

Measuring the TBTF effect on bond pricing

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Measuring the TBTF effect on bond pricing



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Do the biggest banks have a bond funding edge?

"Too big to fail" (TBTF) represents, among other things, the idea that the biggest US banks receive an unfair funding advantage over smaller banks in the bond market. Recent research has shown a sizeable advantage, but our empirical work suggests otherwise. Within the universe of bond-issuing US banks, the six largest banks did indeed experience a slight funding advantage – of just 6bp on average – from 1999 until the financial crisis began in mid-2007. The advantage widened sharply during the crisis, but then reversed to a significant funding *dis*advantage for most of 2011 and 2012. Today, the bonds of these six banks still trade at a roughly 10bp disadvantage to the bonds of other banks.

Behind the differences in TBTF findings

Our findings differ from prior research in large part because other studies have tended to analyze an overly broad universe of bond issuers, including *non-bank* financials and non-US firms from a wide range of countries. Because the funding advantage is greater for non-bank financials than for banks, the effect of using a larger dataset is to inflate the funding advantage attributed to the largest US banks. This research also often fails to consider that the largest firms in most industries receive a bond funding advantage relative to smaller firms, one that is typically greater than the advantage seen in banking. This oversight seriously undermines the notion that government support drives a TBTF funding advantage.

Liquidity and historical loss data support a funding advantage

We find that the bonds of the largest banks provide investors with far greater liquidity, and that this added liquidity can in itself explain the funding advantage that the largest banks have at times experienced. We also find, through a careful examination of historical FDIC data, that the largest US banks generate fewer realized losses than do the failures of smaller banks per dollar of deposits. When the largest banks encounter trouble, as they certainly do at times, their direct financial losses are generally borne by their shareholders or creditors. TARP clearly illustrates this dynamic: the government made a 15% profit on its assistance to the six largest banks and diluted their shareholders by at least 5% to as much as 82%. In contrast, more than 400 small banks have yet to repay their TARP funds in full, and 40% of those that have repaid have relied on other sources of government funding rather than their own resources.



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Introduction: An empirical review of “too big to fail”

“Too big to fail” (TBTF) has become shorthand for, among other things, the idea that the country’s largest banks¹ benefit from a taxpayer-driven funding advantage over smaller banks in the bond market. The funding advantage is thought to reflect the government’s reluctance to risk harming the broader financial system or the economy by allowing the largest banks to fail. As a result, TBTF is said to artificially boost the biggest banks’ credit profiles and unfairly lower their bond funding costs, creating an uneven playing field.

In this paper, we empirically assess the issues surrounding TBTF. We find that the six largest US banks by asset size have indeed experienced a bond funding advantage compared to others within the universe of bond-issuing US banks, but the advantage has been modest – just 31 basis points (bp) on average since 1999, even when we factor in the impact of explicit government support during the height of the financial crisis. From 1999 until the onset of the crisis in mid-2007, the advantage for the six largest banks was just 6bp on average. It widened sharply during the crisis but then reversed to a significant funding *dis*advantage during much of 2011 and all of 2012. Today, these six banks continue to experience a slight funding disadvantage to other bond-issuing banks of roughly 10bp.

Several recent studies have found a far greater funding advantage than we can discern from our own analysis. This appears to be because these studies use overly broad data samples that include not only *banks* but also *non-bank* financials, and not only US firms but also financial institutions from a wide range of countries with banking systems, markets and economies that are quite different from those of the US. The inclusion of data on these other institutions inflates the funding advantage attributed to the biggest US banks, particularly since the biggest *non-bank* financials have a considerably greater relative funding edge than the biggest *banks* do—nearly two and a half times greater over the past decade.

Many of these studies also fail to consider the broader economic and market context by looking beyond the financial industry to assess whether large firms in general have a bond funding advantage. We find that the largest firms in nearly all industries do indeed benefit from lower bond funding costs than their smaller peers, and that the biggest banks actually benefit *less* than the biggest firms in a wide range of other industries. This undermines the notion that government support drives a TBTF funding advantage.

There are a number of reasons why the largest firms tend to enjoy a bond funding advantage. A key reason, seen across a range of industries, is the fact that investors are willing to pay for the benefits of liquidity, and large firms tend to have more liquid bonds. In fact the added liquidity itself could account for the observed funding advantage for the largest banks. It is not uncommon for an “on-the-run” (actively traded) bond of one of the biggest banks to trade 20bp lower than an “off-the-run” (inactively traded) bond for the same issuer, and the differential can be far greater than this among bonds of banks of different asset sizes. A second important reason is the fact that large firms are typically easier to recapitalize than small firms. This leaves bond investors with fewer losses when

¹ How big is a “big bank”? The Dodd-Frank Act imposes a set of prudential standards for banks with assets above \$50bn (of which there are currently 37 in the US), and a further set of stricter standards for banks with assets above \$500bn (of which there are currently six in the US). We focus on the \$50bn threshold when examining historical bank loss data given the prevalence of the threshold in the regulations. However, we focus on the \$500bn threshold when examining bond funding costs given limited bond issuance and trading data for banks below this threshold. Our analyses of bond spreads, liquidity metrics and historical loss data throughout this paper focus only on US firms.



large firms encounter trouble, and supports their willingness to offer bond funding at a lower risk premium.

An empirical review of historical losses in the banking industry is particularly striking in understanding differences in bond funding costs. While the headlines have been dominated by the sheer dollar value of assistance that the largest banks received during the recent crisis, far less attention has been paid to how the government has fared since. A careful examination of the historical data shows that failures of *small* banks have caused the FDIC to incur higher realized losses than failures of the largest banks, on a per-dollar-of-deposits basis, during both of the two major banking crises to hit the US over the past three decades. This is not to say that big banks never face trouble, because they clearly do, but their losses are generally borne by their shareholders or creditors. A clear example is the 2008 Troubled Asset Relief Program (TARP). The government made a 15% profit on the assistance it provided to the six largest banks, while diluting their shareholders by at least 5% to as much as 82%. In contrast, more than 400 small banks have yet to fully repay TARP, and of the roughly 330 that have repaid, 40% relied on funds from other government programs rather than from their own resources.

These empirical findings suggest that while a significant funding advantage for the largest banks would *not* have been unusual or surprising, even without a TBTF subsidy, the actual observed advantage has been quite small and even negative at times. This strongly suggests that the market is in fact *not* pricing in an expectation of government support that would benefit the bondholders of the largest banks. Thus the policy debate should focus less on TBTF subsidies and more on regulators' important resolution-related work now underway to ensure that the government can quickly impose any future banking losses on banks' shareholders and bond investors, reducing the economic fall-out from any future banking crises.

The bond funding edge: Size has some benefits

The key claim associated with TBTF is that the biggest banks have an unfair funding advantage over smaller banks in the bond market thanks to an implicit promise of government support in a crisis. This view has been developed in recent academic and regulatory research that has garnered significant attention. In our view, the research tends to suffer from several shortcomings, which we discuss in greater detail in Appendix A.

A brief review of the current TBTF literature

One key shortcoming of other TBTF research is that it frequently captures an overly broad universe of bond issuers. Much research analyzes non-bank financials, such as stand-alone asset managers and insurance companies, rather than banks alone. Much of the research also includes banks from countries whose economies, markets and financial systems are quite distinct from those of the US, ranging from Albania to Uzbekistan. The results of these methodological approaches are twofold: first, to overstate the amount of available data, and second, as our own analysis of US firms shows, to inflate the purported big bank funding subsidy, largely because the relative funding advantage has been more than twice as high for non-bank financials than for the largest banks themselves.

Another critical shortcoming is that much of the research overlooks the fact that few banks issue bonds in the first place, and the fact that those that do are predominantly the largest banks. This means that many assessments of bond spreads in effect compare the largest banks to the somewhat less large ones—rather than to the small ones.

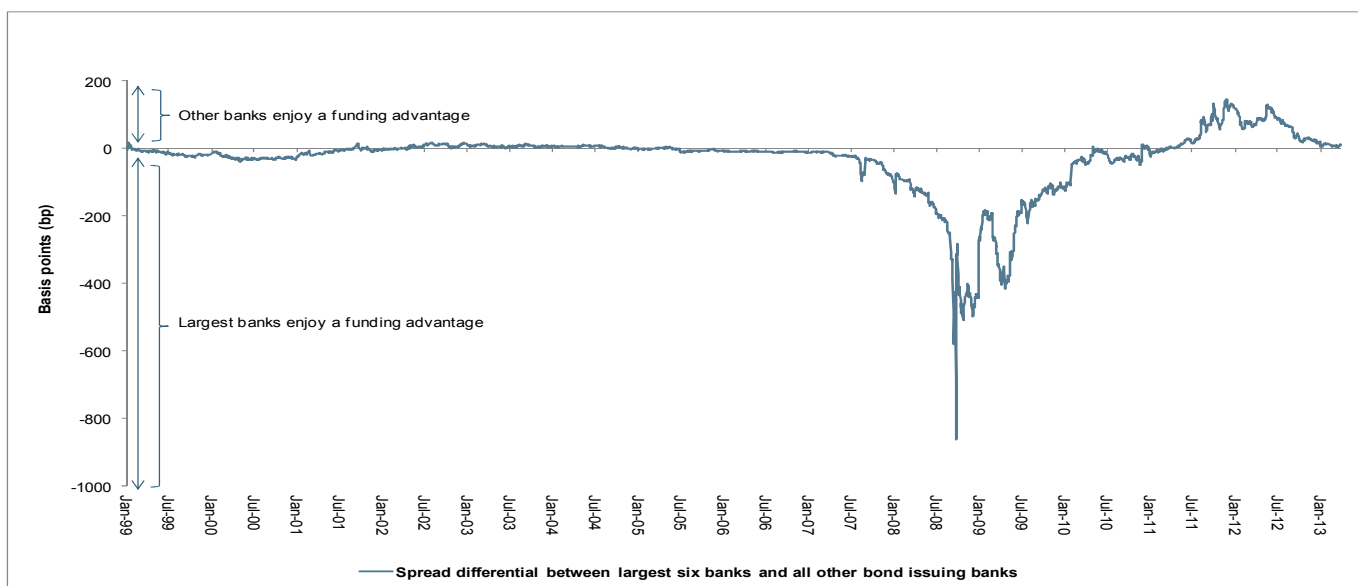


The biggest banks' bond funding advantage: the numbers

Our empirical work on US banks indicates that the six largest banks have at times issued bonds at lower rates than have other banks, and that their bonds have also traded at lower rates. We note that the universe of banks that issue bonds is itself quite small, and largely limited to big banks: over the past five years only 40 banks, with a median asset size of \$56bn, have issued publicly traded debt, according to data from Dealogic. Similarly, there are currently just 27 banks in the IBOXX universe of actively traded investment-grade US bank bonds; the median size of these banks is \$200bn by assets.

Exhibit 1 compares the bond-market spreads of the six largest banks (those with assets above \$500bn) to spreads for all other banks with dollar-denominated long-term debt in the IBOXX investment-grade universe since 1999 (when the IBOXX data became available).² When the line falls below the x-axis, the largest banks have had lower funding costs than the other banks (or a funding advantage); when the line is above the x-axis, the largest banks have paid more, and the other banks have had the funding edge. We explain our methodology in detail in Appendix B.

Exhibit 1: Outside the crisis itself, the bond-funding advantage for the biggest US banks has been small or non-existent
Bond spread differential between the six largest US banks and all other bond-issuing US banks, 1999-1Q2013

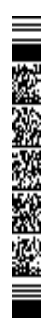


Note: Bond spread differential is calculated as the difference between the average bond spread for the six largest banks by assets and the average bond spread for all other banks in the IBOXX index. Bond spreads are calculated relative to the interest rate on US Treasury bonds with comparable maturities. See Appendix B for further details.

Source: IBOXX Investment Grade Index, S&P Capital IQ, Goldman Sachs Research.

As the exhibit shows, the largest banks' bonds traded on slightly more favorable terms prior to the financial crisis, by roughly 6bp on average from 1999 to the onset of the crisis in mid-2007. This differential widened dramatically during late 2008 and early 2009; given the government's broad intervention in the financial industry at that time—not only through TARP but also through a range of other programs that benefitted the wider

² We ran a similar analysis using data from TRACE, which has the advantage of a broader universe of bonds (about twice as many as the IBOXX universe) but the disadvantages of a shorter time frame (meaningful data begin only in 2007) and a less liquid universe. The results are broadly in line with the results of the IBOXX analysis.



financial system³—it is clear that markets did reflect some expectation of government support for the largest banks at that time.

However, this differential closed as bond markets stabilized and government support was withdrawn, and by early 2011 it had even reversed. In fact, over much of 2011 and all of 2012, the biggest banks' bonds traded at significantly *higher* rates than other debt-issuing banks' bonds—as much as 147bp more at times of significant market stress. Notably, the funding *disadvantage* during this period was significantly wider than any advantage the largest banks had enjoyed before the crisis, and likely reflected bondholders' concerns that they might suffer punitively high losses if regulators chose to liquidate a troubled big bank at that time. These concerns began to subside in the second half of 2012, with the emergence of the outlines of the new bank-resolution protocol oriented toward imposing losses on shareholders and creditors rather than on taxpayers. Today, the biggest banks' bonds still trade at rates that are roughly 10bp higher than those of other bond-issuing banks, meaning that they still experience a funding *disadvantage*.

Taking all of this into account, we find that the largest six banks have had an average funding advantage over all other bond-issuing banks of just 31bp since 1999, even factoring in the bigger advantage seen at the height of the recent financial crisis, and we find a funding *disadvantage* that has persisted since the crisis abated.

As we have noted, we observe a considerably smaller funding advantage for the biggest US banks than many academic papers find. This may be because some of these papers include *non-bank* financials in the dataset, as well as non-US institutions. The non-bank financials industry includes businesses as different from banks as stand-alone broker-dealers and asset managers, along with real-estate investment trusts (REITs) and insurance companies. As Exhibit 2 shows, the funding advantage due to size for non-bank financials is nearly two and a half times the differential for banks—on average 77bp for non-bank financials compared to just 31bp for banks since 1999. The largest non-bank financials also experienced a considerably greater spike in their funding advantage at the height of the crisis in 2008, largely driven by a significant widening in smaller peers' spreads.

Exhibit 2 also shows the impact on the analysis of conflating banks and non-bank financials together into a single analysis.⁴ The combined result actually produces a funding advantage that is slightly higher than even the non-bank financials on their own—87bp on average since 1999. This may more closely match what other research has found, but it also clearly distorts the picture for banks themselves. Basing policy analysis of banks on figures that are primarily driven by *non-bank* financials clearly raises serious questions of relevance.

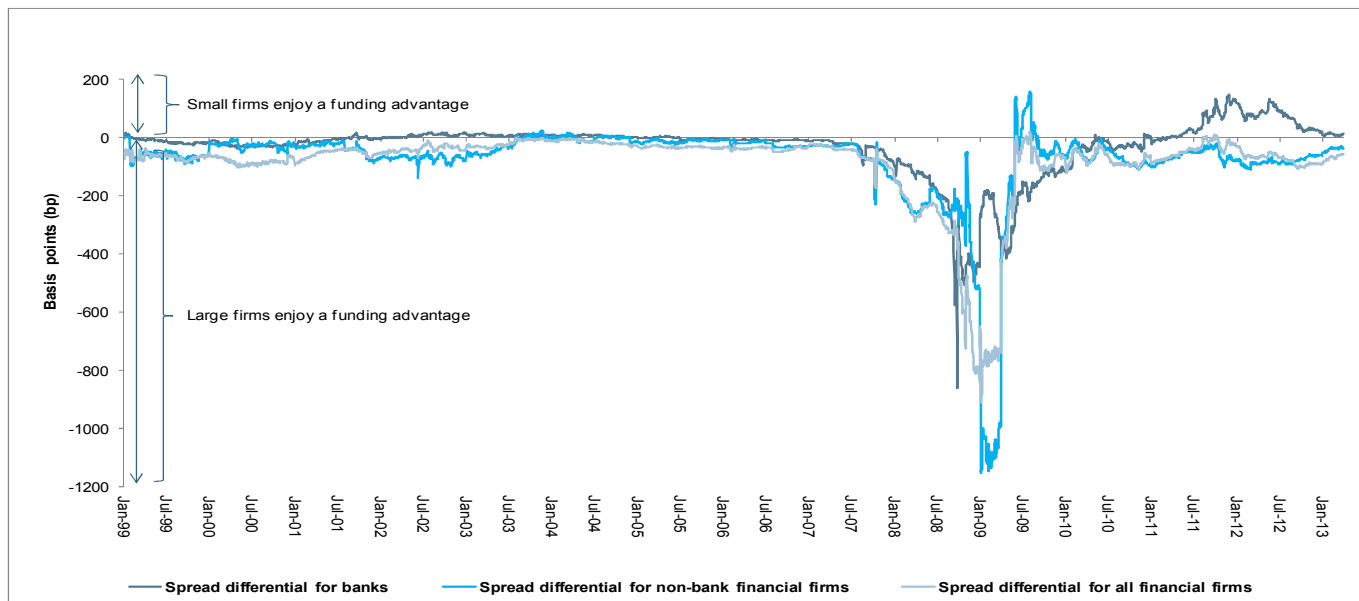
³ TARP is the best-known government intervention of 2008-2009, but it is only one of a long list of programs that benefitted both large and small firms across the broader financial system. The FDIC also guaranteed all non-interest-bearing transaction accounts as well as certain newly issued senior unsecured bank debt. Other significant government programs were designed to provide liquidity to commercial paper issuers, to support the issuance of asset-backed securities, and to facilitate the purchase of asset-backed commercial paper from money market mutual funds.

⁴ This analysis more closely matches the methodology we think some researchers have used. To analyze all financials together, we compared bond spreads for the top 10% of firms by revenue to the bottom 25% by revenue. The smaller firms in the resulting dataset tend to be financial services firms including REITs, which typically have far wider bond pricing spreads than the smaller banks in the dataset. The result is a wider funding advantage than is seen in either industry on a stand-alone basis.



Exhibit 2: The relative funding differential has been greater among US non-bank financials than among US banks—even at the height of the recent crisis—which distorts the analysis for banks themselves

Bond spread differential between average spread of the largest firms and average spread of smaller firms, 1999-1Q2013



Note: For banks alone, the bond spread differential is calculated as the difference between the average bond spread for the six largest banks by assets and the average bond spread for all other banks in the IBOXX index, as in Exhibit 1. For non-bank financial firms and for all financial firms (banks and non-banks) together, the bond spread differential is calculated as the difference between the average bond spread for the largest 10% of firms by revenue and the average bond spread for the bottom quartile of firms by revenue. Bond spreads are calculated relative to the interest rate on US Treasury bonds with comparable maturities. See Appendix B for further details.

Source: IBOXX Investment Grade Index, S&P Capital IQ, Goldman Sachs Research.

Liquidity lies behind much of the biggest banks’ funding advantage

It should not be surprising that the largest banks’ bonds trade at more favorable spreads than the bonds of other issuing banks at times. This differential in large part reflects the benefits of liquidity, the advantages of which are enjoyed by investors and issuers alike. Liquidity enables investors to buy or sell sizeable positions without significantly affecting price; in return, investors typically charge corporate bond issuers a lower premium. Because large firms have greater financing needs, they tend to issue larger bond offerings that naturally attract liquidity by absorbing more of investors’ capital. Larger-sized positions are more cost-effective for investors, who must allocate limited time and resources toward analyzing bond issuers.

The value of liquidity can be seen in two key measures: bond issuance and trading turnover. Data from Dealogic indicate that banking-industry bond issuance over the past five years has been dominated by the largest banks (those with assets above \$500bn), whose aggregate number of bond issuances is 14 times greater than that of all other banks combined. The largest banks issue more frequently (160 bonds per quarter in aggregate, compared to no more than 30 in a single quarter for all other bank issuers combined), and in far greater size (on average, one of the largest banks issues \$7bn of bonds each quarter, compared to \$250mn for a typical other bank issuer).

Big banks’ bonds also trade far more frequently. TRACE data indicates that, on average, bonds from a bank with assets above \$500bn will trade virtually every business day, while bonds issued by one of the smallest banks participating in this market (with assets below \$50bn) will trade just once per week. As a result, it would take close to three months for



markets to trade just \$50mn of a typical small bond-issuing bank's debt; for one of the largest banks, this could be accomplished in less than two hours, as Exhibit 3 shows.

Exhibit 3: Bonds of the largest US banks are significantly more liquid than bonds of smaller US banks

US bank bond trading statistics, January 2007-April 2013

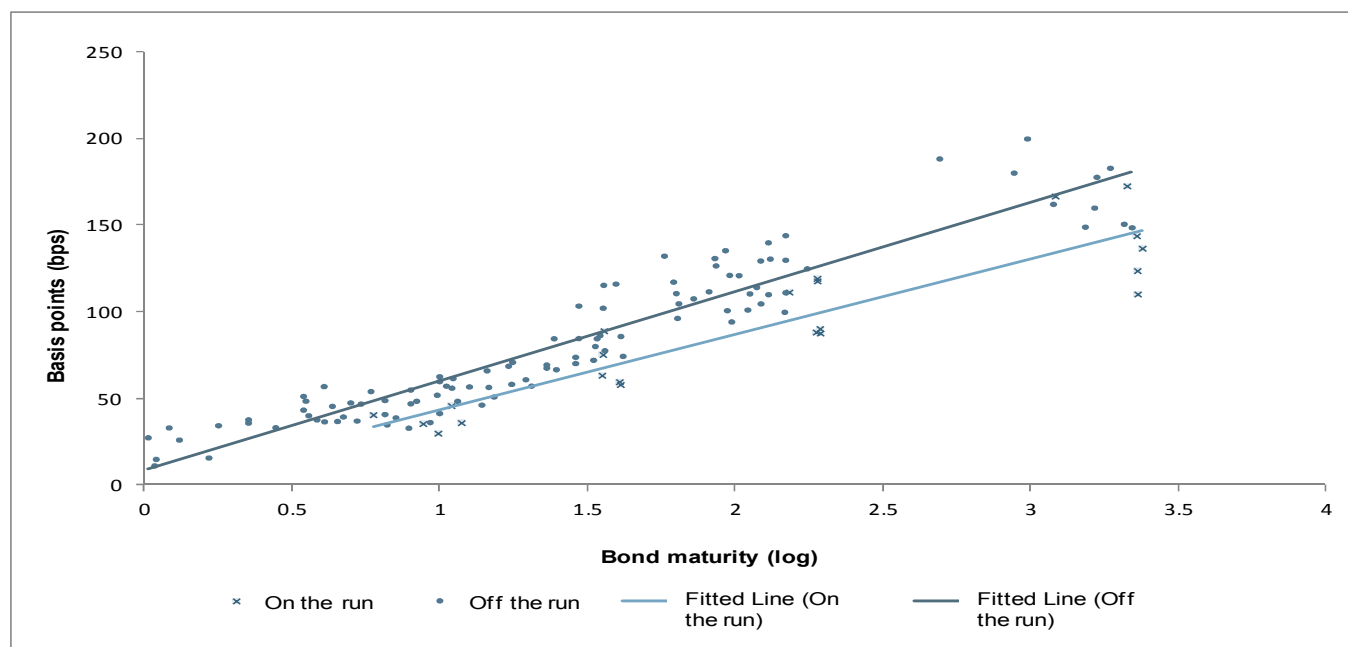
	Average number of firms with bonds traded	Average days each firm traded in one month	Average number of trades in one month per firm	Average dollar value traded in one month per firm (\$mn)	Average time needed to trade \$50mn per firm
Largest banks (>\$500bn in assets)	8	21	15,323	5,788	1.6 hours
Large banks (\$50bn-\$500bn in assets)	22	18	739	278	3.8 days
Small banks (<\$50bn in assets)	29	5	44	18	2.7 months

Source: TRACE, Goldman Sachs Research.

Even for the six largest banks, which are among the most liquid capital structures in the bond market, the "off-the-run" (less frequently traded) bonds trade at a significant spread premium to the "on-the-run" bonds. Exhibit 4 shows how option-adjusted credit spreads vary by (log) maturity for maturities between one and ten years (spread levels are adjusted for firm-level average spreads). Separate curves are fit for "on-the-run" (frequently traded) versus "off-the-run" bonds. These reveal a clear spread premium for "off-the-run" bonds; using the estimated curves at the 10-year point, the liquidity premium is roughly 20bp.

Exhibit 4: The largest banks' less frequently traded "off-the-run" bonds trade at spread premium over their more frequently traded "on-the-run" bonds

Option-adjusted credit spreads for "on-the-run" and "off-the-run" bonds for the six largest US banks, adjusted for firm-level average spread, April 2013



Source: TRACE, Bloomberg, Goldman Sachs Research.

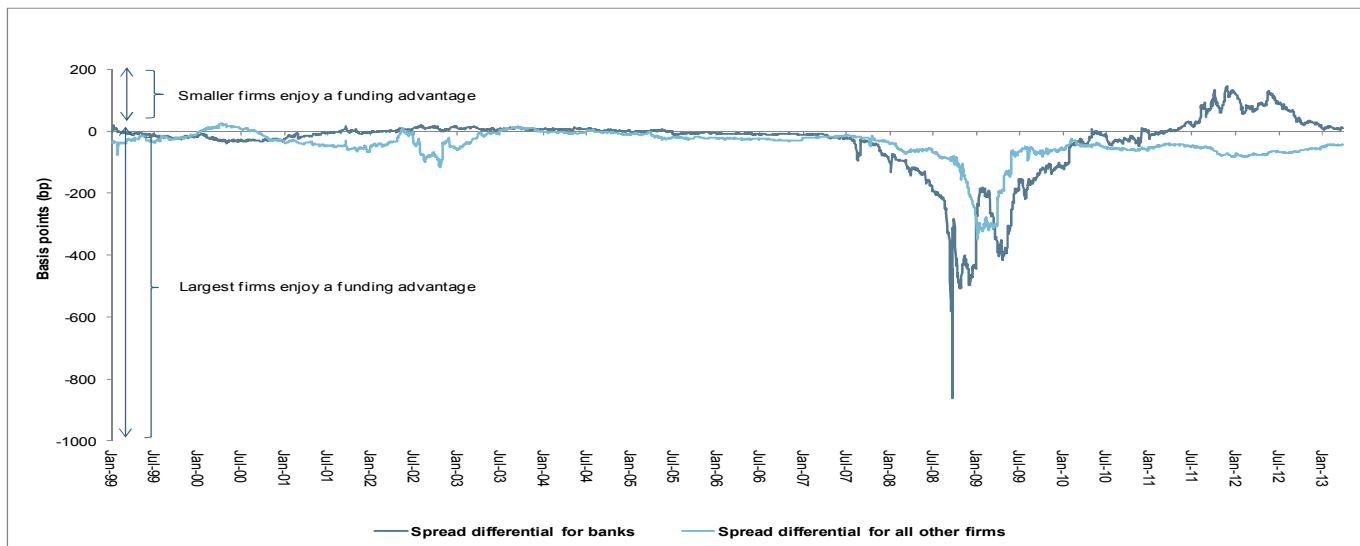
It is worth noting that the lack of bond funding for smaller banks does not give them a relative funding disadvantage. This is because their business models generally allow them to fund themselves almost entirely through deposits, which are even cheaper than the bond funding costs for the largest banks. In today’s low-interest-rate environment, rates paid on deposits are just 40-82bp, compared to average bank issuance yields in the bond market of 235bp in the first-quarter of 2013, meaning that it is the small banks rather than the largest that have an overall funding advantage.

Banks aren’t unique

The benefits of size are seen in industries beyond banking, making it necessary to consider the question of advantageous funding rates for the largest banks in a broader market context.

Our analysis shows that banks are not unique: investors favor the largest firms across nearly all industries. Exhibit 5 overlays the funding differential for non-bank firms onto the equivalent data for banks, showing that investors charge lower premiums to the largest firms across nearly all industries and throughout a wide range of economic conditions. Since 1999, the differential for non-banks has averaged 43bp, greater than the banks’ average of 31bp (even including government aid for banks during the recent financial crisis).

Exhibit 5: The funding advantage for size is seen across US industries
Bond spread differentials by size for US banks and for all other US firms



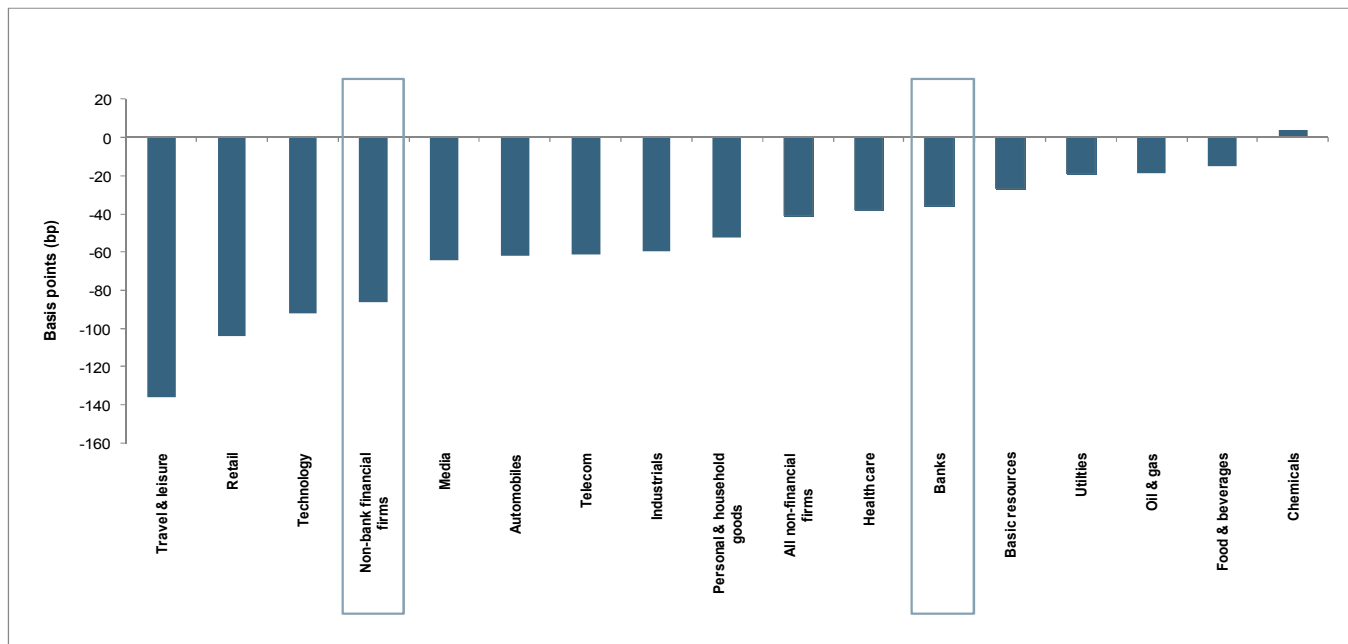
Note: For banks, the bond spread differential is calculated as the difference between the average bond spread for the six largest banks by assets and the average bond spread for all other banks in the IBOXX index, as in Exhibit 1. For all other firms, the bond spread differential is calculated as the difference between the average bond spread for the top 10% of firms by revenue in each industry and the average bond spread for the bottom quartile of firms by revenue in that industry. To calculate the composite for all other firms, we weighted each industry by the number of firms in that industry. Bond spreads are calculated relative to the interest rate on US Treasury bonds with comparable maturities. See Appendix B for further details.

Source: IBOXX Investment Grade Index, S&P Capital IQ, Goldman Sachs Research.

As Exhibit 6 shows in more detail, over the past decade this advantage has been seen in industries as diverse as travel and leisure, retail, technology, media and automobiles, and

the advantage has been considerably greater in other industries, including *non-bank* financials, than in banking itself. The fact that the largest firms typically have a lower cost of funding across industries, and over time, suggests that size does indeed confer benefits that appear distinct from the issue of government support, and that investors will pay for these benefits by providing bond financing more cheaply.

Exhibit 6: The funding advantage for size is greater in most US industries than in the banking industry
Bond spread differentials across US industries, 2002-1Q2013



Note: Calculated as the average of the daily spread differentials from 2002-1Q2013. For banks alone, the daily bond spread differential is calculated as the difference between the average bond spread for the six largest banks by assets and the average bond spread for all other banks in the IBOXX index, as in Exhibit 1. For all other industries, the daily bond spread differential is calculated as the difference between the average bond spread for the largest 10% of firms by revenue in each industry and the average bond spread for the bottom quartile of firms by revenue in that industry. Bond spreads are calculated relative to the interest rate on US Treasury bonds with comparable maturities. See Appendix B for further details.

Source: IBOXX Investment Grade, S&P Capital IQ, Goldman Sachs Research.

Bank failure data support the big bank funding edge

Bond investors charge a lower premium not only for liquidity, but also for safety. When assessing safety, bond investors are typically concerned with the likelihood that a firm might default, and the losses they might incur as a result. While the data on bank bond defaults is quite limited, substantial data on FDIC losses are available, providing insights into the losses that result from banking interventions, and thus into the relative riskiness of the biggest banks compared to smaller ones.

Our empirical review of the historical data suggests that the biggest banks (defined here as banks with assets above \$50bn rather than above \$500bn)⁵ are actually safer

⁵ For this analysis we define the largest US banks as those with assets over \$50bn (using the Dodd-Frank threshold for heightened prudential regulation), which puts them in the largest one-half of one percent of the US banking industry by assets. Using only the six largest banks (those with assets



than their smaller peers in terms of the direct financial losses incurred from FDIC or other government interventions. As we will show, the biggest bank failures generate fewer realized losses to the FDIC for each dollar of deposits. In cases of non-FDIC interventions, such as the TARP program, the biggest banks have in fact generated significant gains for the US taxpayer.

Putting loss figures into context

Using data from the FDIC and from the TARP program, we look at the direct financial losses from the two significant banking crises in the US over the past three decades: the savings and loan (S&L) crisis, which ran from roughly 1986 to 1997, and the recent financial crisis that began in mid-2007.

We benchmark losses to deposits, which gives a reasonable estimate of the risk of loss to bondholders. Perhaps more importantly, this analysis also provides a good indication of the change in risk that would accrue to the government from modifications to the size distribution of the banking system, in particular the question of whether the system would be safer or more dangerous if there were more small banks and fewer large ones.

Losses should also be examined on both a median and a mean basis, because each approach can provide a unique perspective on the data. By reflecting the middle point of the data series, the median loss should capture the characteristics of a “typical” event; however, it can also obscure the impact of extreme events or outliers. By reflecting the average of each point in the data series, the mean loss can better show the impact of outliers—which is important because bank failures tend to be low-probability but high-impact events. Appendix C explains our methodology in more detail.

The biggest banks generate fewer realized losses

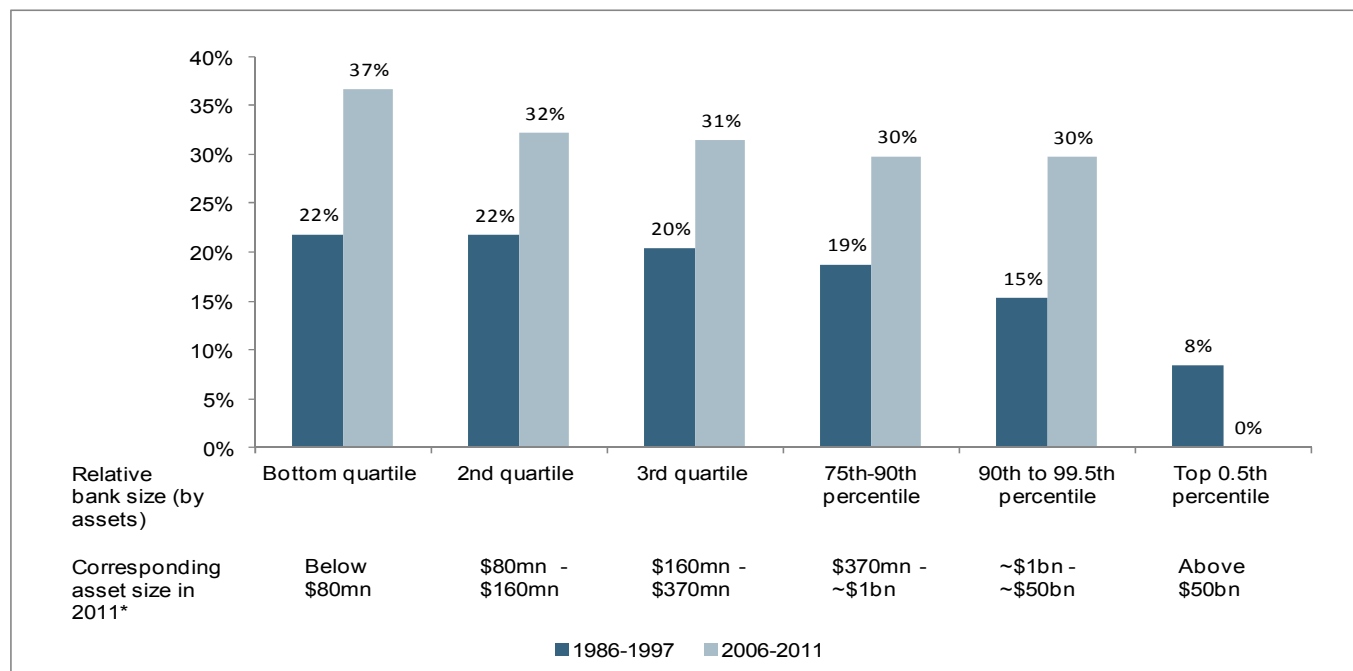
Realized losses from FDIC interventions have been considerably lower at the largest banks than among all others, on a per-dollar-of-deposits basis. As Exhibit 7 shows, median realized losses at the largest banks were just 8 cents for each dollar of deposits during the S&L crisis, and zero during the recent crisis. At the other end of the spectrum, the smallest banks (those with assets below \$80mn) lost 22 cents for each dollar of deposits during the S&L crisis, and 37 cents during the most recent crisis. Median losses at banks with assets equivalent to \$1bn-\$50bn today are somewhat better (15 cents on the dollar during the S&L crisis and 30 cents more recently)—but are still far higher than at the largest banks. When expressed in average terms, as we show in Appendix C, the results are broadly in line with the median analysis: the most significant difference is that the average losses during the S&L crisis were slightly higher than the median losses.

above \$500bn, as we do for the bond funding analysis) would strengthen the results but create extremely small sample sizes for the loss analysis. We benchmark historical data against this Dodd-Frank threshold to account for inflation, growth and consolidation in the industry over time. Appendix C explains our methodology in more detail.



Exhibit 7: For the FDIC, failures of the largest US banks are less costly than failures of smaller US banks

Median losses to the FDIC as a share of deposits in failed banks



* Note: To adjust for changes in the size of the banking industry over time (due to inflation, growth and consolidation), we benchmarked asset sizes to 2011 data. The largest banks are those whose assets put them in the top 0.5% of banks, corresponding to assets of approximately \$50bn in 2011. Appendix C explains our methodology in more detail.

Source: FDIC, Goldman Sachs Research.

Beyond FDIC-led interventions, TARP data from the recent crisis reinforce the finding that the largest banks are less likely to generate government losses.⁶ More than 750 banks have participated in TARP. The outcome has been quite different across size categories, as Exhibit 8 shows. Repayments from banks with assets above \$500bn yielded a 15% profit on the government’s initial \$160bn investment. In many cases the shareholders of the largest banks were also significantly diluted, by at least 5% to as much as 82%, as we show in Exhibit 9, with the government requiring them to raise private-sector equity capital to meet the requirements of the 2009 “stress test” and/or to recapitalize prior to repaying TARP funds. Repayments by banks with assets between \$50bn and \$500bn also yielded a 12% return.

⁶ In 2008-2009, many of the largest failing institutions were purchased by healthier banks, leaving the shareholders of those healthier banks to absorb losses. Other failures were of broker-dealers rather than banks, meaning that the FDIC was not involved at all. Among broker-dealers, Bear Stearns and Merrill Lynch were acquired by banks, while Lehman Brothers went into bankruptcy, with losses absorbed by shareholders and creditors. Two other broker-dealers, Goldman Sachs and Morgan Stanley, converted to bank holding companies in 2008 and participated in TARP. Among major banks, Bank of America and Citigroup received FDIC guarantees along with TARP funds. The government also assisted the American Insurance Group (AIG) in the form of \$70bn in TARP funds and \$112bn of commitments from the Federal Reserve Bank of New York; the two AIG programs together yielded a positive return of \$23bn or 13%. See the following, for example: <http://www.federalreserve.gov/newsevents/press/bcreg/20090116a.htm>; <http://www.sig tarp.gov/Audit%20Reports/Extraordinary%20Financial%20Assistance%20Provided%20to%20Citigroup,%20Inc.pdf>; and <http://www.treasury.gov/initiatives/financial-stability/TARP-Programs/aig/Pages/status.aspx>.

Exhibit 8: The US government made a profit on its investment in large banks through TARP, but has yet to recoup its investment in small banks

Summary statistics for all TARP bank support programs (CPP, TIP, AGP, CDCI) as of April 3, 2013

	Government investment	Return of government investment	Government gains on stock and warrants	Write-offs	Outstanding initial investment	Return of government investment to date
	\$bn	\$bn	\$bn	\$bn	\$bn	%
Largest banks (>\$500bn in assets)	160	160	24	0	0	115%
Large banks (\$50-\$500bn in assets)	52	52	6	0	0	112%
Small banks (<\$50bn in assets)	34	23*	5	(3)	7	103%
Total	246	235	35	(3)	7	113%

*Note: Of the \$23bn repaid, \$2.1bn was borrowed by 137 small banks from the Small Business Lending Fund (SBLF), a government program created by the US Treasury Department to support lending to small businesses. On the use of SBLF funds to repay TARP, see http://www.sig tarp.gov/Audit%20Reports/SIGTARP_SBLF_Report.pdf.

Note: Numbers may not sum due to rounding.

Note: Figures for largest banks include TARP funds that Bank of America received and repaid as a result of its acquisition of Merrill Lynch.

Source: US Treasury Department, Office of the Special Inspector General for the Troubled Asset Relief Program, Goldman Sachs Research.

Exhibit 9: TARP repayments and SCAP fundraising significantly diluted shareholders of the largest banks

TARP repayments by banks with more than \$500bn in assets

Bank	TARP funds received (\$bn)	Common equity raised* (\$bn)	Common equity raised as % of TARP funds	Common share count dilution**
Bank of America	45	48	106%	37%
Citigroup	45	83	184%	82%
Goldman Sachs	10	6	58%	9%
JP Morgan	25	6	23%	5%
Morgan Stanley	10	5	46%	20%
Wells Fargo	25	21	83%	18%

*Note: Includes all common equity raised from the time of the initial TARP receipt until the final TARP repayment; includes equity raises mandated by the Supervisory Capital Assessment Program (SCAP).

**Note: Common shareholder dilution is calculated as the change in common equity shares from the time of the initial TARP receipt until the final TARP repayment, excluding the share impact from mergers and acquisitions.

Source: SNL Financial, company presentations, Goldman Sachs Research.

But the government has fared less well with its TARP assistance to smaller banks, as Exhibit 8 also shows. More than 400 small banks, each with assets below \$50bn, have yet to repay roughly half of the \$14bn they received in aggregate under TARP, and the government has written off a further \$3bn to these small banks entirely. And of the roughly 330 small banks that have exited TARP, 40% did so using funds from other government programs, including the Small Business Lending Fund, a program Congress created specifically to “increase the availability of credit for smaller businesses.”⁷

⁷ See http://www.sig tarp.gov/Audit%20Reports/SIGTARP_SBLF_Report.pdf and <http://www.gao.gov/assets/660/651179.pdf>.



Moving closer to an end to TBTF

It is impossible to rule out the notion that bond investors may price in some expectation of government support. But our empirical work suggests two conclusions: first, that a significant bond funding advantage for the largest banks would *not* have been unusual or surprising, even if TBTF did not affect funding costs, and second, that the actual observed advantage has been quite small over time, and has been a *disadvantage* since the crisis abated. This strongly suggests that the market is *not* pricing in any government assistance that would benefit the largest banks' bondholders. What funding advantage we do find can be explained either by the significantly greater liquidity of the largest banks' bonds, or by their superior loss history.

Our analysis clearly focuses on the narrow question of bank funding costs in the bond market, and neither addresses the very real need for and impact of liquidity provision in times of crisis, nor the externalities of bank failures. These issues have rightly been the focus of many of the regulatory reforms that have been enacted since 2008, and of others currently underway, including the recent focus on single-point-of-entry resolution for the largest banks, which is intended to allow the government to quickly impose any future banking losses on banks' shareholders and bond investors.

If a funding advantage clearly tied to TBTF were to emerge in the banking industry, policymakers and regulators could, and likely would, continue even more vigorously to reinforce the idea that any future bank failures will see owners of bank holding companies' long-term debt "haircut" and losses absorbed by stakeholders rather than by taxpayers, as they should be, while reducing the economic fall-out from any future banking crises.



Appendix A: A brief review of recent TBTF research

TBTF has been the topic of several recent academic and regulatory research pieces.⁸ In conducting our own empirical analysis and in reviewing the recent TBTF research that has garnered significant attention, we uncovered several sticky methodological points that warrant a brief discussion.

First, and as we have noted, some research includes non-bank financials when assessing whether a bond funding differential exists, and in assessing the magnitude of any such differential. Issuers in this broader universe can be as different from traditional banks as insurance companies, stand-alone asset managers, REITs and exchanges. Our own empirical work shows that the largest non-bank financials enjoy a significantly bigger funding advantage than the biggest banks do. The effect of conflating the two is to overstate the universe of available data, to morph the TBTF debate away from banks to all financial firms and ultimately to exaggerate the funding edge attributed to the banks themselves.

Second, much of the research fails to consider whether the biggest firms across a spectrum of industries receive a funding advantage. This misses the broader market and economic context and fails to recognize any size-related advantages, stemming in large part from greater liquidity, that may exist in non-financial industries.

Third, several papers rely on data on banks from countries with banking industries as different from the US as those of Albania, Qatar and Uzbekistan. In some cases, US banks comprise only a small portion of the total sample. While comprehensive, it is not clear that these calculations should be applied to the US banking industry given the differences in banking systems, financial markets and local economies across such a wide range of other countries.

Fourth, while some of the papers employ several statistical measures of risk, many fail to assess actual historical losses from bank failures. This misses one important measure of “safety” that influences bond spread pricing.

Lastly, much of the research misreads the role of credit ratings agencies in determining funding costs. Several researchers have observed that credit ratings agencies currently give the largest banks a ratings “uplift” on the expectation of systemic government support during a crisis. They then assume that investors price the expectation of state support into credit spreads for the largest banks and non-bank financials, resulting in an implicit subsidy. Estimates of this subsidy in the research have ranged widely.

In our view, the link between credit ratings and funding costs may not be as clear or certain as these arguments suggest. While bond-spread performance is frequently driven by near-term market dynamics, ratings take a different time horizon; they are intended to give a longer-term view of credit fundamentals and they typically lag market assessments. This is certainly true in the banking industry, where market prices and ratings have diverged considerably since the crisis began in mid-2007. We calculate that the bonds of the six largest banks have traded since then at spreads that imply a rating at least one notch lower than the headline ratings assigned by Moody’s close to 90% of the time, and at an implied

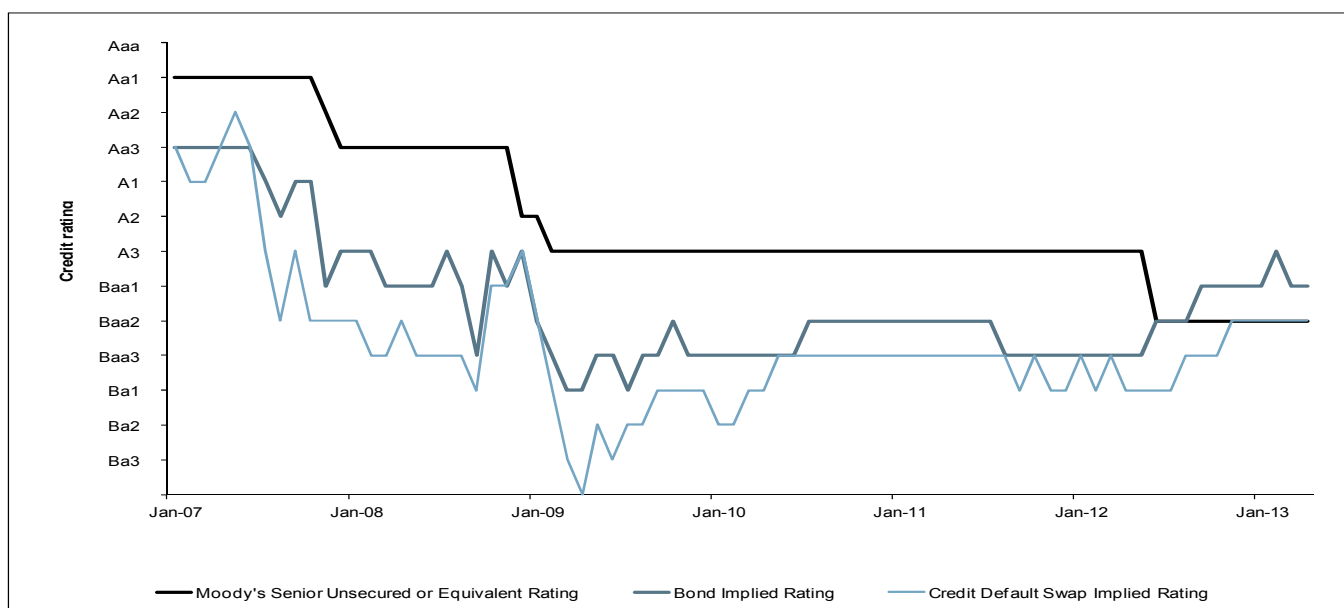
⁸ For example, see http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1961656; <http://www.imf.org/external/pubs/ft/wp/2012/wp12128.pdf>; <http://www.coll.mpg.de/publications/2388>; <http://www.cepr.net/documents/publications/too-big-to-fail-2009-09.pdf>; <http://www.imf.org/external/pubs/ft/wp/2013/wp1394.pdf>; and <http://www.imf.org/external/pubs/ft/sdn/2011/sdn1112.pdf>.



downgrade of at least two notches nearly 80% of that time. Therefore, it is critical to examine actual market prices in considering the question of whether investors price in an expectation of government support.

Exhibit 10 illustrates this point by plotting the Moody's rating for Citigroup, one of the six largest banks, against the ratings that are implied by its bond and CDS prices in the markets. Beginning before the crisis, and until as recently as last summer, market-implied spreads were considerably weaker than the Moody's senior debt ratings. Actual and market-implied ratings have converged recently, but this is in part because the actual ratings have come down, bringing them more into line with market expectations.

Exhibit 10: Citigroup's bonds have traded below, at and above the level its rating would imply over the past six years
 Moody's actual and implied credit ratings for Citigroup, January 2007-April 2013



Source: Moody's.

Moreover, Moody's has recently indicated that it is reconsidering its ratings and may reduce the "systemic support" component by year-end, given progress made towards ending TBTF. S&P has also said that it may no longer factor government support into rating the largest US banks "if regulations make clear that the government will not bail out banks in times of financial stress," and if the agency is "convinced that mechanisms are in place for an orderly resolution." Fitch also said recently that it may factor less support into European and US bank ratings as regulatory reforms develop across jurisdictions. Therefore, even if the "credit uplift drives a funding advantage" argument is true today—which is difficult to prove given the evidence of similar funding differentials across industries—it is now being reevaluated by the major ratings agencies whose work is said to underpin the argument.⁹

⁹ See <http://www.fsround.org/hyperlink/Moody-Reassessing-Systemic-Support-March-2013.pdf>; Fitch: Peer Review: Global Trading and Universal Banks, May 16, 2013 (see press release: http://www.fitchratings.com/creditdesk/press_releases/detail.cfm?pr_id=791358); and S&P: U.S. Banks in the 2020s: Two Potential Roads Diverge, Feb. 15, 2013.



Finally, while credit ratings undoubtedly offer a useful data point, they are not (nor should they be) dispositive for the sophisticated institutional investors who hold the vast majority of bank debt and who operate their own substantial research and analytic infrastructure. And while many institutional investors continue to monitor and assess them, the importance of ratings in the bond market has fallen significantly in recent years.



Appendix B: Bond spreads, liquidity and issuance data

We have used three databases in our analysis of bond spreads, issuance and liquidity.

We obtained **bond spread data** from the IBOXX Investment Grade Index, which contains daily pricing information for investment grade bonds traded in the US from January 1999 to March 2013. We mapped all bonds in the index to the ultimate parent company using the S&P Capital IQ ISIN database. We then limited the universe to US-based firms.

We classified as banks all firms that had at least one FDIC-insured affiliate; this allowed us to exclude other non-bank financials such as stand-alone asset managers and broker-dealers, insurance companies and REITs. Broker-dealers that became bank holding companies in 2008 were classified as banks throughout the entire sample period. From 1999 to 2013, there are a total of 44 unique banks.¹⁰

To make the spreads of bonds with different maturities comparable, we benchmarked all spreads to a US Treasury bond of comparable maturity. We mapped all bond identifiers (ISINs) to the corresponding parent firm using the S&P Capital IQ ISIN database. We then calculated for each firm the median spread across all of the firm's bonds that priced on that day.

We determined firm size in two ways. For banks, we sorted by asset size and compared the average spread of the six largest banks (those with assets above \$500bn) against the average spread of the remaining banks (18 on average over the entire period). In all other industries, we based size on revenues rather than assets, given that revenues are the standard measure of size in most other industries. We used the S&P Capital IQ Financials Database to obtain the fiscal year-end revenue of each non-bank firm from the latest reported income statement matched to the corresponding bond pricing date. We limited our analysis to those firms that had both a bond spread and a matched income statement, excluding any firms that were not present in the S&P Capital IQ dataset or whose financial data were outdated by more than two years.

To calculate the spread differential in non-bank industries, we classified as "big" the top 10% of firms by revenues. We then compared the average spread in this category to the average spread among the smallest firms, defined as the bottom quartile by revenues. To obtain the non-financial composite bond spread differential, we weighted each industry by the number of firms in the industry.

To measure **bond turnover**, we used the more comprehensive TRACE dataset, which includes each corporate bond ISIN in the US since 2006 (although the dataset became sizeable only in 2007). We linked each bond to the ultimate parent company using the S&P Capital IQ dataset. We then computed the number and dollar value of trades for each bond on a daily basis. We classified banks exactly as we did in our IBOXX analysis. The TRACE universe of banks is roughly twice the size of the equivalent IBOXX universe (TRACE has 81 unique banks over the 2007-2013 period and 58 in 2013; IBOXX has 44 unique banks in total and 27 in 2013). The 30 smallest issuing banks (with assets below \$50bn) have few bonds,

¹⁰ While there were a limited number of firms in this database at the outset, by late 2000 there were 16 banks, 5 non-bank financials and 79 non-financials. By March 2013, the dataset had grown to 27 banks, 45 non-bank financials and 281 non-financials. We focus our industry-level analysis on the 2002-2013 period, given the limited data for the first few years. In 2002 the dataset contained 23 banks, 15 non-bank financials and 135 non-financials.

and their bonds trade infrequently. A brief review of the TRACE data yields results broadly in line with the results of the IBOXX analysis.

For our **bond issuance** analysis, we obtained data from Dealogic for US-based banks from 2003 to 2013. The data include each bond issue, including the type, size, date of pricing, issuer name and currency. We examined all corporate bond and medium-term note issuances that were denominated in US Dollars, given that other types of issuances, like preferred stock, are not comparable to debt in this context.



Appendix C: Bank failures and FDIC loss statistics

We derived our information on FDIC bank failures and losses from two databases.

The FDIC's database of bank failures, known as the "failures and assistance transactions database" (F&A),¹¹ has information on failures of FDIC-insured banks dating from 1934. However, information on losses sustained by the FDIC is available only from 1986 to 2011. Using this database, we categorized events of FDIC intervention as "failures" when the FDIC provided loss data;¹² our final dataset includes 2,471 events consolidated for all firms at the ultimate Federal Reserve regulated parent company that experienced recorded losses from 1986 through 2011.

To gauge relative size, we relied on the FDIC's "Research Information Systems" database (RIS), which contains comprehensive financial and regulatory data for all FDIC insured institutions from 1984 to 2011.¹³ We used the same RIS ultimate parent identifier (as in the footnote below) to aggregate all subsidiaries of a parent holding company into their ultimate regulated entity for both the RIS and the F&A entities. We assessed relative size using assets as the key metric, relying on the RIS data for both failed and healthy banks. When we found discrepancies between the F&A and the RIS, we relied on RIS for the asset and deposit information but maintained the F&A's proportion of losses to assets. In the few instances when a bank in the F&A did not appear in the RIS database, we used the assets and deposits as provided by the F&A.

In order to determine the relative size of a failed bank, we computed percentile break-points on the entire universe of banks by assets, both failed and healthy, in the RIS database for each quarter from 1986 to 2011. Our benchmark was Dodd-Frank's threshold—\$50bn or more in assets—which in 2011 was the top 0.5th percentile, or top one half of one percent of all U.S. banks. In 2011 there were 35 banks in this category, against a total universe of 6,900 consolidated banks. Using this benchmark, we segmented the full universe of banks into the following buckets for each quarter from 1986 to 2011: 0-25th percentile, 25th-50th percentile, 50th -75th percentile, 75th -90th percentile, 90th -99.5th percentile and lastly the "top" bucket, or the top 0.5th percentile. Exhibit 11 shows the 2011 dollar figures for these thresholds. We assigned all FDIC losses to the appropriate size bucket based on the date of the bank intervention that resulted in a loss, and then computed losses relative to deposits for each size category.

¹¹ Available at <http://www2.fdic.gov/hsob/SelectRpt.asp?EntryTyp=30> (last retrieved on April 16, 2013).

¹² We treated events with recorded losses as failures regardless of whether the FDIC categorized them as "failure" or "assistance." In some cases, the FDIC recorded a loss as "zero"; we have included these cases in our analysis. Further, we treated any event of FDIC intervention in a subsidiary of a bank group to be an event for the entire group. In a few instances, several subsidiaries of one bank failed at the same time; we have consolidated these into a single loss at the parent level (using the Fed level identifier RSSDHCR).

¹³ See <http://www2.fdic.gov/dict/rishome.asp>. We obtained access to this database through a Freedom of Information Act request.



Exhibit 11: We benchmark historical bank sizes to assets in 2011 for all FDIC-insured institutions

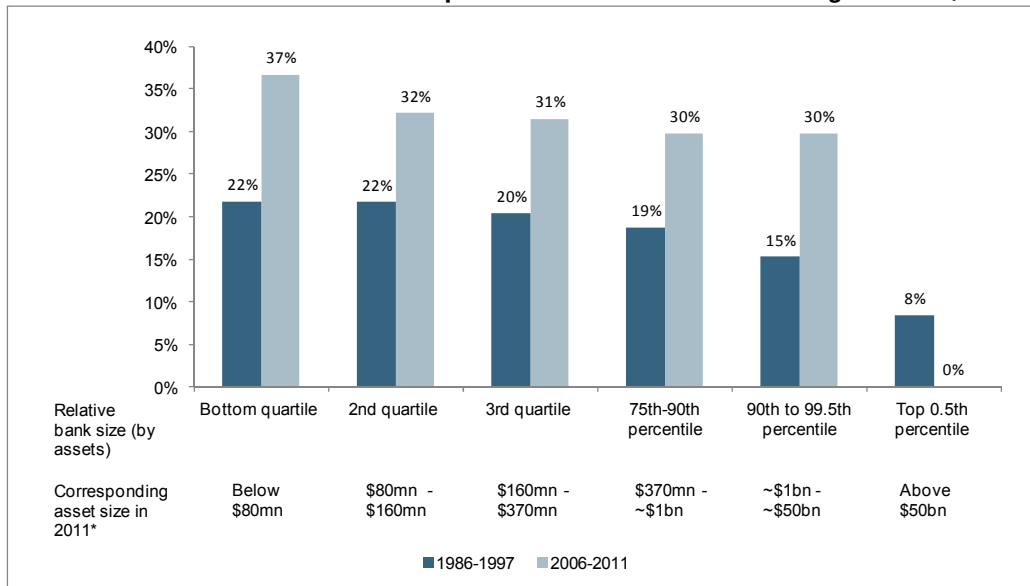
2011 average total assets, \$mn

Bottom quartile	2nd quartile	3rd quartile	75th-90th percentile	90th to 99.5th percentile	Top 0.5th percentile
\$0 - \$79	\$79-\$164	\$164-\$370	\$370-\$933	\$933-\$50,700	>\$50,700

Source: FDIC, Goldman Sachs Research.

Exhibits 12 and 13 show the difference between the median and mean losses, with the median losses representing the “typical” event, as we show in the main body of this paper, and the mean analysis capturing the outliers.

Exhibit 12: FDIC losses as a share of deposits are much smaller at the largest banks, on a median basis . . .

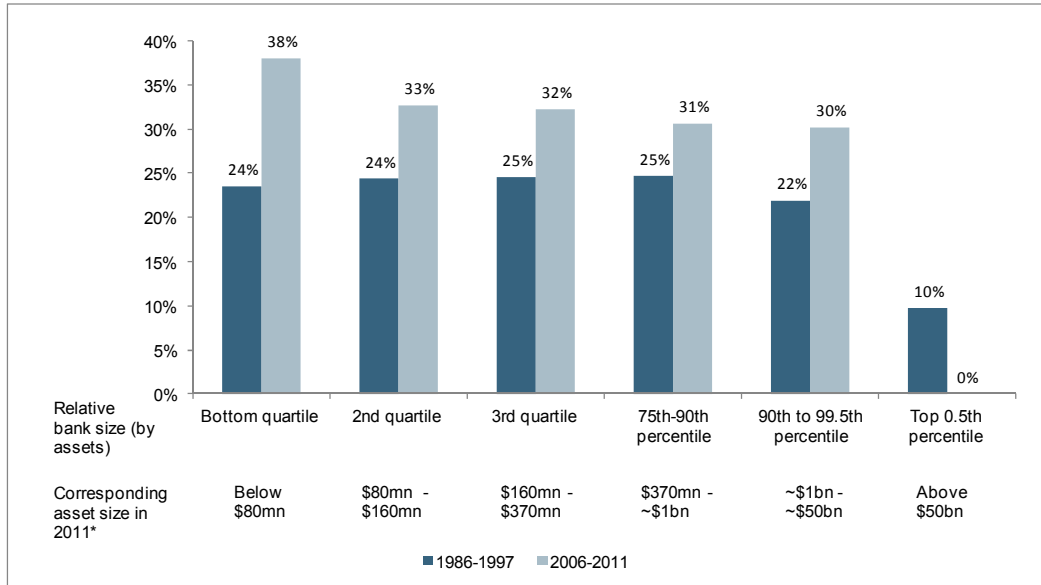


*Note: To adjust for changes in the size of the banking industry over time (due to inflation, growth and consolidation), we benchmarked asset sizes to 2011 data. The largest banks are those whose assets put them in the top 0.5% of banks, corresponding to \$50bn in assets in 2011.

Source: FDIC, Goldman Sachs Research.



Exhibit 13: . . . and FDIC losses as a share of deposits are also much smaller at the largest banks on an average (mean) basis



*Note: To adjust for changes in the size of the banking industry over time (due to inflation, growth and consolidation), we benchmarked asset sizes to 2011 data. The largest banks are those whose assets put them in the top 0.5% of banks, corresponding to \$50bn in assets in 2011.

Source: FDIC, Goldman Sachs Research.



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