Signals to the Market:
Too Big to Fail Banks and the Recent Crisis

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Abstract: Banks deemed too big to fail have been a subject of intense controversy for over 20 years since the inception of the term in 1985. Since then multiple crises have shaken the world markets. Markets respond to information in rational ways and this response provides a measure of how investors view all businesses. With particular note to banks with high systemic risk this paper observes stock market behavior over the events of Lehman Brothers, AIG, and TARP in 2008. Banks deemed too big to fail are found to respond differently to these events than other banks. This has implications for the market overall as investors and regulators respond to new crises in the future.

1. Introduction

The year 2008 witnessed the largest and most involved intervention by the

government into the US financial system to date. In a worldwide recession marked by

falling house prices and lack of credit lines, countless financial institutions became

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distressed after assets used to collateralize loans dropped sharply in value, and the United

States federal government had to decide whether and how to intervene. Bear Stearns led

off in March of 2008 with its liquidity crisis. Later Fannie Mae and Freddie Mac required

capital injections to continue servicing home mortgages. September witnessed the

collapse of one of the biggest investment banks, Lehman Brothers, as well as the bailout

of AIG and requests from the Treasury department to fund banks. The government

response to these events sends signals concerning the government's role in financial

markets and these signals change how businesses respond to future events.

Normally the government does not become involved in preventing bankruptcy

except when a financial institution is so systemically important that its failure would

cause a cascade of other failures and eventually economic collapse. Such institutions that

carry high systemic risk are commonly labeled "Too Big to Fail."[1] Many of the banks

that eventually required additional capital injections, including Bank of America,

Citigroup, AIG, and several others received help because their importance to the stability

of the financial system superseded the costs associated with the moral hazard problems

introduced by intervention.

To study the impact of signals sent by a government intervention requires the

determination of which of the many hundreds of financial institutions are perceived as

too-big-to-fail (TBTF). The United States does not provide any tangible list of the banks

it would bail out in the event of financial stress and, while investors can often guess

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[1] The origin of this term is linked to the failure and subsequent bailout of Continental Illinois in 1985. Since then the term has been extended to describe any business (though typically a bank or financial institution) that is especially important to economic stability. This is somewhat of a misnomer as asset size does not directly correlate to systemic importance, but the term is still used and other terms such as Systemically Important Financial Institutions (SIFI) have also entered the nomenclature. This paper will continue to use Too Big to Fail for familiarity purposes though other terms such as "systemically important" and "too interconnected" will also be used. See Stern (2004, p 13-16) for discussion concerning TBTF's origin and usage.

which banks are systemically important based on size and interconnectedness, some uncertainty surrounds TBTF regulation. Market signals and responses to crises are a useful source of information for investors and regulators alike to observe how those perceptions of TBTF change and evolve as events unfold, and government officials concerned with limiting TBTF bailouts in the future create recommendations based on these reactions.

It is therefore a useful exercise to observe how certain events alter the perceived TBTF protection of different financial institutions. For example, does allowing a bank previously perceived as TBTF to file for bankruptcy send a message to other possible TBTF banks that removes their expectation of a future bailout? How would measures aimed at protecting a much broader group of banks affect those perceived to be TBTF? The reactions by markets to specific actions taken by the government are a rich source of information and understanding these signals is the first step in solving the TBTF problem.

Following a case study framework, I set out to determine the market reactions to three important events from September 15th to September 25th, 2008. On September 15th, 2008, the first notable event occurred when Lehman Brothers was allowed to collapse. One of the largest investment banks at the time, the failure sent the Dow Jones Industrial Average plummeting 504 points, the 12th largest drop since the index was created.[2] Many investors drew sharp parallels between Lehman Brothers and Bears Stearns, another investment bank that was bailed out by JP Morgan Chase and the Fed in March 2008.

Until the recent crisis, investment banks were generally not considered systemically important enough to be bailed out. The repeal of the Glass-Steagall act in 1999 allowed commercial banks to begin investing in exotic instruments like

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[2] The Wall Street Journal Historical Index Data, updated daily.

collateralized debt obligations and mortgage-backed securities. These banks traded with pure investment banks, spreading systemic risk to these institutions.[3] Which investment banks would receive bailout funding in the face of insolvency, however, remained unclear. This uncertainty continued into the current crisis; Bear Stearns was systemically important enough to provide funding, but Lehman in all its similarities to Bear was not. The decision to allow Lehman to fail is a topic still hotly debated by regulators and economists alike.[4]

The next day on September 16th, 2008, AIG, one of the world's largest insurance companies, announced it would receive capital injections from the US Treasury to prevent insolvency. The results of this paper will show a positive wealth effect accruing to TBTF institutions but not to smaller banks during this event, implying a shift of expectations toward endorsing TBTF protection. Of all the financial institutions to receive funding from the government, AIG is most often associated with Too Big to Fail and has in many ways defined the term in the current financial crisis.[5]

Finally on September 19, 2008, the US government announced a strong commitment toward combating financial turmoil for all banks. Secretary of the Treasury Henry Paulson asked Congress to grant the Treasury the ability to purchase illiquid toxic assets in order to strengthen the balance sheets of all banks. This program, later named the Troubled Asset Relief Program (TARP), was initially rejected by the House of

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[3] Barth et all (2000). Also Elizabeth Warren, one of the five outside experts on the Congressional Oversight Panel of the Troubled Asset Relief Program believes the repeal of this act to be a large contributor to the recent financial crisis (Stewart 2009)

[4] See Taylor (2009) and Jones (2009) for two of the many opinions debating Lehman's significance.

[5] The Treasury openly admitted they would not allow AIG to fail due to the potential for "extremely high" losses incurred by businesses in the US and world economies if AIG filed for bankruptcy. Henry Paulson even went so far as to suggest that even if condition of the insurance giant did not improve, more money would be invested as the Treasury was unwilling to allow it to fail. See Zuill and Stempel (2009) and Boyle and Judge (2009).

Representatives ten days later. In October 2008 Congress passed a similar program that would allow the Treasury to provide capital injections to the same banks under the same name of TARP. The important signal occurred in the shift toward commitment to financial institutions and thus the announcement was the pivotal cause of movement, not necessarily the actual disbursement of funds.[6]

Each of these events caused notable changes in market perceptions of both TBTF and non-TBTF banks alike. This paper observes stock prices of all banks classified in different ways depending on TBTF status in order to determine how each of these events affected perceptions of TBTF protection. Since TBTF protection is not explicit, several combinations of banks with high probability of bailouts are tested for wealth effects accruing to their stock prices in order to determine if the group as a whole experienced significant residual returns on important event study dates.

I find evidence consistent with the hypothesis of significant positive wealth effects accruing to TBTF banks during the AIG bailout as well as positive returns for all banks during the TARP announcement, among other results. By observing market reactions to each of these varied events, this paper seeks to explain which policies imply bailout protection and which do not, or in the case of Lehman Brothers' collapse, which policies remove bailout protection and which fail to send such a signal.

This paper is organized as follows. In section 2. I discuss why stockholders of TBTF banks should expect a positive wealth effect when protection is announced (and consequentially a negative one when it is removed) in a theoretical framework. Section 3 presents the data and explains some reasons for the setup of the case study. In section 4,

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[6] This is set in the theory of the semi-strong form of efficient markets where investors use all past and present information in order to value a stock.

my methodology is presented and discussed and section 5 presents the results. Section 6

analyzes these results. The final section will summarize implications from the data and

attempt to provide possible changes to bailout policy given these results.

2. Theory

Before all else, what is Too Big to Fail and why should it matter? The term

entered popular use in 1985 during the bailout of Continental Illinois.[7] Concurrently with

the bailout the Comptroller of the Currency cited the largest eleven banks as so large that

all liabilities, even uninsured ones, would be covered by deposit insurance.[8] Deposit

insurance is provided and is explicit; while the FDIC does try to cap the amount,

precedent seems to imply that such limitations do not always apply. From the period of

2000 to 2008 when 62 financial institutions failed, 96.39% of deposits and 98.88% of

assets were fully protected, including nearly all insured depositors and most uninsured

short term lenders, debt holders, and equity holders.[9] Protection is widespread even for

those not under the purview of explicit deposit insurance.

Deposit insurance, however, is not TBTF protection. Deposit insurance is paid for

by member banks and except in times of crisis is not a net loss but rather a net gain for

FDIC accounts. Bailouts on the other hand are directly funded by the Treasury with the

backing of US taxpayers, providing liquidity to a bank in order to ensure unprotected

creditors do not suffer losses that would spark chains of bankruptcies. A bank can only

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[7] See O'Hara and Shaw (1990) for a study similar to this one concerning the Continental Illinois bailout and TBTF announcement. They found positive wealth effects accruing to the banks cited as systemically important and negative effects accruing to those that were not.

[8] There were bailouts and funding by the FDIC prior to Continental Illinois, but the treatment of the bank changed perception and enacted new policies concerning systemic banks. See Golembe (1999).

[9] Data gathered from the FDIC historical statistics on banking, http://www2.fdic.gov/hsob/hsobRpt.asp

remain in operation if its creditors are paid, so if a bank is systemically important and the government cannot allow it to fail, creditors can expect to receive their investments either from the bank or from the government in the event of a bailout.

The reasons for bailing out a bank are often tied to its contribution to systemic risk. While not concretely defined,[10] systemic risk becomes a factor when a bank has so many large and important connections to other institutions that the default of one will cause those who lent to that bank to also default, and so on down the chain. This ripple effect is particularly detrimental to the world economy as a single bankruptcy can cause financial distress for multiple institutions; thus a government, if it feels a bank could potentially start one of these chains by failing, will intervene and prevent the bank from failing. Because the bailout occurred because of size and number of connections, the bank is called "too big to fail."

The next question is: why should anyone care that TBTF protection exists? The simple answer is that government bailout assurance artificially lowers the cost of funds to the bank and incentivizes moral hazard. A creditor that believes a bank or any institution will fail soon is unlikely to provide funding due to higher probability of losses. That business in the event of failure will typically file for bankruptcy, freezing the collateral on loans until assets can be sold to cover as many liabilities as possible. More often than not at least some creditors receive little to nothing in bankruptcy resolution.[11]

This fear of loss permeates the world economy and forces creditors to evaluate the probability of institutional failure when extending credit. Businesses are charged a higher risk premium as compensation compared to that institution should it be completely free

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[10] See Taylor (2010) for a discussion on the problems with defining systemic risk.
[11] This is inherent in the need to file for bankruptcy, which occurs when a business owes more than they have the ability to repay.

of failure risk. To keep this premium as low as possible requires sustaining a low risk of insolvency. This builds an incentive that pressures businesses to maintain responsible business practices. For some banks, however, failure is not an option, that is the government provides a safety net in the event of looming insolvency. A creditor to that bank will provide funding without worry and at a cheaper cost of borrowing. This leads to two effects: cheaper sources of financing and increased risk taking. [12]

Cost of funds is tied directly to a given bank's creditworthiness. Any deposit, CD, or uninsured borrowings beyond the normal FDIC coverage should factor in a premium accounting for the possibility of bankruptcy. Removing the ability to fail also removes the risk premium, lowering the cost of funds and creating a subsidy for the bank. This subsidy is captured by shareholders as profits increase due to smaller interest expense. A bank will not necessarily remain at this level of borrowing, however, because it could be at a lower level of risk and return than optimally desired. The bank has incentive to increase risk by increasing leverage and expected return. This additional wealth effect should also accrue to shareholders. This increase in leverage will also increase risk though not borne by the institution. The bank essentially earns a free lunch, creating a moral hazard because managers can take the risks without having to pay the premium. [13] This also decreases a creditor's incentive to monitor businesses, furthering the moral hazard and causing the banks protected with taxpayer funding to take excessive risks.

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[12] This builds off the concept of a risk/return trade off. If a bank has a set optimal risk/return portfolio of assets and the government provides bailout protection, this reduction of risk pushes the bank out of its optimal ratio thus reducing costs. It then has the incentive to increase its risk back to its optimal portfolio, the result of which is a higher return. See Fama and Macbeth (1973).

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Directly government bailout funding protects creditors, but equity holders of that bank will also receive positive returns due to the stated wealth effect. Therefore given changes in TBTF expectations, stock prices should be affected by the market response to such signals.[14] If a market believed a bank would not be rescued but then a signal indicates it would, a positive wealth effect will accrue to that bank's shareholders. Inversely if a bank was considered TBTF and then loses that coverage, a negative effect will cause share prices to drop. But if the market believed TBTF coverage already existed and a signal indicated coverage applied to that bank, the market would have already factored this into account and no further change would result unless coverage was extended or affected other institutions in that bank's web of connections.

This paper aims to capture that positive or negative excess return and provide tests of statistical significance to show if given events created significant effects relating to TBTF protection alterations. Our three primary dates of study will be examined in addition to days between and after in order to see if the events changed perceptions and sent signals to equity holders and consequently markets as a whole. While these events are not explicit assignments of TBTF protection, the implicit signals are still perceived by investors as signifying what the government would do should a bank crisis arise. These signals are perhaps the most difficult to ascertain the meaning of and markets do not always interpret them properly, yet my results show strong evidence that systemic banks and non-systemic banks are treated differently in the market, implying these days were in fact assumed to be signals relating to TBTF.

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[14] This assumes a signal is credible. All events mentioned in this paper are events and requests instead of promises, thus credibility is not an issue for this particular study.

3. Data

Sample selection began with CRSP data of 732 commercial and investment banks[15] with prices and returns from January 1, 2007 to December 31, 2008. There are many thousands of banks operating in the United States but only a small fraction of them are publicly traded and thus have equity price data. Of these, 626 had return data available for the study period of September 15-25 2008. The data from January 1, 2007 to September 14, 2007 will be used to obtain estimators to be used in the study period in order to calculate residual returns. The division of TBTF and not-TBTF is different depending on the sample.

The timeframe for the study was set up to frame the days in question as well as to articulate a time when volatility greatly increased. The study observed stock returns for September 15, 2008 through September 25th, 2008. Volatility in the market substantially increased during the Lehman bankruptcy announcement and continued into the last quarter of 2008. July and August experienced low volatility in market returns with standard deviations of 1 percent and 1.3 percent, respectively.[16] The first half of September also found markets relatively stable with a standard deviation of 2 percent. On the 15th and continuing through the rest of the month, volatility increased to 4.34 percent. For this reason the study begins on the 15th and continues past the TARP announcement to the 25th.[17]

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[15] These groupings were determined according to SIC codes signifying their practicing industry. The majority have codes 6020-6022, but there are others

[16] All calculations are based on returns to the S&P 500 as a market proxy, adjusted for splits and dividends.

[17] We will not examine the effects of the TARP vote as that is outside the purview of this study

Determining which banks are likely to receive government funding in the event of a crisis is a difficult issue to tackle.[18] There is no official list of TBTF institutions. If the SEC or Treasury were to release the institutions it felt could not fail, those banks would automatically accrue wealth effects and in essence have a blank check to take as many risks as the government would pay for. This would also hurt other banks unfairly as the TBTF banks' cost of funding would decrease substantially, allowing for greater profits in those institutions at the expense of smaller banks who do not gain that insurance.

Many of the issues relating to bank bailouts and failures such as Bear Stearns and Lehman Brothers were directly attributable to the uncertainty of each institution's contribution to systemic risk. This uncertainty pervaded the 2008 financial crisis and continues to permeate our discussion today.[19] It is not my purpose to pin down a list of systemically important banks but rather observe how different definitions send different signals to investors. Therefore multiple definitions will be tested inside the methodological framework proposed and then summarized accordingly. This is done also to reflect the concept that different investors have different perceptions of risk in financial institutions, and this approach will be more robust compared to covering just one murky definition.

Three independent definitions of "too big to fail" have been chosen to test and observe how each responds to signals created by the market. The first is proposed first by the Controller of the Currency in 1984 and revised by Stern (2001). Following the

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[18] Stern (2001), Summe (2009), Moody's (2008), and many others have offered possible groupings of banks that should be deemed "too big to fail." Even as the term emerged during the bailout of Continental Illinois there was disagreement between the press, government, and investors about which institutions carried this new label (Shaw 1990). I assume that some TBTF banks exist and that investors rely on others who claim inside information for information on that classification, thus I will rely on these outside definitions as well and not attempt to create my own definition of TBTF.

[19] See John Taylor "Defining Systemic Risk Operationally" (2009) for a discussion on our progress toward understanding the theory of systemic risk and steps that should be taken in order to clearly define the term.

concept that those institutions with high systemic risk are those with the largest number

of connections (and thus have the greatest number of assets), this definition takes the

minimum asset cutoff for TBTF institutions in 1984 of $24 billion and adjusts it for

inflation using the CPI, creating a cutoff in 2007 dollars of $49 billion. [20] After removing

foreign controlled and private banks, the 24[21] largest banks in the United States met this

cutoff, shown in Appendix A.

This list is advantageous in that it follows government precedent in bailout

preference. If asset size is a direct causation of TBTF status, then it follows that this list

would articulate the banks the government directly implicates as systemically important.

Conversely, asset size may not directly correlate to systemic risk. Given the bailout of

Long Term Capital Management in 1998, there have since been implications that quality

of connections is more important than quantity.[22] So even if a bank is large, it may not

receive bailout funding. A prime example of this is the fire sale and bankruptcy of

Washington Mutual on September 25, 2008. The bank held over $307 billion in assets

though very few were tied to other important institutions. Thus it failed despite its large

asset base which would have been within the adjusted Controller of the Currency's

minimum asset cutoff.

The second definition is provided by Moody's Investors Services. In January of

2008 prior to the financial turmoil of the year, the established credit rating agency

published the probabilities of bailout funding from the government for each of the largest

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[20] Calculator can be found at bls.gov
[21] It is an interesting side note that originally only 11 banks met the cutoff but now 24 have enough assets to be classified too big to fail by the definition proposed by the Controller. This supports Stern's hypothesis that TBTF protection has increased and also the idea that the wealth effect has made these banks more profitable, incentivizing more institutions to achieve TBTF status.
[22] See Dowd (1999)

ten banks. This list was covered in BusinessWeek soon after, and the list of these banks is provided in Appendix A. Of the ten, Moody declared only 8 had a high probability of receiving assistance should they become insolvent. These 8 are all included in the first definition, but this second definition excludes many banks due to their smaller number of connections to other systemic institutions.[23]

This more concentrated definition provides a list many policy makers would most likely prefer because it requires fewer institutions to insure with government funding. These are presumably, however, the "riskiest of the risky" financial businesses and thus most prone to insolvency. Also, being a list of only commercial banks, this classification fails to account for investment banks as being too big to fail. The list is also still fundamentally based on asset size;[24] it does not avoid the issues concerning the differences between size and level of connection like the first sample. It does provide observation into how only the largest institutions respond to information, and since these are the institutions with the highest probably of a bailout, this definition provides insightful and unique results with several days of notable interest in the study.

The final definition used in this study is the list of banking institutions that ultimately received equity injections from the United States Treasury in October of 2008. This funding stemmed from the Troubled Asset Relief Program (TARP) originally requested by Secretary of the Treasury Henry Paulson on September 19 2008.[25] Of the 19

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[23] It seems most definitions proposed by private institutions encompass a smaller number of banks than policy moves typically suggest. A list published in the *Financial Times* cites only six institutions as being systemically important. There are no immediate explanations for this. See Jenkins and Davies (2009).
[24] Moody's evaluation observed only with the top ten banks, and even all of them did not have a high probability of bank bailout. It is possible there are smaller commercial banks with multiple important connections to other financial institutions that could cause them to be systemically important and this definition would fail to capture them.
[25] While this original request was for the Treasury to buy illiquid toxic assets and was voted down ten days later in the House of Representatives, funding began on October 9 2008 and continued until the House

institutions to sell preferred shares to the Treasury, 12 of them were banks or bank holding companies.[26] These funds provided increased equity to balance out large debt burdens and prevent the possibility of a future liquidity crisis. Since funding was ultimately provided, Paulson and the Treasury viewed these institutions as both systemically important and unstable enough to warrant capital injections.[27] These banks were percieved as too big to fail even before they faced balance sheet losses. For this reason this group is our last test sample, listed in Appendix A.

The TARP group is interesting in that it includes many of the large banks included in Moody's but also includes investment banks such as Goldman Sachs and Morgan Stanley. The inclusion of these is proper as, while investment banks had access to the discount window traditionally limited to commercial banks,[28] they still presented interesting and unique risks relating to over-the-counter derivatives market as well as clearing payments for other banks in repo and overnight lending markets. The web of connections created by these financial instruments presents a strong perception that these banks would be considered too big to fail and thus should be examined in the context of this paper.

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released the remainder of the $700 billion in funding on January 16, 2009. The announcement was the important market signal to these banks and not the actual disbursement of funding. See www.newyorkfed.org for a timeline of events.

[26] Merrill Lynch is included on this list even though it was officially acquired by Bank of America on September 15, 2008. This is because Merrill stock continued to trade and closely followed the movements of Bank of America. Since assets had yet to exchange hands, it is presumed if Merrill experienced further trouble it would require federal injections as well.

[27] The banks, however, did not all feel the same way but the Treasury still forced these banks to sell preferred shares and receive the funding to promote stability. In particular Bank of America and Goldman Sachs were especially concerned with ownership dilution and paid the funds back as soon as possible on December 10, 2009.

[28] The Fed opened the discount window on March 17, 2008 to investment banks in the event of needed liquidity. Interestingly any of these institutions has yet to borrow from the window, perhaps because each feels it would be perceived in the market as a sign of financial instability and weakness. See http://www.reuters.com/article/idUSN1954536520080319

4. Methodology

The methodology behind this approach follows a standard financial event study framework.[29] Residual returns for each of the ten study days will be calculated and compared for statistical significance. I will use the preceding 428 days to September 15, 2008 to calculate residual returns using the standard market model provided by Fama:[30]

$$R_{jt} = \alpha_j + \beta_j R_{mt} + \varepsilon_{jt} \qquad (1)$$

Where R_{jt} is firm specific return, R_{mt} is market return, α_j and β_j are firm specific intercept and covariance with the market, respectively. The error term is assumed to have zero mean, be independent of all returns, and be uncorrelated between firms. Using CRSP data on market returns and returns of the 732 banks under question, I regress returns of the market for the time period of 428 days leading up to the event study window on the returns of a given bank in the same time frame. This method is used to determine unique α_j and β_j estimates, denoted $\hat{\alpha}_j$ and $\hat{\beta}_j$, respectively, for each of the banks. Once these are calculated, estimated residual returns are determined for each of the banks on study days in question using market and bank returns for those days and OLS estimates. Rearranging the equation denotes the follow model:

$$\hat{\varepsilon}_{jt} = R_{jt} - \hat{\alpha}_j - \hat{\beta}_j R_{mt} \qquad (2)$$

where $\hat{\alpha}_j$ and $\hat{\beta}_j$ are the OLS values from the estimation period.

These estimated residual returns are calculated for each individual bank over the ten day event window and will be used to determine significance of returns depending on

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[29] See Brown and Warner (1985)

[30] The one beta market model is standard for event studies, though multi-beta models may also be used to capture additional sources of return explanation. This extension was not performed due to time constraints and may prove to be fruitful if further study is performed. Some studies, however, refute this claim. See Fama (1985) for standard model and Kane and Unal (1988) for other possible models.

classification of bank. Following standard analysis of panel-organized data, it is impossible to assume that residual returns for these banks are cross-sectionally independent as a given set of estimated residual returns occur on the same date.[31] In order to analyze these returns in groups, I use a test statistic common in financial event studies originally developed by Jaffe (1974) and elaborated on by Brown and Warner (1985, p. 7 for further discussion). For a given day in the event window, the test statistic is

$$\bar{e}_t / \hat{S}(\bar{e}_t) \tag{3}$$

$$\bar{e}_t = \frac{1}{N} \sum_{i=1}^{N} e_{it} \tag{4}$$

$$\hat{S}(\bar{e}_t) = \sqrt{\sum_{t=-429}^{-1} \frac{(\bar{e}_t - \bar{\bar{e}})^2}{428}} \tag{5}$$

$$\bar{\bar{e}} = \frac{1}{429} \sum_{t=-429}^{t=-1} \bar{e}_t \tag{6}$$

where *N* equals the number of firms. This test statistic is the ratio of the mean excess return of a given sample to its estimated standard deviation taken from the same period upon which $\hat{\alpha}_j$ and $\hat{\beta}_j$ are estimated for each bank. Combined this test statistic allows for each sample to avoid bias of possible cross-sectional dependence and improves the robustness of the results. If the e_t are independent, identically distributed, and normal, the test statistic is distributed normal.[32]

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[31] In a similar vein, heteroskedasticity was projected to be a problem. However each of the bank returns are regressed individually against market returns, and variances of estimators were found not to change substantially when more robust tests were performed during this step. Estimators were found to be significant regardless.

[32] This assumes the degrees of freedom are also sufficiently large. Since degrees of freedom exceed 400, the test statistic is assumed normal. See Brown and Warner (1980).

5. Results

Table I shows excess returns for all banks in the sample selection.

Table I

Excess Returns to All Banks

This table includes data for all banks in the sample. Dates for the resulting returns are noted. All returns are denoted as percentages, *t*-statistics are given in parentheses.

Date	All banks (N=732)
15-Sep-08	-0.0005
	(0.0826)
16-Sep-08	0.0096
	(1.4425)
17-Sep-08	-0.0013
	(0.1920)
18-Sep-08	0.0409
	(6.1692)
19-Sep-08	0.0314
	(4.7339)
22-Sep-08	-0.0115
	(1.7272)
23-Sep-08	0.0063
	(0.9503)
24-Sep-08	-0.0025
	(0.3813)
25-Sep-08	-0.0057
	(0.8643)

* Significant at 5%   `
** Significant at 10%

Neither returns during the 15th and 16th (the dates of the Lehman Brothers bankruptcy declaration and AIG bailout, respectively) were significant for all banks on a average. The only significant dates are those bracketing the announcement by Henry Paulson concerning TARP. This plan was proposed on the September 19, 2008. Word most likely leaked about the potential financial bailout package on September 18, 2008.

Banks on average posted positive residual returns regardless of a given bank's level of systemic risk, yielding positive excess returns of 4.1% and 3.1% for the 18th and 19th, respectively.

Two reasons for the large increases in these institutions emerge. The first is that, given the language of Paulson's request, it is possible investors believed all banks would receive bailout assistance and not just large or interconnected ones.[33] This would mean the bailout announcement caused a direct wealth effect to accrue to banks in the expectation many would be allowed to sell assets to the government. Given the uncertainty surrounding the events of Lehman Brothers and AIG a few days prior, investors were also unsure how the government would react to the next systemically important financial institution to declare insolvency. This announcement was also a vote of confidence in these largest banks, which in effect stabilized the financial industry as a whole. All of this contributes to the positive wealth effect not only for TBTF banks but every bank that would profit from an increased commitment by the government to financial institutions.

Table II shows the results of the first group of too big to fail institutions, defined according to asset size.

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[33] See "Statement by Secretary Henry M. Paulson, Jr. on Comprehensive Approach to Market Developments" (2009).

Table II

Excess Returns for Large Banks

This table describes residual returns for all banks divided according to asset size. The group labeled TBTF is separated by total assets as of Sept 30, 2007 with the minimum cutoff being $57 billion. This is calculated by adjusting the cutoff implied by the Controller of the Currency in 1983 and adjusting it for inflation (Stern p 64).

Date†	Asset size (N=24)	Other banks (N=708)
15-Sep-08	-0.0074	-0.0003
	(0.4897)	(0.0446)
16-Sep-08	0.0258**	0.0090
	(1.7168)	(1.3847)
17-Sep-08	-0.0111	-0.0009
	(0.7360)	(0.1393)
18-Sep-08	0.0878*	0.0391*
	(5.8292)	(6.0561)
19-Sep-08	0.0991*	0.0288*
	(6.5840)	(4.4593)
22-Sep-08	-0.0290**	-0.0108
	(1.9276)	(1.6692)
23-Sep-08	0.0004	0.0065
	(0.0245)	(1.0106)
24-Sep-08	-0.0173	-0.0020
	(1.1486)	(0.3042)
25-Sep-08	-0.0165	-0.0053
	(1.0945)	(0.8237)

* Significant at 5%
** Significant at 10%
† 15-Sep-08 is $t=0$

The results show little difference between the TBTF and not groups. Both accrued significant excess returns on the 18th and 19th. The values of returns for each group were varied with the TBTF group generating a larger absolute return of 8.78% and 9.91% for those two dates, while the other banks created returns of 3.91% and 2.88%, respectively. The volatility of the TBTF group is greater however (1.5% standard deviation versus .64% standard deviation for the other bank sample), resulting in statistical significance of relative similarity as observed in the *t*-statistics. There is no significant excess loss on the

15th when Lehman Brothers collapsed and a significant return on the day of the AIG

bailout at the 90% confidence level.

The next group to be analyzed is that postulated by Moody's Investors Services:

Table III

Excess Returns According to Moody's

This table describes residual returns for all banks
divided according to Moody's Investors Services.
The rating agency performed analysis on the top
ten commercial banks to determine the
probability of a bailout should the institution
approach insolvency. See Henry (2008).

Date†	Moody probability (N=8)	Other banks (N=724)
15-Sep-08	-0.0378*	-0.0001
	(2.5433)	(0.0101)
16-Sep-08	0.0425*	0.0091
	(2.8625)	(1.3874)
17-Sep-08	-0.0236	-0.0010
	(1.5853)	(0.1496)
18-Sep-08	0.0632*	0.0406*
	(4.2573)	(6.1664)
19-Sep-08	0.0796*	0.0308*
	(5.3592)	(4.6706)
22-Sep-08	-0.0336*	-0.0112
	(2.2585)	(1.6952)
23-Sep-08	0.0049	0.0063
	(0.3294)	(0.9594)
24-Sep-08	-0.0117	-0.0024
	(0.7881)	(0.3658)
25-Sep-08	0.0146	-0.0060
	(0.9805)	(0.9100)

* Significant at 5%
** Significant at 10%
† 15-Sep-08 is $t=0$

There are several statistically significant days of returns for this group of banks.

The day of the Lehman collapse created a loss of 3.78% for the systemically important

banks compared to only a .01% excess return for the other banks. The Moody TBTF

banks also accrued a residual return of 4.25% on the AIG bailout day while other banks did not observe such a jump. All banks observed excess returns on the day prior to the TARP announcement as well as on the 19th, though TBTF banks also incurred a residual loss of 3.36% on the day after the announcement.

    The final table shows the returns for those banks receiving TARP funding after the events of the case study. These and the other banks' returns are shown below:

Table IV

Excess Returns for TARP Recipients

This table describes residual returns for all banks that ultimately received TARP bailout money funding. These are labeled as the TBTF sample as a test of those banks the government funded in order to avoid future collapse. See Kiel (2009).

Date†	TARP Recipients (N=12)	Other banks (N=720)
15-Sep-08	-0.0045	-0.0005
	(0.3272)	(0.0717)
16-Sep-08	0.0387*	0.0090
	(2.8412)	(1.3680)
17-Sep-08	-0.0246**	-0.0008
	(1.8067)	(0.1243)
18-Sep-08	0.0147	0.0415*
	(1.0787)	(6.2990)
19-Sep-08	0.0996*	0.0301*
	(7.3060)	(4.5708)
22-Sep-08	-0.0162	-0.0114**
	(1.1861)	(1.7277)
23-Sep-08	-0.0013	0.0065
	(0.0930)	(0.9808)
24-Sep-08	-0.0075	-0.0024
	(0.5515)	(0.3696)
25-Sep-08	0.0121	-0.0061
	(0.8844)	(0.9245)

* Significant at 5%
** Significant at 10%
† 15-Sep-08 is $t=0$

There are several unique characteristics of this division of TBTF banks worth noting. First there are no statistically significant residual losses on the 15th for either group. On the 16th during AIG there is a significant 3.87% residual return to the TBTF banks that is not seen in the other banks. Also of particular note, the 18th which has been a day of significant excess return for all bank groups no matter the classification system is not significant at any level for the TARP funding recipient group. The group did see a large excess return of 9.96% on the following day when the funding was officially announced. No other days were significant for the TBTF banks.

6. Analysis

When comparing the different definitions of TBTF, several patterns emerge. Lehman Brothers was often insignificant for both the samples of TBTF banks and the remaining financial institutions. Only the Moody TBTF sample was significant on this day, though there are several other alternative explanations for this group's large excess return. This was also the most volatile of the samples taken, a property that can be explained by the small sample size. Investment banks were excluded from this sample but several are present in the TARP sample, and as there were no significant residual losses accruing to this group, it is implied that Lehman's peers in the investment banking industry were not excessively punished in the stock market by investors during Lehman's bankruptcy. The more general deduction concerning signals is that most banks, if there were any beliefs the government would provide assistance in the face of insolvency, did not lose this perception of protection during the Lehman Brothers collapse.

During each analysis of residual returns, banks with systemic risk accrued a significant positive return on the day of the AIG bailout while other banks did not. Assuming that there was at least some level of uncertainty concerning TBTF policy at the time, this decision by the US Treasury sent investors a signal that bailouts were still possible. While other banks observed a positive effect as well on these days, none of the non-TBTF samples produced a significant residual return. This reinforces the postulation that the significant residual return observed by TBTF banks was in fact a result of systemic risk protection and not some outside unobservable factor.

The request to buy toxic assets by Paulson before Congress through TARP created significant positive effects for all banks regardless of size on the day of the announcement, September 19th. It is interesting to note that on the day prior (September 18th) as word began to leak about a possible bailout plan for the financial industry, all banks accrued significant residual returns except those that actually ultimately received TARP funding. Those institutions did observe a substantial gain when the funding was actually announced. It is possible the announcement to end short selling as well as the establishment of the money market guarantee program played a role in this as well.[34] If those who received TARP funding were apprehensive about the possibility of government aid, it is possible then investors waited until more evidence was available. Upon learning they would in fact be protected, stock prices jumped.

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[34] See ustreas.gov and sec.gov for transcripts of the press releases. While these events may have transpired simultaneously, all of them are essentially votes of confidence in the system or in the case of the ban on short selling, a limit to an investing technique that can put downward artificial pressure on stocks. All of them combined point to reinforcement of the financial system, thus they affect only the magnitude of the returns which were already deemed significant.

7. Conclusion

        The events of September 2008 were some of the most volatile and unexpected financial markets had ever encountered. Lehman Brothers held over $500 billion in assets at the time of its bankruptcy, AIG was at a time the 18th largest company in the world, and Henry Paulson requested over $700 billion in funding to bolster the equity values of major financial institutions. Lehman for all its size, however, was not deemed systemically important and thus allowed to fail. In terms of signals sent to other businesses expecting bank bailout funding, the collapse did not negatively banks except a select few volatile commercial banks.

        The bailout of AIG did send a signal that if businesses are TBTF, the government will not necessarily allow them to fail like it did in the case of Lehman. It is unclear what expectations banks held prior to September 2008, but AIG provided significant excess residual returns for only TBTF banks. The TARP funding gave all financial institutions the expectation of future bailouts, and this signal was not limited to banks of a particular size or level of interconnectedness.

        Another important result is the differences between the definitions of TBTF. Simply defining the term according to the size limits suggested by the Controller of the Currency in 1984 during the bailout of Continental Illinois does not seem to have stood the test of time in terms of revealing TBTF protection benefits. Its reaction to AIG was the least responsive among the TBTF samples. The Moody probability definition was the most significant of the three samples but failed to include important institutions like Goldman Sachs and others that seem to carry TBTF protection as evident by government support.

The TARP group could have been the set of banks Henry Paulson planned on aiding all along and thus is most responsive to the decisions of the government during the announcement with a 9.96% residual return. It too responded to AIG but not to Lehman Brothers, implying an air of uncertainty pertaining to TBTF protection heading into the week of September 15th. Even to this day, debate rages over the importance of Lehman Brothers and how its failure affected financial markets overall. If regulators and economists alike are still uncertain even after observing the market, how could investors have predicted the result in September 2008? Signals were occluded and unclear, thus the information was not acted upon.

If the government is to put a halt on bank bailouts in the future, it must first recognize how certain events change and shape perceptions of TBTF protection for financial institutions. The empirical evidence collected does not support the allowed failure of a large institution such as Lehman Brothers as a viable signal that limits perception of TBTF. Conversely providing capital injections to a large company such as AIG does inform only the largest and most systemic banks of their protection from insolvency. Finally regardless of size, the announcement of TARP was a vote of confidence in the US financial system and all banks viewed bailout money from the government accruing to the largest institutions as beneficial. Policy makers must understand these signals when shaping future regulation as to craft policies that send credible messages to financial markets.

Appendix A

Sample 1- Asset Size

Criteria for TBTF: Based on 1984 announcement by Controller of Currency that the top 11 banks would be bailed out in the event of impending insolvency. The smallest of these was Wells Fargo with an asset base of $24 billion in 1983. This number is adjusted for inflation to 2007 when analysis in this paper begins to $49 billion. Out of the top 30 banks on September 30, 2007, 26 banks qualify. Removing foreign and private banks and adding in three investment banks and Washington Mutual leaves a sample size of 24 banks.

1. Citigroup
2. Bank of America
3. J.P. Morgan Chase & Company
4. Wachovia
5. Wells Fargo
6. HSBC North America Inc.
7. US Bancorp
8. Suntrust
9. ABN Amro North America
10. Citizens Financial Group, Inc.
11. National City Bank
12. Regions Financial Corp.
13. BB&T Corp.
14. PNC Financial Services Group, Inc.
15. State Street Corp.
16. Keycorp
17. Northern Trust Corp.
18. Comerica Inc.
19. Marshall & Ilsley Corp.
20. M&T Bank Corp.
21. Washington Mutual
22. Goldman Sachs
23. Merrill Lynch
24. Morgan Stanley

Sample 2

Criteria for TBTF: Moody's Investor's Services provided estimates of bank bailout probabilities for the nation's top ten commercial banks as of January 2008. BusinessWeek published an article with these probabilities, and the sample is taken directly from this. Of the top ten, 8 were given a rating of "high" or "very high" when determining the chance of government support. Two of the firms, SunTrust and Washington Mutual were given ratings of "low" on the same probability. The following 8 were used in the sample.

1. Bank of America
2. Bank of New York Mellon
3. Citigroup
4. J.P. Morgan Chase and Company
5. State Street
6. U.S. Bancorp
7. Wachovia
8. Wells Fargo

Sample 3

Criteria for TBTF: In October of 2008 Congress officially authorized the U.S. Treasury and Henry Paulsen to disburse funding to some of the nation's largest banks. While an official list has yet to be published by the government, news organizations such as the New York Times and ProPublica are keeping track of the preferred stock purchases as well as any repayments through individual institution announcements and publications. Of the largest 19 institutions that received funding, 12 are financial firms which have publicly traded data. These banks create our final sample selection of 12 banks.

1. Citigroup
2. Bank of America
3. Wells Fargo
4. J.P. Morgan Chase and Company
5. Goldman Sachs
6. Morgan Stanley
7. PNC Financial Services
8. US Bancorp
9. Bank of New York Mellon
10. State Street
11. Regions Financial Corporation
12. Merrill Lynch

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