include some indicators, such as the Libor-OIS spread, whose day-to-day signals might have been misleading due to lack of trading volume, it at least partially makes up for that disadvantage by including a number of other indicators of markets that traded actively at the time such as the equity and commercial paper markets. There may well be better ways to construct a daily index of financial conditions and we will offer some suggestions below. But as a first cut we think the Bloomberg index offers the advantages of being readily available and objective in the sense that it was created precisely with the goal of providing market practitioners with a comprehensive measure of financial conditions.

To provide context for this event study, Table 1 presents descriptive statistics for changes in the Bloomberg index over different frequencies and different time horizons. The data is presented over two time periods (1) the pre-Lehman period of January 1991 through August 2008 and (2) a longer period from January 1991 through September 2009 which includes post-Lehman data as well. The table also includes summary statistics on 1-day, 3-day and 20-day changes since some of the events that are of interest undoubtedly unfolded over multi-day periods.

As is clear from Table 1, the minimum and maximum ranges of the data, as well as measures such as skewness (a preponderance of one-sided moves) and kurtosis (“fat tails”), are far more extreme in the January 1991 through September 2009 sample that includes both pre-Lehman and post-Lehman observations. For example, the most extreme 3-day decline in the index was 2.78 points which happens to represent the

⁷ Taylor (2008)

three days ending September 17, 2008. That was a period that spanned the news of Lehman's filing on September 15th, news on the Reserve Fund crisis on September 16th, and the beginning of a large-scale run on money market funds on September 17th. By the standard of the pre-Lehman data sample, when the mean and standard deviation of typical 3-day moves were 0.00 and 0.20 respectively, the 3-day shock following the Lehman decision was a 13.6 standard deviation event. That was an order of magnitude larger than anything seen in the pre-Lehman data sample. The largest prior 3-day shock according to the Bloomberg index was a 1.27 point decline (a 6.3 standard deviation event) for the 3-day period ending August 31, 1998, a decline that occurred at the time of the LTCM crisis.

The degree to which the Lehman decision represented a massive shock to financial conditions can be seen graphically in Figure 6, which shows 3-day changes in the Bloomberg index measured in terms of cumulative movements in daily z-scores based on norms of the January 1991 through August 2008 period. If this graph is likened to an electrocardiograph, it would date the inception of the "financial heart attack" as the 3-day period spanning September 15-17, 2008 – i.e., the period immediately following the decision not to rescue Lehman. By this measure, the Lehman shock represented the equivalent of a 20.7 standard deviation daily event occurring over three days. Since a one-standard deviation daily price move for the U.S. stock market was about one percent during the pre-Lehman period, this means that the multi-market meltdown that occurred in the immediate aftermath of the Lehman decision was roughly the equivalent of a 21% meltdown in the U.S. stock market in a 3-day period.

Figure 6 also shows that the largest 3-day positive shock over the entire period occurred on the three days ending October 20, 2008. A scan of news headlines and event databases like those maintained by the New York Federal Reserve Bank or the Atlanta Federal Reserve Bank shows no notable market or policy events during that 3-day period. However, the record shows that the Fed announced a \$540 billion Money Market Investor Funding Facility (MMIFFF) on October 21, 2008. This program was designed to help money market mutual funds meet redemption pressures by providing loans from the Fed that could be collateralized with commercial paper and other relatively illiquid assets. Bloomberg News carried the following comments on the MMIFFF program on October 21, 2008.

"The central bank's announcement today 'is a big event,' BlackRock Inc. Chief Executive Officer Laurence Fink said during an earnings conference call with analysts and investors. 'It is the first thawing.'

"BlackRock and JPMorgan were members of the consortium of money managers that put together the plan and presented it to the Fed, people briefed on the matter said."⁸

Although the MMIFFF plan was not announced as of October 20th, a skeptical analyst might suspect that some of the news leaked out to Wall Street trading desks ahead of the announcement. That said, it could simply be the case that the credit market "melt-up" ahead of the October 21st MMIFFF announcement was a delayed reaction to other

⁸ Torres and Condon (2008)

major policy initiatives announced in mid-October including the October 10th announcement of the G-7 Plan of Action and the October 13th announcements that (1) TARP funds would be used for equity injections in major banks and (2) large swap lines had been set up among major central banks. Whatever the trigger, the “credit market melt-up” of October 18-20 was a 17.4 standard deviation event based on daily data, making it roughly the equivalent of a 17% increase in the U.S. stock market over a 3-day period. Accordingly, the events of those days probably deserve greater scrutiny by policy makers, regulators, and academic researchers seeking to understand market responses to news and policy events of those turbulent days.

Tables 2 and 3 list respectively the largest 1-day and 3-day movements (positive or negative) in the Bloomberg index during the September-October 2008 period along with comments on associated market or policy events that were gathered from the previously mentioned events databases of the New York and Atlanta Federal Reserve Banks.⁹ The 1-day changes are depicted graphically in Figure 7 as well.

A detailed analysis of all large movements in financial conditions from that period is beyond the scope of this paper, but we will venture a few comments on this data. Regarding the daily data shown in Table 2, it is notable that the single largest daily negative shock did not occur on September 15th when Lehman filed for bankruptcy. Instead, the largest negative shock occurred on September 29th when Congress voted down the TARP plan proposed by the U.S. Treasury. The second largest negative shock occurred on September 17th when a massive run on money market funds was triggered by news that a major money market fund, the Reserve Fund, had “broken the buck” on the previous day because of its large exposure to Lehman bonds. The September 15th Lehman bankruptcy shock is only the third largest negative shock of this period by this daily measure, although the other large negative shocks can all be viewed as aftershocks triggered by the Lehman decision. Interestingly, the largest daily shock in absolute terms during this period was the previously mentioned and somewhat mysterious “credit market melt up” of October 20th.

In the spirit of Sherlock Holmes’ “dog that didn’t bark,” we would also note some days that did not make the list of top ten shocks: September 23th and September 24th, the days highlighted by Cochrane and Zingales as days when poorly received speeches to Congress by Fed Chairman Bernanke and Treasury Secretary Paulson were supposed to have been the true triggers for panic.¹⁰ Those days were indeed negative (-2.8 and -5.1 standard deviations respectively), but not of the same order of magnitude as the two days following the Lehman decision that apparently triggered the panic (-9.8 and -10.4 standard deviations on September 15th and 17th respectively).

We would also argue that looking at multi-day changes in the Bloomberg index may be more helpful for understanding the impact of the Lehman decision than focusing on daily changes. For example, we think the change in financial conditions in the three days ending September 17th represents a more useful snapshot of the immediate impact of the Lehman decision than a one-day change for a simple reason: it took three days for market participants to absorb the information that Lehman-related

⁹ Federal Reserve Bank of New York (2009) and Dwyer and Tkac (2009)

¹⁰ Cochrane and Zingales (2009)

losses had become a threat to the entire money market fund industry. More broadly, as Richard Robb has observed:

“The other principal mistake of the Lehman deniers is their assumption that the incident unfolded entirely on September 15, 2008 and any effect had to be observable by that morning. But during the final two weeks of September, the market still had to absorb the news that the Securities and Exchange Commission had no plan for an orderly transfer of client assets in the US, while Lehman Brothers International Europe would be handed over to an administration process designed for liquidating grocery stores.”¹¹

In other words, it makes sense to think of the Lehman decision as a major shock that created a chain reaction of events that unfolded over many weeks. Accordingly, many of the sharp moves that occurred on any given day may have been due to unidentifiable events such as major hedge fund liquidations. And while the timing of such events may have been somewhat random, with the benefit of hindsight they may appropriately be viewed as inevitable consequences of the shock triggered by the Lehman decision. From that perspective, the entire move down in the Bloomberg index from a level of minus 2.2 points on September 12th to a nadir of minus 11.5 on October 10th may be considered a reasonable first-approximation estimate of the size of the shock to financial conditions. And since that shock triggered the most severe global recession in 60 years, the real-sector costs of the Lehman decision were obviously enormous and almost certainly unintended.

Since the shock was followed quickly by major countermeasures such as the rescue of AIG, guarantee of money funds, coordinated rate cuts, TARP, MMIFF etc., it will probably never be possible to quantify precisely the size of the Lehman shock independent of the positive influence of such countermeasures. However, since the Bloomberg Index declined by 4.6 standard deviations in the third quarter, with virtually the entire decline occurring in the last three weeks of the quarter, we might as well approximate the net shock based on quarterly data to be a 5 standard deviation event on the Bloomberg index. And while stock markets continued to tumble for many months thereafter, according to the Bloomberg Index financial conditions began to thaw significantly in the fourth quarter and thereafter, limiting the net shock to a one-quarter, 5 standard deviation event.

Whatever government policy failings contributed to the crisis, this event study also suggests a major role for coordinated government policy in setting the stage for the recovery. In particular, the bottom of the financial conditions index occurred on or around October 10th, at which time a blitz of government measures were announced. These included the Group of Seven action plan announced on October 10th, the announcement of large swap lines among major central banks on October 13th, and the announcement of the U.S. Treasury on October 13th that it would shift the emphasis of the TARP plan to direct injections of capital into major financial institutions in line with official initiatives in the U.K.

5. Relating the Size of the Financial Shock to the Subsequent Economic Downturn

¹¹ Robb (2009)

In addition to using the Bloomberg Index as a comprehensive measure of financial conditions, it is also worth validating whether the index is a useful leading indicator of economic activity. Not surprisingly, since the index was designed with that purpose in mind, we find that it is.

For an economy like that of the U.S., where capital markets along with banks and quasi-banks (such as hedge funds) all act as important financial intermediaries, a broad-based measure of financial conditions like the Bloomberg index makes sense as a summary measure of how financial conditions across multiple markets are likely to affect the future path of the real economy. That said, the Bloomberg index also appears to be a good coincident indicator of bank lending conditions *alone*. As shown in Figure 8, a three-month smoothed version of the Bloomberg index has a strong contemporaneous negative correlation (-0.82) with the Federal Reserve's Senior Loan Officer Opinion Survey regarding the percent of loan officers intending to tighten credit. And as shown in Figure 9, that survey itself can be considered a useful leading indicator of real GDP growth, with a strong negative one-quarter ahead correlation (-0.64).

Since the Bloomberg index is available daily while the Fed' survey is updated only once a quarter, the more timely Bloomberg index should be able to give useful early indications of future changes in bank lending conditions and real GDP growth. As shown in Figure 10, the Bloomberg Index appears to be a useful direct leading indicator of real GDP growth, with a strong positive one-quarter ahead correlation (0.61).

The leading indicator properties for real GDP of both the Fed Senior Loan Officer Survey and the Bloomberg Index can also be seen in the results of pairwise Granger causality tests shown in Table 4. Those results are based on transforming all of the variables into stationary series by using first differences. The statistical tests reject the null hypotheses that: (1) the Bloomberg Index does not Granger-cause the Fed Senior Loan Officer Survey; (2) the Bloomberg Index does not Granger-cause U.S. real GDP growth; and (3) the Fed Loan Officer Survey does not Granger-cause U.S. real GDP growth. The results also indicate that the Bloomberg Index has been a particularly strong leading indicator of the bank lending conditions, with the relevant Granger causality test being significant at the 1% level.

Having validated the relationship between the Bloomberg Index and subsequent real GDP growth, we believe that it is also worthwhile to estimate the strength of the relationship. In particular, such analysis should be helpful in calibrating the degree of effectiveness of unconventional policy measures in restoring growth in the aftermath of a significant financial shock.

A very simple approach is to regress year-on-year growth in real GDP on lagged values of the Bloomberg Index. We have found that a two-quarter lag provides a regression with the strongest explanatory power as measured by the R-squared. The results of this regression are presented as Equation 1 in Table 5 and are presented graphically in Figure 11, which shows actual and estimated real GDP growth from 1991 through 2009 based on this simple regression. Figure 11 also shows the quarterly history of the Bloomberg Index, which posted a recovery of more than 5

standard deviations from its quarterly nadir at the end of the third quarter of 2008 to the end of the second quarter of 2009.

Within a few weeks of the Lehman shock this simple relationship pointed to a hard landing for the economy and, in view of the dramatic recovery of financial conditions, was beginning by the middle of the second quarter of 2009 to point toward the possibility of a V-shaped recovery in subsequent quarters. According to the regression, a one point increase (decrease) in the Bloomberg Index should lead to a 0.86 percentage point acceleration (deceleration) in real GDP growth. Since the year-on-year growth of U.S. real GDP was approximately zero at the time of the Lehman shock, based on this relationship it is not surprising that the real GDP went on to post year-on-year declines in the 3%-to-4% range in the first half of 2009. If the relationship is symmetric – which is a big if – it would suggest that year-on-year GDP growth could be about 2% by early 2010, which would in turn imply a surprisingly strong recovery in GDP growth in the second half of 2009, including quarterly growth rates that could exceed 6% at an annual rate.

Equation 1 is hardly an ideal forecasting equation since the low value of the Durbin-Watson statistic (0.40) indicates serial correlation in the error term. Table 5 presents a number of other specifications using normalized transformations of the data to permit comparisons of the importance of different estimated coefficients on different lags of the right hand side variables. It also addresses the serial correlation problem by first-differencing the real GDP growth term and adding a lagged value of that term on the right hand side. In virtually all cases, one and two quarter lags of the Bloomberg Index are statistically significant as predictors of future movements in real GDP. Accordingly, the 5-standard deviation negative shock to financial conditions associated with Lehman's bankruptcy in the third quarter of 2008 could be expected to propagate large negative shocks to real GDP growth over the next several quarters, while the subsequent sharp recovery in the Bloomberg Index of more than 5 standard deviations could well foreshadow a significant recovery in U.S. real GDP growth in the second half of 2009.

However, as the simple regressions indicate, lagged values of real GDP shocks are themselves predictive of future movements in GDP and are likely to interact with past financial shocks in a complex way. To try to take into account such interactions, we estimated several VAR models using different combinations of the macroeconomic variables shown in Table 6. All of this data was transformed into stationary series to meet the statistical assumptions of the VAR methodology.

The simplest VAR model was estimated for up to four quarters of lags on two variables: the normalized first-difference of U.S. real GDP growth and the first difference of the Bloomberg Index. In Figure 12 we present the variance decomposition from this model. This indicates that shocks to financial conditions have their primary influence on altering real GDP growth over about four quarters and can account for nearly one-quarter of subsequent innovations in the real GDP series. It also shows that about three-quarters of subsequent innovations in the real GDP series can be explained by prior shocks to GDP, suggesting that massive changes in financial conditions are required to “move the needle” in the wake of a Lehman-type shock.

In Figure 13 we present the impulse response representation of the simple two-variable VAR model. This shows that a one-standard deviation shock to financial conditions can alter future GDP innovations by about 0.7 standard deviations within four quarters. Since the standard deviation of the first difference of U.S. real GDP growth has been about 0.74 percentage points over the 1991-2009 period, it implies that a 9-standard deviation shock to financial conditions (the initial size of the Lehman shock), could have led to a deceleration of GDP growth of nearly 7 percentage points over the subsequent four quarters. As we showed earlier, robust policy actions quickly attempted to mitigate the size of the shock, limiting it to about half of that amount in a manner that was concentrated in the third quarter of 2008. Again, since year-on-year GDP growth was roughly zero at the time of the shock, these model results are highly consistent with the fact that year-on-year real GDP growth posted a decline of nearly 4% in the first half of 2009 notwithstanding the vigorous countermeasures that limited the shock.

Since the recovery from the October 2008 trough in the Bloomberg Index reached nearly 11 standard deviations by September 2009, from a statistical viewpoint the size of the positive shock to financial conditions based on policy initiatives has come to exceed the size of the negative shock associated with Lehman's bankruptcy. With few other guideposts for anticipating the potential impact of such a positive shock, we believe that such simple VAR models may be useful in calibrating the potential response of the economy to the unconventional policy measures that have targeted overall improvement in financial conditions. The results of the simple two-variable model are quite similar to results from alternate VAR models that incorporate additional data such as the Federal Reserve Bank's Senior Loan Officers' Survey, the unemployment rate, and the ISM purchasing managers survey.

Virtually all of the combinations of variables we have examined point to reasonably robust growth resuming in the second half of 2009 and in 2010 with two caveats. First, in a multi-variate framework, the impact of the Bloomberg index appears to work primarily as a leading indicator of bank lending conditions. Accordingly, if the financial crisis has seriously impaired that linkage then the model results may be overly optimistic. Second, even robust recoveries in growth of GDP and industrial output appear unlikely to deliver comparably robust improvement in the labor market anytime soon. That appears to be due to strong and persistent impacts on labor market variables of prior shocks.

Table 7 shows the forecast results from simulations of a 5-variable VAR model over the 2009:Q3 to 2010:Q4 period. These results indicate that the massive improvement in financial conditions since the fourth quarter of 2008 could deliver surprisingly strong economic activity through the end of 2010, with quarterly rates of GDP growth averaging 5% over that period. That is more than double consensus estimates as of mid-2009. And while we would treat the results of such simulations with due caution, they do suggest the possibility that recent unconventional policy measures could yield unconventional results.¹²

¹² The simulation results also suggest that the shock to labor markets has been so profound that, even with such strong GDP growth, it is likely that only about a third net loss of two million jobs that were lost during the recession will be offset by new job creation by the end of 2010.

Our work suggests the following directions for future research on this topic. First, although we believe that the Bloomberg Index is a useful tool for measuring financial conditions, it may be improved by dropping variables such as Libor-OIS spreads that give misleading signals during a crisis when they effectively stop trading. Instead, other variables reflecting widely traded risk proxies like the ABX index or CDX indexes might be added. In addition, if the objective is to aggregate information from financial markets as a tool for predicting future economic activity, other statistical techniques could be used to optimally design such targeted financial conditions indexes. For example, commercial providers of portfolio risk models such as Sungard APT track thousands of securities prices every day in equity, fixed income, currency and derivatives markets and use principal components analysis to measure the key dimensions of financial risk that are apparent in daily trading patterns. Rigorous analysis of the degree to which such principal components provide useful predictive information for key economic variables of interest could provide financial conditions indexes that are more accurately calibrated to the needs of policymakers. This may be particularly true when unconventional tools such as quantitative easing render traditional analytical tools ineffective.

6. Conclusion

We believe that getting the story right on Lehman is important for several reasons. First, if influential economists are permitted to use questionable evidence to persuade others that Lehman's failure was no big deal, it makes it more likely that other systemically important institutions will be permitted to fail in the future. Second, understanding that the Lehman decision was a very costly policy error is important for framing future debates about the urgency of reforming the financial system and, most importantly, reining in the excessive leverage that set the stage for the crisis.

For most of the post-war period, the conventional wisdom about dealing with the moral hazard issue associated with systemically important institutions has followed the advice of economic historian Charles Kindleberger: "Always come to the rescue, in order to prevent needless deflation, but always leave it uncertain whether the rescue will arrive in time or at all so as to instill caution in other speculators, banks, cities, or countries."¹³ Since U.S. financial authorities are well versed in this aspect of the art of central banking, they must surely have anticipated that letting Lehman fail risked a potentially catastrophic outcome. The fact that they failed to rescue Lehman suggests that the Kindleberger doctrine may have bumped into hard political constraints, whereby the "too big to fail" doctrine ran into the reality that a number of financial mega-firms have – at least politically -- become "too big to bail."

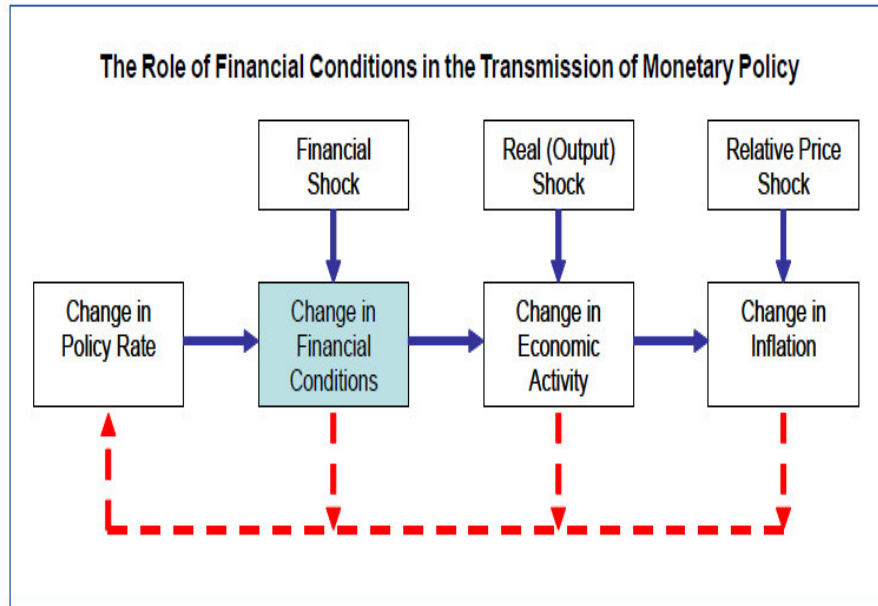
This raises the risk that in the next crisis, the nation's leaders will not be able to muster the political capital for TARP-type measures that require close coordination among the central bank, the Treasury, and Congress. Accordingly, to return to our medical analogy, we think that interested parties may wish to reflect on the following imaginary conversation between a cardiac patient and their doctor: "You suffered a very serious heart attack, but fortunately you survived this time thanks to modern medicine. But unless you fundamentally change your health habits and lifestyle, the risk is high that you will not survive the next attack."

¹³ Kindleberger and Aliber (2005)

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Figure 1



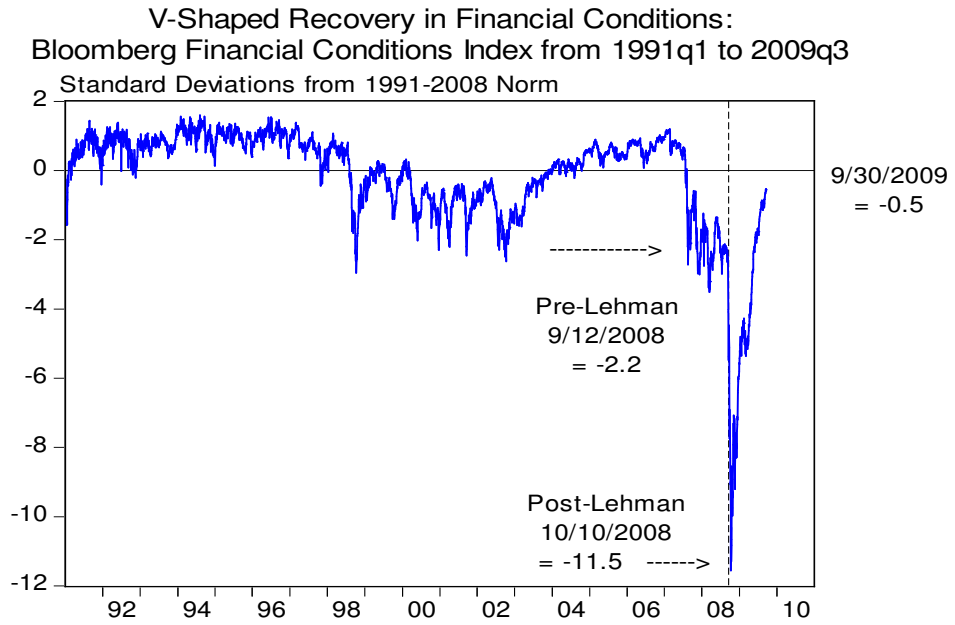
Source: Michael Rosenberg (2008) Financial Conditions Watch, Global Financial Market Trends and Policy, Bloomberg LLP, August 14, 2008

Figure 2

Bloomberg's Financial Conditions Index Components and Weights	
	Index Weight
Money Market	
Ted Spread	11.1%
Commerical Paper/T-Bill Spread	11.1%
Libor-OIS Spread	11.1%
	33.3%
Bond Market	
Investment-Grade Corporate/Treasury Spread	6.7%
Muni/Treasury Spread	6.7%
Swaps/Treasury Spread	6.7%
High Yield/Treasury Spread	6.7%
Agency/Treasury Spread	6.7%
	33.3%
Equity Market	
S&P 500 Share Prices	16.7%
VIX Index	16.7%
	33.3%
Total	100%

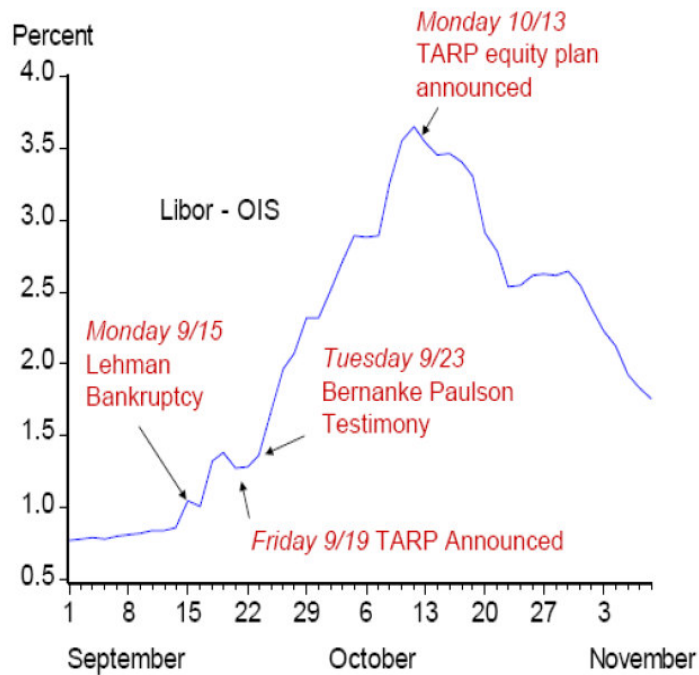
Source: Michael Rosenberg (2008) Financial Conditions Watch, Global Financial Market Trends and Policy, Bloomberg LLP, August 14, 2008

Figure 3



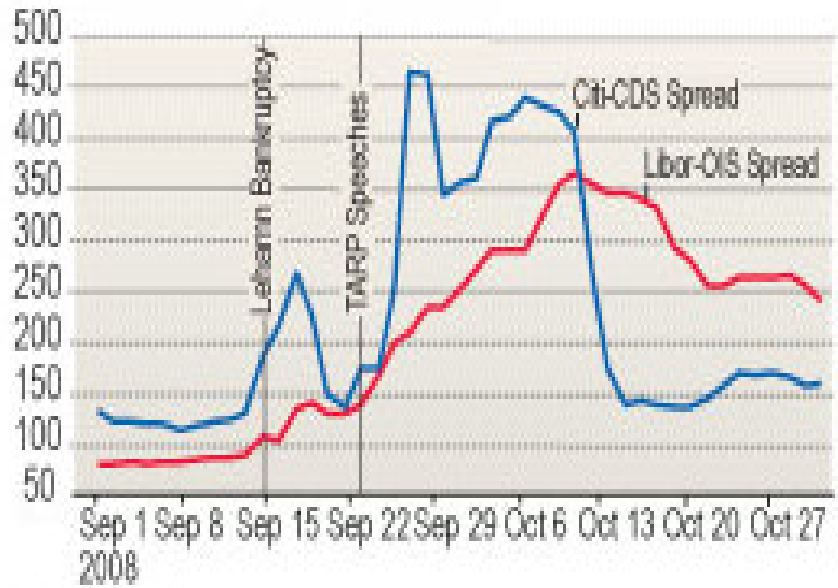
Source: Bloomberg

Figure 4 - John Taylor's Event Study of the Dramatic Worsening of the Crisis



Source: Taylor (2008)

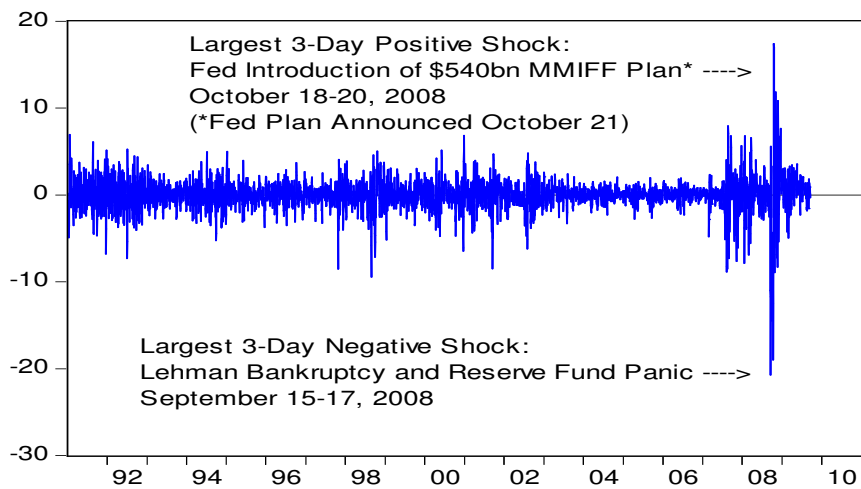
Figure 5 - John Cochrane and Luigi Zingales Event Study: When Concern Turned to Panic



Source: Cochrane and Zingales (2009)

Figure 6

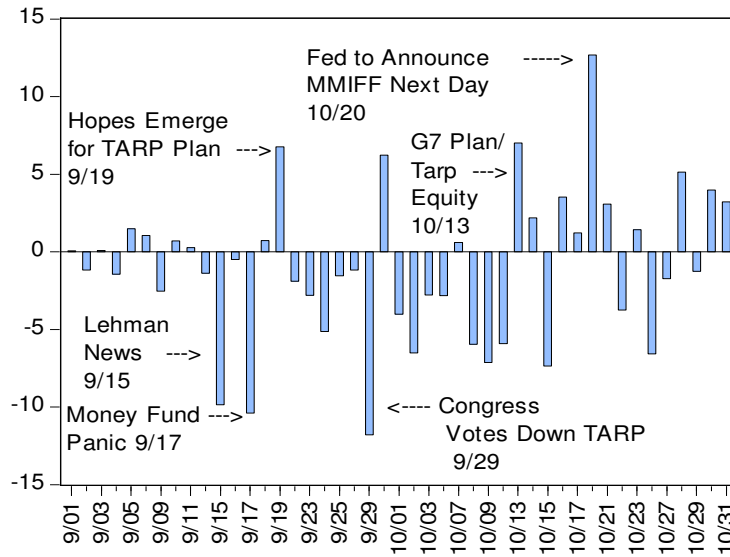
A Financial Electrocardiogram?
3-Day Changes in Bloomberg Financial Conditions Index
Measured by Cumulative Sum of Z-Scores of Daily Changes



Source: Bloomberg and Trilogy Global Advisors

Figure 7

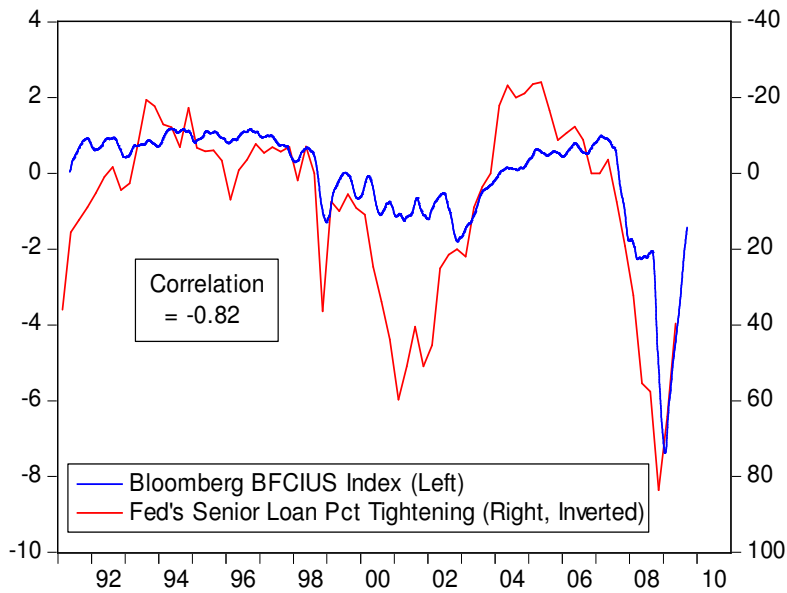
Large Shocks Followed Lehman Bankruptcy:
Daily Changes in Bloomberg Index Expressed as Z-Scores: 9/1/2008 - 10/31/2008



Source: Bloomberg

Figure 8

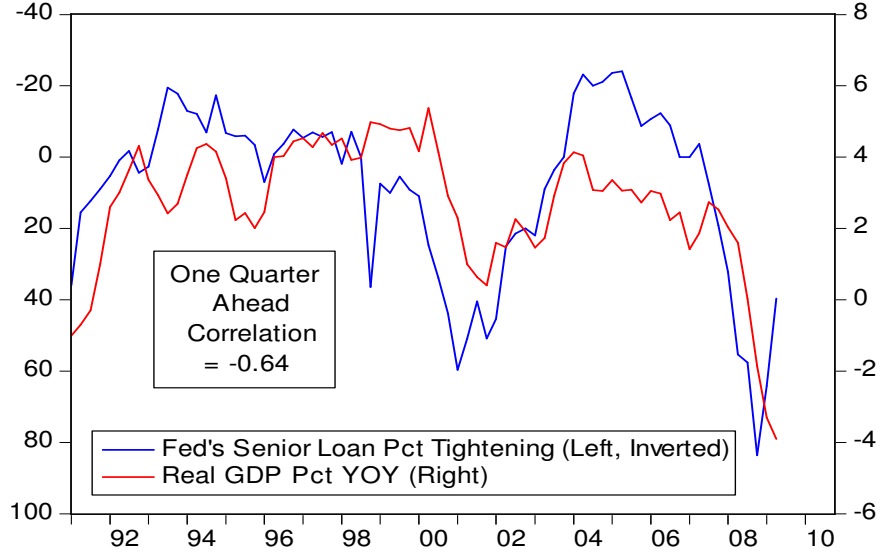
Bloomberg Financial Conditions Index is Strongly Correlated
with Fed's Senior Loan Officer Survey (Percent Tightening Credit)



Source: Bloomberg

Figure 9

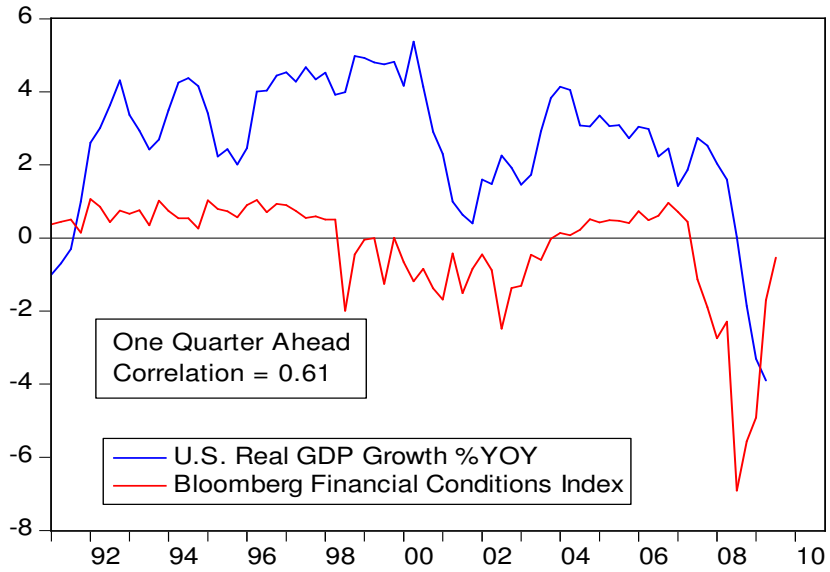
Fed's Senior Loan Officer Survey (Percent Tightening Credit)
is a Leading Indicator of U.S. Real GDP Growth



Source: Bloomberg

Figure 10

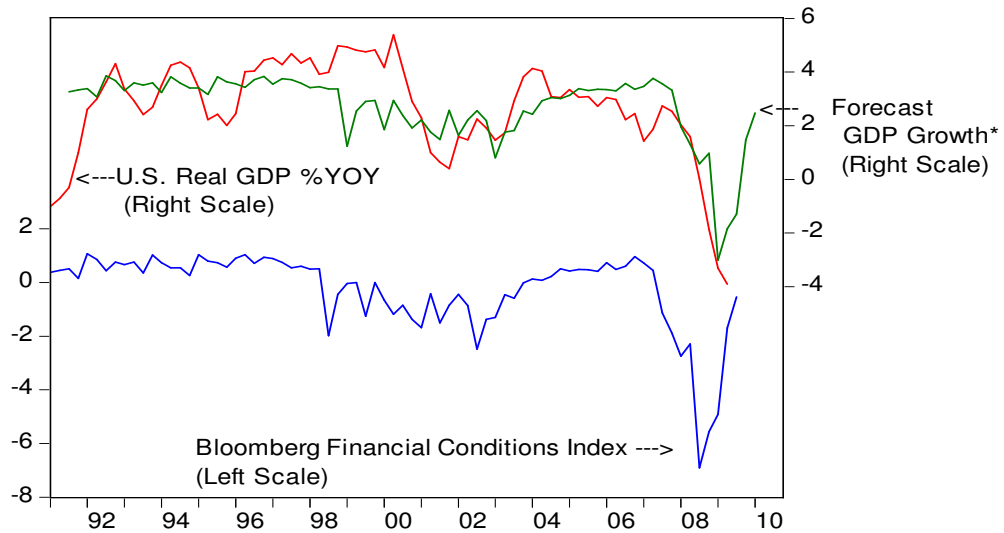
Bloomberg Financial Conditions Index Leads
U.S. Real GDP Growth



Source: Bloomberg and Trilogy Global Advisors

Figure 11

Will a V-Shaped Recovery in Financial Conditions Lead to a V-Shaped Recovery in the U.S. Economy?



Forecast Model: $GDP \%YOY = 2.94 + 0.86 * \text{Bloomberg Index}(2 \text{ Qtr Lag})$

Sources: Bloomberg and Trilogy Global Advisors

Figure 12

Variance Decomposition of First Difference of U.S. Real GDP %YOY Growth

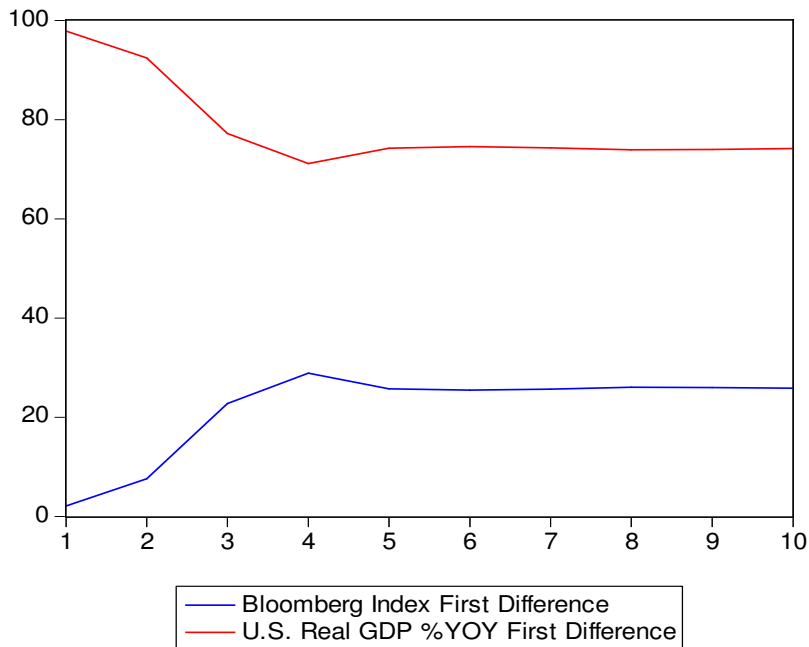


Figure 13

Accumulated Response of the First Difference of U.S. Real GDP %YOY Growth to Cholesky One S.D. Innovation in the Bloomberg Index

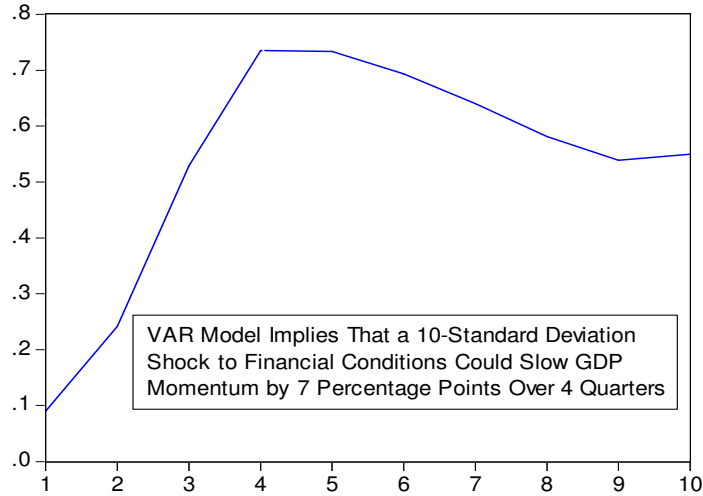


Table 1
Descriptive Statistics for Changes in Bloomberg Index Over Different Frequencies and Time Horizons:

	January 1991 to September 2009			January 1991 through August 2008		
	1-Day Change	3-Day Change	20-Day Change	1-Day Change	3-Day Change	20-Day Change
Mean	0.00	0.00	0.00	0.00	0.00	-0.01
Median	0.00	0.01	0.03	0.00	0.00	0.02
Maximum	1.71	2.34	4.48	0.88	1.07	2.10
Minimum	-1.58	-2.78	-8.85	-1.00	-1.27	-3.18
Std. Dev.	0.15	0.24	0.63	0.13	0.20	0.43
Skewness	-0.54	-0.86	-3.44	-0.30	-0.45	-0.69
Kurtosis	17.07	21.09	43.36	8.61	7.40	7.78
Jarque-Bera Probability	40367 0.00	67128 0.00	339700 0.00	6088 0.00	3874 0.00	4735 0.00
Sum	-0.09	-0.20	1.20	-1.87	-5.38	-28.69
Sum Sq. Dev.	110.71	271.16	1938.79	81.89	181.29	836.58
Observations	4863	4880	4863	4588	4605	4588

Table 2
Ten Largest Daily Changes in Bloomberg Index During
September - October 2008 Ranked by Absolute Value of Daily Z-Score

Date	Bloomberg Index Change (Z-Score)	Associated Market or Policy Event*
10/20/2008	12.68	Fed established MMIFF following day
9/29/2008	-11.77	Congress rejected TARP previous day
9/17/2008	-10.37	Run on Money Market funds triggered by Lehman losses
9/15/2008	-9.85	Lehman files for bankruptcy
10/15/2008	-7.35	TARP capital injections begin previous day/FDIC TLGP guarantees previous day
10/9/2008	-7.13	Coordinated rate cuts previous day
10/13/2008	7.02	G7 Action Plan/Fed & ECB & BoE & SNP announce swap lines/TARP Equity Plan**
9/19/2008	6.75	Treasury guarantees money market funds/announces TARP plan
10/24/2008	-6.58	PNC purchases National City
10/2/2008	-6.52	TARP proposal passed Congress following day

*Bolded items refer to counter-intuitive market reactions to associated event

**10/13/2008 marks first day of recovery from 10/10/2008 nadir of Bloomberg index (-11.5 standard deviations from norm)

Table 3
Ten Largest 3-Day Changes in Bloomberg Index During
September - October 2008 Ranked by Absolute Cumulative Sum of 3-Day Change in Daily Z-Score

Date	Bloomberg Index Change (Z-Score)	Associated Market or Policy Events*
9/17/2008	-20.71	Lehman bankruptcy plus AIG crisis plus run on Reserve Fund
10/10/2008	-18.97	Coordinated rate cuts on 10/8; Fed pays interest on reserves on 10/9
10/20/2008	17.43	<i>Fed announces \$540bn MMIFF plan following day**</i>
10/21/2008	16.98	<i>Fed announces \$540bn MMIFF plan**</i>
9/29/2008	-14.48	Congress rejected TARP after contentious debate
10/3/2008	-13.31	Congress passes TARP plan
10/9/2008	-12.48	Coordinated rate cuts on 10/8; Fed begins paying interest on reserves
10/6/2008	-12.12	Treasury guarantees money market funds/announces TARP plan
10/22/2008	12.01	<i>Fed announced MMIFF plan previous day**</i>
9/16/2008	-11.72	Lehman bankruptcy plus AIG and Reserve Fund Crises

*Bolded items refer to counter-intuitive market reactions to associated event

**Italicized items are all clustered around Fed announcement of \$540bn MMIFF plan

Table 4

Pairwise Granger Causality Tests

Sample: 1991Q1 2009 Q2

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
FEDS1 does not Granger Cause BF1	71	0.43506	0.6491
BF1 does not Granger Cause FEDS1		23.7789	2.E-08
GDPY1 does not Granger Cause BF1	71	1.65837	0.1983
BF1 does not Granger Cause GDPY1		3.20152	0.0471
GDPY1 does not Granger Cause FEDS1	71	0.77207	0.4662
FEDS1 does not Granger Cause GDPY1		4.84569	0.0109

GDPY1 = First Difference of U.S. Real GDP %YOY

BF1= First Difference of Bloomberg Financial Conditions Index

FEDS1= First Difference of Fed's Senior Loan Officer Survey, Percent Tightening Lending Conditions

Table 5

Impact of Bloomberg Index on U.S. Real GDP: Alternate Regression Specifications

Sample: 1991:Q1 - 2009:Q2

Equation Number	Left-Hand Variable	Right-Hand Variable				Summary Statistics	
		Constant	BF(-1)	BF(-2)	GDPYZ(-1)	R-Squared	Durbin-Watson
1	GDPY	2.94 (0.15)***	--	0.86 (0.11)***	--	0.47	0.47
2	GDPY	0.51 (0.19)***	--	0.32 (0.07)***	0.83 (0.06)***	0.87	1.41
3	GDPYZ	--	0.41 (0.06)***	--	--	0.38	0.44
4	GDPYZ	--	--	0.47 (0.06)***	--	0.45	0.45
5	GDPYZ	--	0.17 (0.10)*	0.31 (0.11)***	--	0.48	0.33
6	GDPYZ	--	0.09 (0.05)*	0.10 (0.06)*	0.82 (0.06)***	0.87	1.44
7	GDPY1Z	--	0.27 (0.07)***	--	--	0.16	1.57
8	GDPY1Z	--	--	0.28 (0.08)***	--	0.15	1.44
9	GDPY1Z	--	0.16 (0.13)	0.13 (0.14)	--	0.17	1.50
10	GDPY1Z	--	0.16 (0.08)**	0.23 (0.13)*	0.25 (0.12)**	0.24	2.03
11	GDPY1Z	--	--	0.30 (0.13)**	0.35 (0.11)***	0.20	2.13

Note: Variable Definitions

GDPY = U.S. Real GDP, Percent Year Ago

GDPY1Z = U.S. Real GDP, Percent Year Ago, Z-Score

BF(-1) = Bloomberg Financial Conditions Index, Lagged One Quarter

BF(-2) = Bloomberg Financial Conditions Index, Lagged Two Quarters

GDPY1Z(-1) = U.S. Real GDP, Percent Year Ago, First Difference, Z-Score, Lagged One Quarter

* Significance at the 10% Level

** Significant at the 5% Level

*** Significant at the 1% Level

Table 6
Key Macroeconomic Variables: Summary Statistics
Sample: 1991:Q1 - 2009:Q2

	BF1	FEDS1	GDPY1	NAPMC1	LR2
Mean	-0.03	0.05	-0.04	0.04	0.01
Median	-0.01	-0.50	-0.05	-0.27	0.02
Maximum	3.22	36.40	1.61	6.93	0.43
Minimum	-4.62	-29.00	-1.89	-11.33	-0.47
Std. Dev.	0.94	10.86	0.74	3.10	0.20
Skewness	-1.26	0.19	-0.06	-0.26	0.06
Kurtosis	11.49	4.56	2.86	4.69	2.32
Jarque-Bera	238.63	7.86	0.10	9.54	1.43
Probability	0.00	0.02	0.95	0.01	0.49
Sum	-2.07	3.60	-2.90	2.80	0.97
Sum Sq. Dev.	63.13	8498.29	39.71	692.99	2.75
Observations	73	73	73	73	72

Note: Variable Definitions

BF1 = Bloomberg Financial Conditions Index*

FEDS1 = Federal Reserve Senior Loan Officers Survey, Percent Tightening Loan Conditions*

GDPY1 = U.S. Real GDP, Percent Year Ago*

NAPMC1 = ISM Purchasing Managers Survey*

LR2 = U.S. Unemployment Rate**

*First Difference

**Second Difference

Table 7
VAR Model Simulations for Key Macroeconomic Variables:
Forecast Period: 2009:Q3 to 2010:Q4

		FEDS	GDP	PAYROLL	ISM	BFCIUS
Actual	2008Q1	32.2	-0.7	-14	49.5	-2.75
	2008Q2	55.4	1.4	-109	49.1	-2.29
	2008Q3	57.6	-2.7	-126	47.4	-6.91
	2008Q4	83.6	-5.5	-319	36.1	-5.56
	2009Q1	64.2	-6.6	-516	35.9	-4.92
	2009Q2	39.6	-1.0	-384	42.6	-1.70
Forecast	2009Q3	5.0	4.4	-436	50.9	-2.87
	2009Q4	-13.5	7.9	-107	64.9	-0.32
	2010Q1	-41.1	2.1	34	75.5	-1.93
	2010Q2	-39.0	6.3	202	76.0	-0.42
	2010Q3	-50.1	6.7	228	75.6	-2.88
	2010Q4	-21.4	2.7	242	66.5	-1.35

Variable Definitions:

FEDS = Federal Reserve Bank Senior Loan Officer Survey, Percent Tightening

GDP = U.S. Real GDP, Seasonally Adjusted Annual Rate, Percent

PAYROLL = U.S. Average Monthly Change in Nonfarm Payroll

ISM = ISM Purchasing Managers Survey, Composite for Manufacturing

BFCIUS = Bloomberg Financial Conditions Index for U.S., End of Period