

**MODELING  
METHODOLOGY**FROM MOODY'S ANALYTICS  
QUANTITATIVE RESEARCH GROUP

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# Quantifying the Value of Implicit Government Guarantees for Large Financial Institutions

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**Abstract**

The government guarantee, explicit or implicit, of the so-called "Too-Big-to-Fail" (TBTF) institutions has a market value and represents a cost to tax payers. In this study, we quantify the values of these guarantees with a market value-based approach.

These government guarantees reduce investor's expected losses and should have price implications, reflecting value transfer from tax payers to these TBTF institutions and their stake holders. By nature of the support, we postulate that it should primarily affect large financial institutions. Also noticing that recent government bailouts have primarily benefited credit investors rather than equity investors, we expect that such support affects credit spreads much more than it affects equity prices. Therefore, we look at price implications along two dimensions: comparing large financial institutions against small financial institutions and comparing Credit Default Swap (CDS) spreads observed from credit markets against default risk or Fair-value Spreads (FVS) derived from equity markets. By our estimates, the value of these government guarantees can be very significant. Compared with other studies on the subject, our approach has a number of advantages, as it is a market-based approach that can be used on both an *ex ante* and *ex post* basis.



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# 1 Overview

Failures of large financial institutions can cause large shocks to financial systems and the overall economy. Governments have an incentive to bail out these institutions when they are in trouble, despite the obvious problem of moral hazard. This “Too-Big-to-Fail” (TBTF) conundrum, as confirmed by governments’ actions during the recent financial crisis, is real. Government support, even when implicit, has costs and consequences. It is important to understand them. Part of these government guarantees’ costs may represent value transfer from taxpayers to the stake holders of these institutions, reflected in lower credit spreads for large financial companies. In this study, we attempt to quantify the values of these implicit guarantees with a market value-based approach.

*Ex ante*, these guarantees reduce investors’ expected losses and should have price implications, reflecting value transfer from tax payers to these TBTF institutions and their stake holders. By nature of the support, we postulate that it should primarily affect large financial institutions. Also noticing that recent government bailouts have primarily benefited credit investors rather than equity investors, we expect that such support affects credit spreads much more than it affects equity prices. Therefore, we look at price implications along two dimensions: comparing large financial institutions against small financial institutions and comparing Credit Default Swap (CDS) spreads observed from credit markets against default risk or Fair-value Spreads (FVS) derived from equity markets.

Empirical evidence supports our conjectures. Specifically, we observe large gaps between FVS and CDS spreads for the top US and European banks, with CDS spreads approximately 50 basis points tighter than FVS during the recent period. In other words, without the implicit government guarantees, the CDS spreads could be potentially 50 bps higher for these TBTF institutions. Such a gap does not exist for smaller banks and is much smaller before the crisis.

In addition, we use CDS spreads as a proxy for funding costs and explore the funding cost difference between large and small banks. We find that when controlling for the differences in default risk, the gap in funding costs between small and large banks increased significantly after the crisis, supporting our conjecture that government support has become more valuable.

To put the TBTF premium in dollar terms, with a conservative assumption of 50 basis points in the TBTF premium, we estimate the market value (US\$) of TBTF support for the top 20 US banks is \$170 billion, and the value of TBTF support for the top 20 European banks is \$293 billion, if their governments back half of their total liabilities.

Our study makes a number of important contributions to the understanding of the values of the TBTF guarantees. Despite the importance of the subject, as far as we know, there is only one study, Baker and MacArthur (2009)<sup>1</sup> that explicitly measures the value of the TBTF subsidy. Using funding cost data from the FDIC, they estimate that the TBTF subsidy is significant for the FDIC insured large US banks. In related research, Brewer and Jagtiani (2009) estimate the premium banks paid to become TBTF using bank merger data between 1991 and 2004. Using information from the equity market, they conclude that at least \$14 billion in added premiums for the eight merger deals brought the organizations to more than \$100 billion in assets, which also suggests that the TBTF premium can be significant. Penas and Unal (2004) examine changes in adjusted bond returns at acquiring and target banks in response to their merger announcements during the period 1991-1998. They also compare credit spreads on bonds issued before and after mergers. They find evidence that bondholders attach a value to banks becoming TBTF through mergers. Our study provides additional insights into the value of the TBTF subsidy. Previous studies only focused on banks in the US, while our research covers all types of TBTF institutions, including investment banks and insurance companies in both the US and Europe. It is important to note that previous studies were conducted on an *ex post* basis and are usually either at the aggregate level (Baker and MacArthur, 2009) or for certain group of institutions, such as acquiring banks (Brewer and Jagtiani, 2009; Penas and Unal, 2004). In contrast, while we provide empirical evidence of the value of TBTF on *ex post* basis, our framework can provide an *ex ante* estimate of the TBTF premium for a particular TBTF institution.

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<sup>1</sup>Baker, Dean and Travis McArthur, September 2009, “The Value of the ‘Too Big to Fail’ Big Bank Subsidy,” Center for Economic and Policy Research, Issue Brief, September 2009.

## 2 Data

We use data from financial institutions in the US and Europe. We analyze Large Investment Grade Financial Institutions that have both EDF<sup>TM</sup> (Expected Default Frequency) credit measures and CDS spreads. Our US sample includes 83 financial institutions and our European sample includes 107 financial institutions. We define Large Institutions as the Top 20 in book assets as of December 2007; we define the remainder as Small Financial Institutions. This classification of large versus small is likely conservative, in that, smaller banks may also benefit from government support. In that sense, the estimated TBTF premium is also conservative, because it is measured with relative prices between large and small institutions as defined here.

Table 1 Top 20 Largest Financial Institutions as of December 2007, by Book Assets (US \$mm)

US	Europe
CITIGROUP INC	NATIXIS
BANK OF AMERICA CORP	DEXIA
JPMORGAN CHASE & CO	COMMERZBANK AKTIENGESELLSCHAFT
MORGAN STANLEY	AXA
MERRILL LYNCH & CO INC	CREDIT SUISSE GROUP AG
AMERICAN INTERNATIONAL GROUP	AGEAS
GOLDMAN SACHS GROUP INC	BANCO SANTANDER SA
FEDERAL HOME LOAN MORTG CORP	HBOS PLC
WACHOVIA CORP	SOCIETE GENERALE
LEHMAN BROTHERS HOLDINGS INC	ABN AMRO HOLDING N.V.
METLIFE INC	ALLIANZ SE
WELLS FARGO & CO	DEUTSCHE BANK AKTIENGESELLSCHAFT
PRUDENTIAL FINANCIAL INC	ING GROEP N.V.
BEAR STEARNS COMPANIES INC	CREDIT AGRICOLE SA
HARTFORD FINANCIAL SERVICES	ROYAL BANK OF SCOTLAND GROUP PLC
WASHINGTON MUTUAL INC	BNP PARIBAS
U S BANCORP	UBS AG
COUNTRYWIDE FINANCIAL CORP	HSBC HOLDINGS PLC
LINCOLN NATIONAL CORP	BARCLAYS PLC
FANNIE MAE	BAYERISCHE HYPO-UND VEREINSBANK AG

### 3 Methodology

We estimate the TBTF premium with two related but different approaches. The first approach focuses on the difference between observed CDS spread and a modeled credit spread, and the second approach focuses more on the funding costs of banks. For both approaches, we need to make sure that we can accurately control for the differences in the credit risk between TBTF institutions and other firms. It is critically important to control this measure as the differences in credit risk can contribute to the differences in observed credit spreads for TBTF institutions and other firms. For this purpose, we first introduce our measures of default risk and our approach for modeling credit spreads.

#### 3.1 Modeling Default Risk and Fair-value CDS Spreads

Large amounts of market information exist in both the equity and credit markets that can be used to assess credit risk of firms. Both a firm's equity and debt can be valued as options on the asset value of the firm. This insight, originally introduced by Black, Scholes, and Merton, can be applied to assess the default risk of firms with traded equity. In this

framework, default occurs when the value of the firm's assets is insufficient to allow the firm to meet its contractual obligations. The unobservable business value of the firm is inferred from equity prices, together with the company's capital structure, and the business risk of the firm. Over the past two decades, Moody's KMV has developed the Vasicek-Kealhofer (VK) version of this framework to calculate Expected Default Frequency (EDF) credit measures for publicly traded companies. This model, widely used by institutions around the globe, provides daily default probabilities for more than 30,000 public companies worldwide and has been proved to be a forward-looking measurement of default risk for publicly traded firms.<sup>2</sup>

Another source of market information for credit risk is the CDS market. A CDS contract is a derivative instrument protecting against default risk, with the buyer paying the seller a premium in exchange for the recovery of credit loss when default happens. The premium (i.e., the CDS spread) mostly reflects default risk—if the likelihood of default is high, the protection is more expensive, which is reflected in a higher spread. Intuitively, credit spreads reflect expected loss after accounting for investors' risk aversion. This insight allows us to develop a valuation framework that links credit spreads to its underlying risk drivers: default probability, loss given default, and market risk premium. With this framework, we can derive a fair-value CDS spread (FVS) implied by an equity-based EDF measure. A fair-value CDS spread is an estimate of the CDS spread, calculated from the equity-based EDF credit measure.

Fair-value spreads are constructed to match observed CDS spreads, on average, by geographical regions and asset classes. This feature is motivated by observing that, for companies with similar EDF levels, we find clusters of CDS spreads by region and by asset classes. Across regions, controlling for EDF levels, Japanese companies tend to have much lower CDS spreads; across asset classes, controlling for EDF levels, investment grade companies tend to have lower spreads than high yield entities. In this model, a firm's fair-value CDS spread is determined by its default probability, market risk premium on default risk, and Loss Given Default (LGD). We estimate the default probability from the firm's equity prices and financial statement variables using Moody's Analytics Public EDF Credit Measures model; we estimate regional market risk premium by aligning EDF measures and CDS spread levels for all companies in a regional sample; we estimate LGD by aligning EDF measures and CDS spread levels for all companies in the banking sector for the region. Further details are available in Dwyer et al (2010).

### 3.2 CDS Spread Approach

Observed CDS spread reflects the assessment of credit risk of a bank by its credit investors, factoring in government support to the bank's borrowings; the fair-value CDS spread is used to measure the risk level of a bank due to its economic fundamentals, as assessed by equity market participants, and is not distorted by government intervention. Specifically, it is government's stated goal not to bail out the equity holders of banks. If a TBTF premium exists for a bank, we would expect the observed CDS spread to be higher than the fair-value CDS spread. Further, considering TBTF support is concentrated in large institutions, we would expect the difference between fair-value CDS spread and observed CDS spread to be larger for large, systematically important banks. We use this approach to assess the TBTF premium for both pre- and post-crisis periods.

Using the spread difference between FVS and CDS as a proxy for the TBTF premium, we can empirically verify the following implications:

1. The spread difference should be persistently positive for large financial institutions.
2. The spread difference of large financial institutions should grow after the market sees the government bailouts in the crisis.
3. The spread difference of large financial institutions should be larger than that of small institutions.
4. As a robustness check, we do not observe the same characteristics for industrial firms. A TBTF premium does not exist for industrial firms. Before the crisis, the average spread difference for large industrial firms was 2.5 bps, compared with 25 bps for large financial institutions; after the crisis, the average spread difference for large industrial firms is -19 bps, compared with 125 bps for large financial institutions.

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<sup>2</sup>Dwyer and Korablev, 2007; Korablev and Qu, 2009.

### 3.3 Funding Cost Approach

Baker and McArthur (2009) use cost of funds data from the FDIC, and find that the gap in funding costs between smaller banks and TBTF banks increased from 0.29% to 0.49% before and after the Bear Stearns bail out. The authors further point out that the 0.49% gap implies a government subsidy of \$34.1 billion each year.

Our analysis refines the Baker and McArthur method, in that we also control for change in the default risk before and after the financial crisis.

First, we build a simple linear model

$$(\text{FundingCost}_{\text{Small}} - \text{FundCost}_{\text{Large}})_t = \alpha_0 + \beta_0 (\text{EDF}_{\text{Small}} - \text{EDF}_{\text{Large}})_t + \varepsilon_t$$

to estimate the funding cost gap between small and large banks from their default risk gap, we calibrate the model with pre-crisis data. We then compare the predicted funding cost with the actual funding cost gap for the post-crisis period; the difference reflects the increased TBTF premium.

## 4 Results

In this section, we present the results of our two basic methodologies for assessing spread differences, looking first at FVS-CDS differences and FVS-CDS vs. Book Assets, as well as the spread differences over time. We then calculate the actual TBTF market value premium.

### 4.1 Difference in CDS Spread and Fair-value Spread

If a TBTF premium exists, one would expect CDS spreads (CDS) for large banks to be lower than their fair-value CDS spreads (FVS). Indeed, as reported in Figure 1, over the sample period between late 2001 and early 2010, Large US Institutions consistently had higher FVS than CDS, except during a brief period, at the peak of the most recent credit crisis, when excessive volatility in both credit and equity markets caused temporary, unsynchronized movements in CDS and FVS. When comparing such spread differences between the large bank and small bank groups, in Figure 2, we see that, post-crisis, the median TBTF spread premium for Large US Institutions is approximately 56 bps larger than for Small US Institutions. Pre-crisis, the median TBTF spread premium for Large US Institutions is approximately 23 bps larger than for Small Institutions. These compare with the funding cost differences of 49 basis points before crisis and 29 basis points, respectively, after the crisis, as estimated by Baker and McArthur.

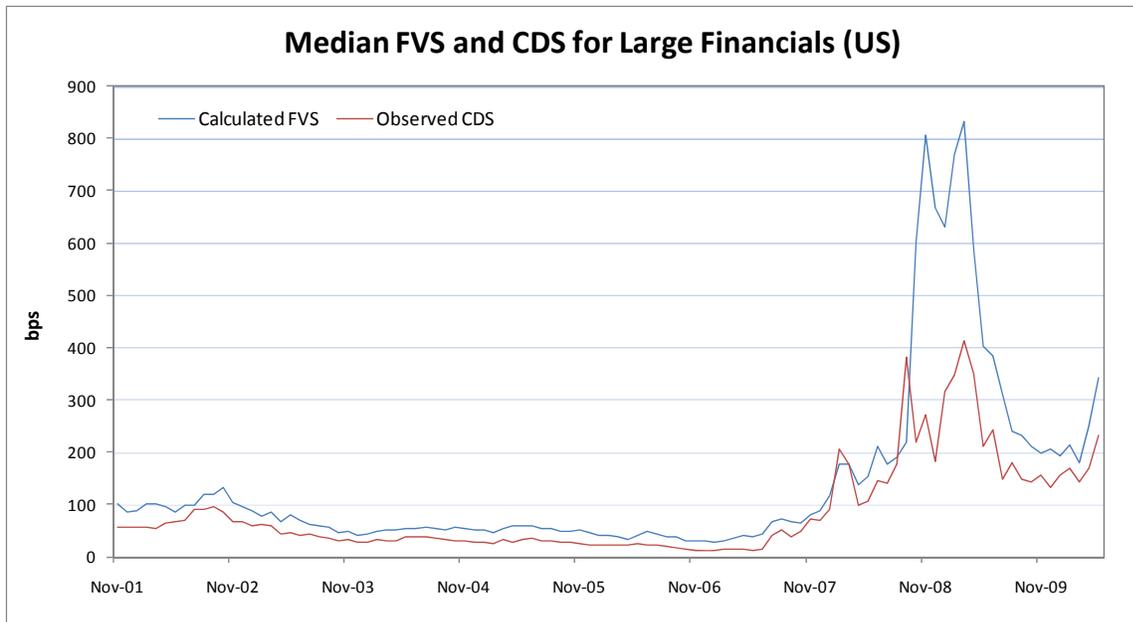


Figure 1 An overview of Calculated FVS and Observed CDS for Large US Financial Institutions, November 2001 – May 2010.

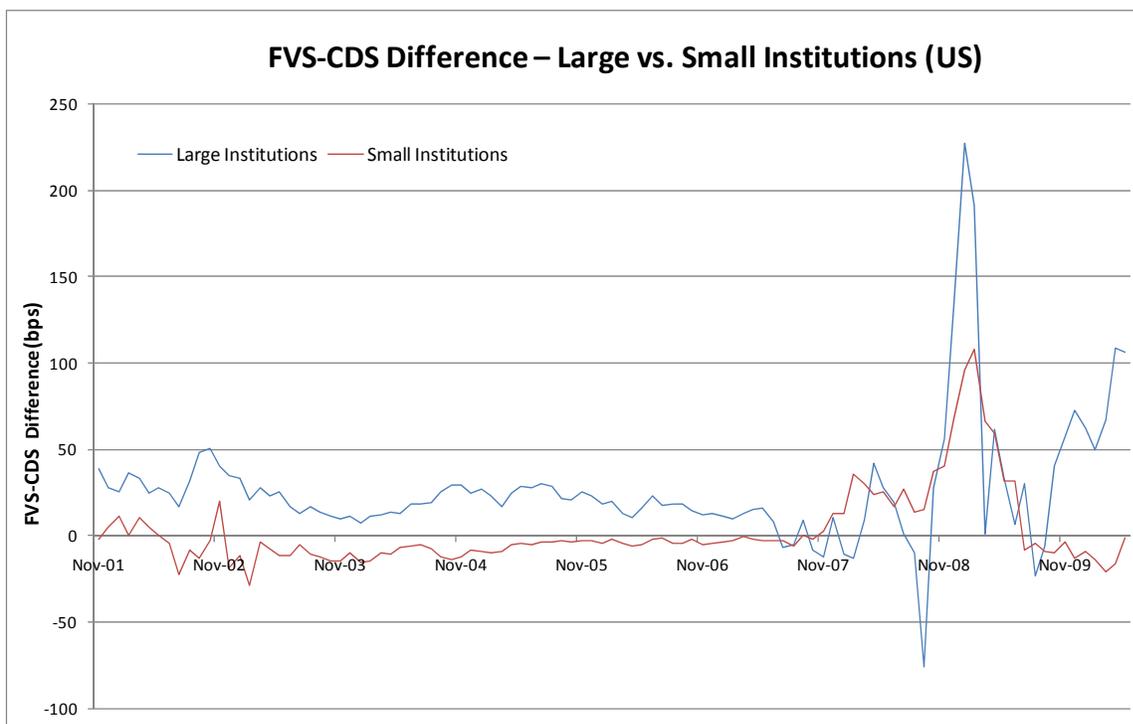


Figure 2 Pre-crisis, the median TBTF spread premium for Large US Financial Institutions is approximately 23 bps larger than for Small US Financial Institutions. Post-crisis, the median TBTF premium for Large US Financial Institutions is approximately 56 bps larger than for Small US Financial Institutions.

We find similar behavior in Europe. Figure 3 shows that throughout the sample period, Large European Institutions tended to have higher FVS than CDS, and the spread difference is higher post-financial crisis. In Figure 4, we can see

that such differences are always higher for Large Financial Institutions than for Small European Institutions. The post-crisis, median TBTF spread premium for Large European Institutions is approximately 51 bps larger than for Small European Institutions, while it was only 3 bps larger pre-crisis.

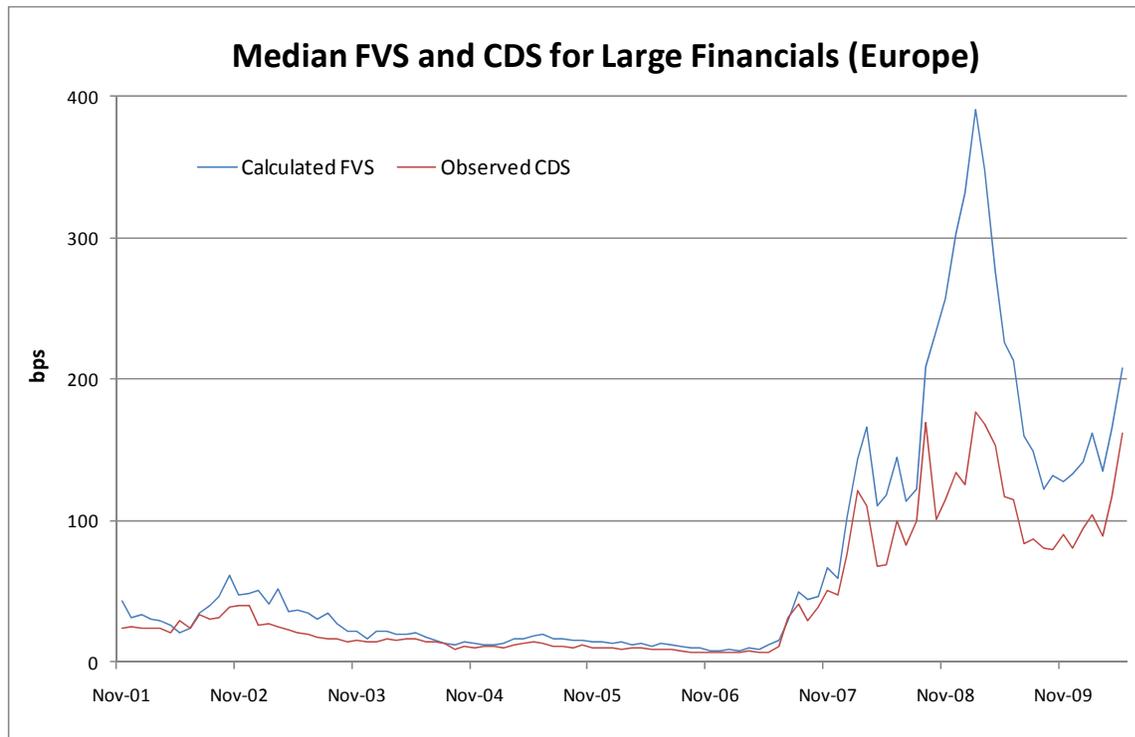


Figure 3 An overview of Calculated FVS and Observed CDS for Large European Financial Institutions, November 2001 – May 2010.

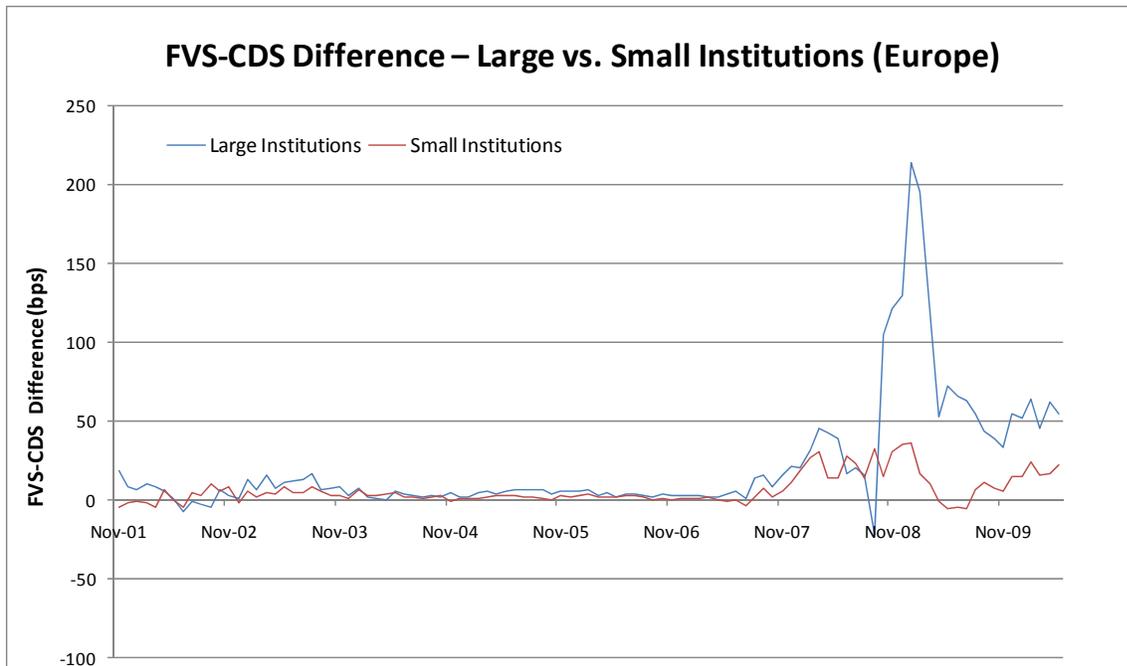


Figure 4 Pre-crisis, the median TBTF spread premium for Large European Financial Institutions is approximately 3 bps larger than for Small European Financial Institutions. Post-crisis, median TBTF spread premium for Large Institutions is approximately 51 bps larger than for Small Institutions.

Next, in Figures 5 and 6, we look at the difference in FVS-CDS (bps) vs. Company Size (Book Assets) in both the US and Europe. Note: we bind FVS-CDS between -500 and +500 bps.

In the US, before the crisis, there was a small TBTF premium visible; FVS-CDS appears to increase with company size, as shown in Figure 5, April 2007. This increasing relationship is more profound after the crisis, as seen in May 2010.

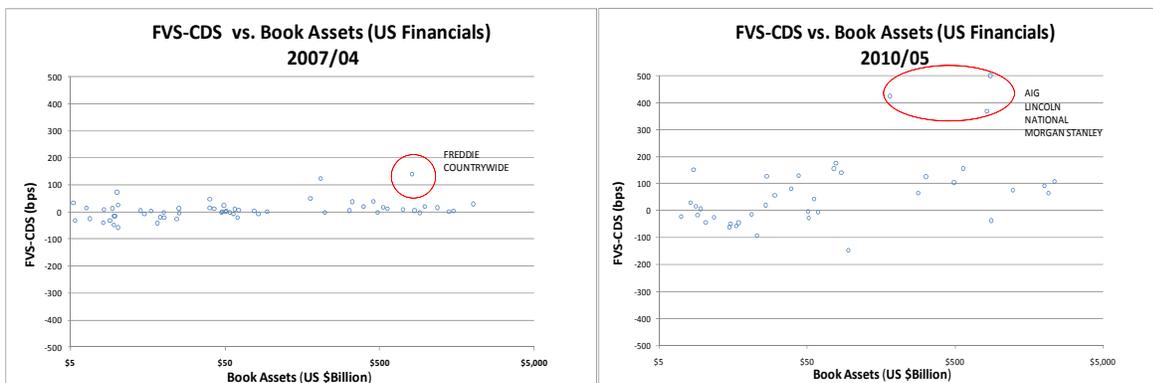


Figure 5 US Financials – FVS-CDS (bps) vs. Book Assets, 2007/04 and 2010/05

In Europe, on the other hand, before the crisis the relationship between FVS-CDS and company size was hardly present (April 2007). Post-crisis, however, the positive relationship is quite obvious (May 2010).

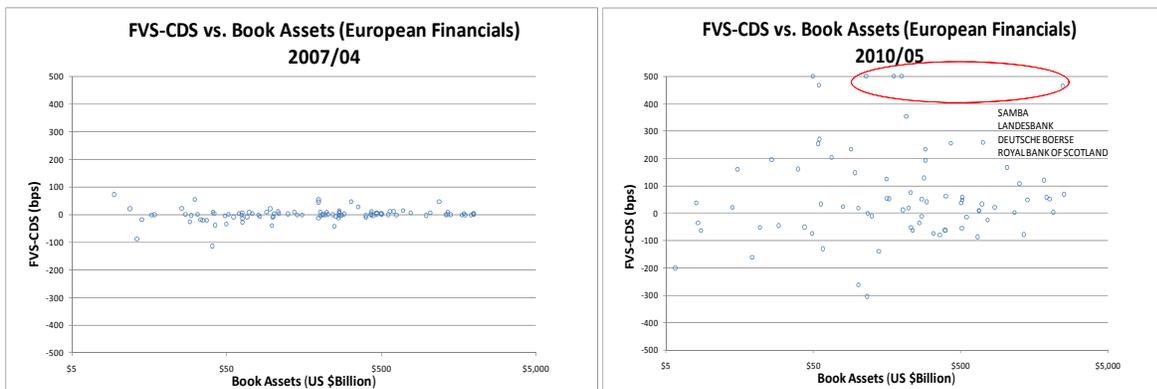


Figure 6 European Financials – FVS-CDS (bps) vs. Book Assets, 2007/04 and 2010/05

## 4.2 Funding Cost Differences

In this section, we use observed CDS spread as a proxy for funding cost.<sup>3</sup> First, as described in Section 3, using pre-crisis data, we estimate the funding cost gaps between small and large financial institutions as a function of the default risk gaps between them. We then compare the predicted post-crisis funding gap with the realized funding gap, and report the predictive errors. We find an average error of 164 basis points on the US sample (Figure 7), and an average error of 73 basis points on the European sample (Figure 8). A positive error indicates increased funding gap between small and large institutions after the financial crisis, when controlling for the change in their respective default risk levels.

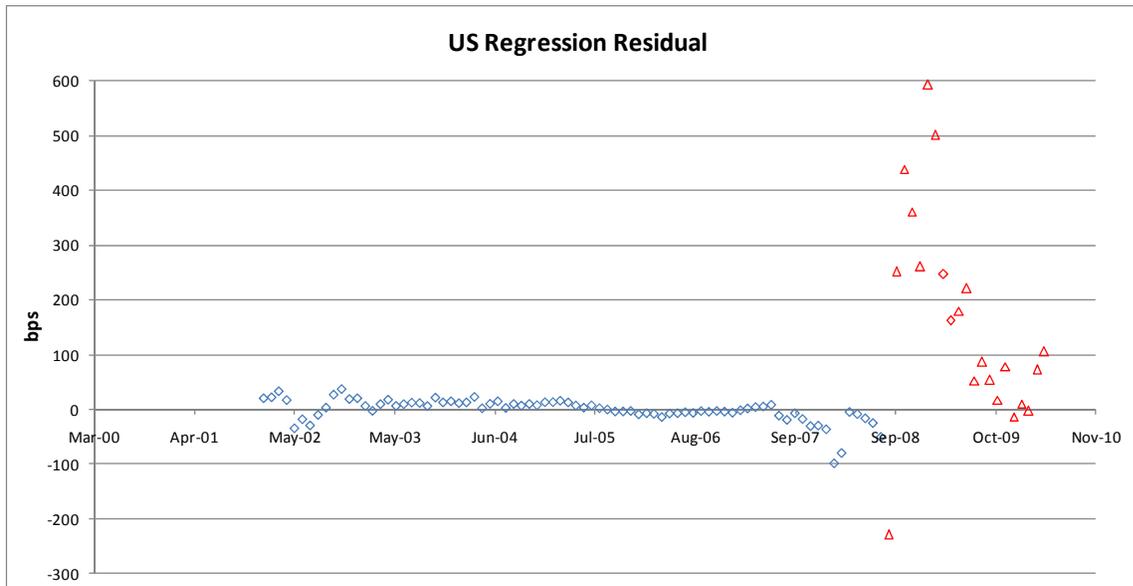
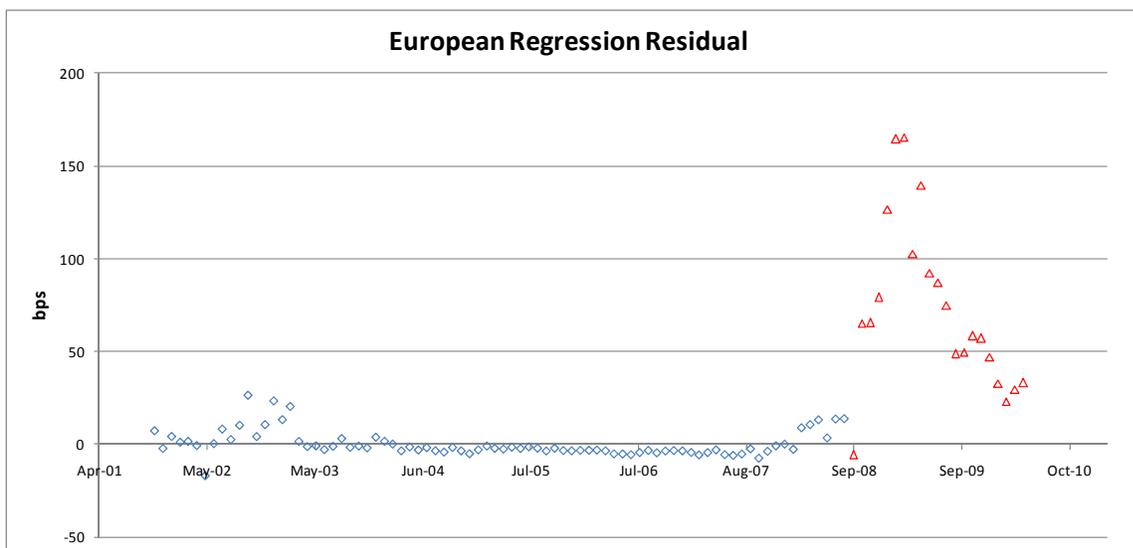


Figure 7 Relative Funding Costs Decreased for Large US Banks, when Controlling for Relative Default Risk



<sup>3</sup> A more appropriate proxy for funding cost should be CDS spread plus a certain benchmark, the risk-free rate. But as we are looking at relative funding costs between large and small institutions, ignoring the benchmark for both groups does not cause any bias in the difference.

Figure 8 Relative Funding Costs Decreased for Large European Banks, when Controlling for Relative Default Risk

### 4.3 Calculating the TBTF Premium in Dollar Amount

To assess the market value of government-implicit guarantees in dollar amount, we use a simple zero-coupon bond model to assess the market value of the TBTF premium. For each dollar of face value zero coupon debt of duration  $t$ , the value of TBTF sponsorship is

- $v = e^{-(r+CDS)t} - e^{-(r+CDS+premium)t} = e^{-(r+CDS)t} (1 - e^{-premium*t})$
- Assuming risk-free rate = 170 bps; Duration = five years

To assess the aggregate value of the TBTF guarantees, we can sum up all total liabilities of these TBTF institutions and assume that a fraction of these liabilities would be guaranteed. Furthermore, for simplicity, we assume a risk-free rate of 170 bps and duration of five years for the zero-coupon bond, and a conservative, 50 bps TBTF spread premium in our calculation. As reported in Table 2, we estimate that the market value (US\$) of TBTF support for the top 20 US financial institutions is \$170 billion, and for the top 20 European financial institutions the market value is \$290 billion, if their governments back half of their total liabilities.

Another way to understand our findings is to examine the benefit of the premium to a specific TBTF institution. If we want to look at the market value of the TBTF guarantee of a specific firm, we can look at the differences between its CDS and FVS spreads and then apply the above calculation to the amount of liability that is presumable covered under the TBTF. For example, using the above assumptions, if a TBTF firm were to issue \$1B of five-year zero coupon bonds, the TBTF guarantee would have saved the institution \$20 million.

Table 2 Value of TBTF Guarantees

	Median CDS (bps)	Estimated TBTF Premium (bps)	Total Liability (Trillions)	Assumed Fraction of Debt Guaranteed by Government (%)	Market Support (in Billions)
US	250	50	\$17	30%	\$102
	250	50	\$17	50%	\$170
EUR	200	50	\$28	30%	\$176
	200	50	\$28	50%	\$293

## 5 Conclusion

After the recent financial crisis and government bailouts, we see significant TBTF premiums for large financial institutions in the US and Europe. We find that, when controlling for the difference in default risk, the gap in funding costs between large and small banks increased significantly after the crisis, supporting our hypothesis that government support has become more valuable. While the crisis has stabilized, it may not be completely over, and it remains to be seen if this TBTF premium will continue.

As we have estimated, the dollar values of the government TBTF government can be very significant, representing a value transfer from tax payers to the stakeholders of these institutions. This raises a number of important questions: Should these TBTF institutions be required to pay for the subsidies? If so, by how much, and by what means? Should they be required to hold more capital and/or to be taxed at a higher rate? Should the TBTF banks be assessed higher deposit insurance premiums?



These are public policy questions with significant implications that warrant further research beyond the scope of this paper. Nevertheless, our research provides a framework that quantifies the market value of the TBTF premium with empirical evidence that will help shape future research on the subject.

## Appendix A Top US and European Banks by Total Liabilities, August 2010

Table 3 Largest European and US Banks, Total Liabilities (US \$mm)

Europe			US	
BNP PARIBAS	FRA	2,750,871	FANNIE MAE	3,257,749
DEUTSCHE BANK AKTIENGESELLSCHAFT	DEU	2,394,628	FEDERAL HOME LOAN MORTG CORP	2,345,314
BARCLAYS PLC	GBR	2,359,709	BANK OF AMERICA CORP	2,130,704
HSBC HOLDINGS PLC	GBR	2,340,426	JPMORGAN CHASE & CO	1,842,899
ROYAL BANK OF SCOTLAND GROUP PLC	GBR	2,304,448	CITIGROUP INC	1,782,850
CREDIT AGRICOLE SA	FRA	2,176,888	WELLS FARGO & CO	1,106,090
ING GROEP N.V.	NLD	1,555,532	GOLDMAN SACHS GROUP INC	809,369
LLOYDS BANKING GROUP PLC	GBR	1,500,919	AMERICAN INTERNATIONAL GROUP	775,061
BANCO SANTANDER SA	ESP	1,435,998	MORGAN STANLEY	758,443
UBS AG	CHE	1,384,717	METLIFE INC	534,532
SOCIETE GENERALE	FRA	1,383,476	PRUDENTIAL FINANCIAL INC	466,264
UNICREDIT SPA	ITA	1,118,044	HARTFORD FINANCIAL SERVICES	295,259
COMMERZBANK AKTIENGESELLSCHAFT	DEU	1,106,491	U S BANCORP	255,074
CREDIT SUISSE GROUP AG	CHE	1,076,503	PNC FINANCIAL SVCS GROUP INC	233,318
AXA	FRA	912,453	BANK OF NEW YORK MELLON CORP	205,297
NORDEA BANK AB	SWE	707,984	SLM CORP	202,232
DANSKE BANK AS	DNK	556,368	CAPITAL ONE FINANCIAL CORP	172,219
SVENSKA HANDELSBANKEN AB	SWE	304,274	LINCOLN NATIONAL CORP	167,491
SKANDINAVISKA ENSKILDA BANKEN	SWE	301,298	SUNTRUST BANKS INC	147,645
SWEDBANK AB	SWE	245,885	STATE STREET CORP	146,016

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## References

- Baker, Dean and Travis McArthur, September 2009, "The Value of the 'Too Big to Fail' Big Bank Subsidy," Center for Economic and Policy Research, Issue Brief, September 2009.
- Brewer, Elijah and Julapa Jagtiani, December 2009, "How Much Did Banks Pay to Become Too-Big-To-Fail and to Become Systemically Important?" Federal Reserve Bank of Philadelphia Working Paper No. 09-34.
- Dwyer, Douglas and Irina Korablev, 2007, "Power and Level Validation of Moody's KMV EDF™ Credit Measures in North America, Europe, and Asia," Moody's Analytics White Paper.
- Dwyer, Douglas, Zan Li, Shisheng Qu, Heather Russell and Jing Zhang, March 2010, "CDS-implied EDF™ Credit Measures and Fair-value Spreads," Moody's Analytics White Paper.
- Korablev, Irina, Shisheng Qu, 2009, "Validating the Public EDF Model Performance During the Credit Crisis," Moody's Analytics White Paper.
- Penas M.F., Unal, H., 2004, "Gains in Bank Mergers: Evidence from the Bond Market," *Journal of Financial Economics*, 74, 140-179.