João A. C. Santos

Evidence from the Bond Market on Banks' "Too-Big-to-Fail" Subsidy

- Expectations that the government will step in to save the largest banks from failure could create a "subsidy" for these banks by encouraging investors to discount risk when they provide funding.
- A look at bond data over the 1985-2009 period suggests that investors accept lower credit spreads on bonds issued by the largest banks than on bonds issued by small banks.
- The funding advantage enjoyed by the largest banks appears to be significantly larger than that of the largest nonbanks and nonfinancial corporations.
- This evidence is consistent with the idea that "too-big-to-fail" status gives the largest banks a competitive edge.

1. Introduction

The idea that some firms may be too big to fail appears to go back as far as 1975 in connection with Lockheed Corporation and the financial difficulties experienced by that firm at the time.[1] It was, however, the demise of Continental Illinois Bank in 1984 that provided solid supporting evidence for this idea.

Continental Illinois, which was the seventh-largest U.S. bank by deposits, experienced runs by large depositors following news it had incurred significant losses in its loan portfolio. Concerns that a failure of Continental Illinois would have significant adverse effects on the banks that had deposits with it led regulators to take the unprecedented action of assuring all of Continental's depositors—large and small—that their

[1] In 2008, in his *New York Times* column on language, William Safire explored the origins of the phrase, citing a 1975 *Business Week* article about Lockheed Corporation that carried the headline "When Companies Get Too Big to Fail" ("Too Big to Fail or to Bail Out?" *New York Times*, April 6, 2008).

João A. C. Santos is a vice president at the Federal Reserve Bank of New York.
joao.santos@ny.frb.org

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money was fully protected.[2] Subsequently, during Congressional hearings on Continental Illinois, the Comptroller of the Currency indicated that the eleven largest banks in the United States were too big to fail and would not be allowed to fail.[3]

The perception that some banks will be rescued because they are too big to fail is important because it can have far-reaching implications. If investors, creditors in particular, believe that certain banks are too big to fail, they will discount risk when providing those banks with funding. This insensitivity of financing costs to risk will encourage too-big-to-fail banks to take on greater risk. The largest banks' risk taking, in turn, will drive the smaller banks that compete with them to take on additional risk as well.[4]

That perception has triggered a large body of research attempting to determine whether bank investors, including depositors, believe that the largest banks are too big to fail, and whether those banks behave differently because they expect to be rescued if they get into financial difficulties. A number of studies have tried to test the too-big-to-fail hypothesis by investigating spreads on bank bonds. Flannery and Sorescu (1996), for example, find that yield spreads on bank bonds were not risk sensitive after the Continental Illinois bailout, suggesting that bond investors believed large banks were too big to fail. However, the authors find that bond spreads came to reflect the specific risks of individual issuing banks starting around 1988 when conjectural guarantees no longer covered (many) bank debentures. Balasubramnian and Cyree (2011) document that the relationship between spread and risk for the largest banks flattened after the rescue of Long-Term Capital Management in 1998. Anginer and Warburton (2014) find a positive relationship between risk and bond spreads in the secondary market but only for mid-size and small institutions. Acharya, Anginer, and Warburton (2013) document that bond credit spreads continued to be less sensitive to risk for the largest financial institutions even after the passage of the Dodd-Frank act.[5] Penas and Unal (2004), in turn, focus on bank mergers. They find that bondholders of medium-sized banks that may push the merging bank into the too-big-to-fail category realize the highest returns around the merger and only these banks benefit from some savings when they issue in the bond market after they merge.

Some studies have considered instead credit default swap (CDS) spreads. Demirguc-Kunt and Huizinga (2010) report that, in countries with weak finances, too-big-to-fail banks could increase their value by downsizing (they are too big to save) while, in stronger regimes, CDS spreads tend to decrease with bank size.[6]

Other studies have focused on support ratings, which attempt to capture the likelihood that the bank will receive government support if it runs into financial difficulties. Rime (2005) shows that proxies for the too-big-to-fail status of a bank, such as size and market share, have a positive effect on a large bank's support rating relative to its stand-alone rating. Haldane (2010) documents that the stand-alone versus support ratings differential was between 1.5 and 4 notches for a sample of U.K. banks, building societies, and global banks between 2007 and 2009. Ueda and Weder di Mauro (2011) in turn report that, for the top forty-five U.S. banks, the mean support rating differential increased from 3.2 in 2007 to 4.1 in 2009, suggesting an increase in the importance of the too-big-to-fail status over that period.

Still other studies have considered the cost of deposits and bank merger premiums. Baker and McArthur (2009), for example, report that the average cost of deposits is lower for large banks. They also report that the difference in the cost of deposits for banks with more than $100 billion in assets and those with less increased in the period from the fourth quarter of 2008 to the fourth quarter of 2009. Jacewitz and Pogach (2013) report that the risk premium on uninsured deposits paid by the largest banks was 15 to 40 basis points lower than at other banks, based on deposit rates offered at the branch level over the 2005-08 time period.

Brewer and Jagtiani (2007), meanwhile, study the purchase premium that acquirers are willing to pay for becoming too big to fail and gaining the presumed benefits of that status. The authors estimate that, over the 1991-2004 period, acquirers in nine mergers were willing to pay about $14 billion in additional premiums in order to become too big to fail.[7]

Lastly, a set of studies has unveiled evidence that banks believed to be too big to fail take on additional risk. Gropp,

[2] Simultaneously, the Federal Reserve Board, the Federal Deposit Insurance Corporation (FDIC), and the Comptroller of the Currency, together with twenty-four U.S. banks, announced a $7.3 billion bailout for Continental Illinois. The rescue package comprised a $2 billion capital injection by the FDIC and the group of twenty-four banks and an unsecured line of credit by the banks of $5.3 billion.

[3] See O'Hara and Shaw (2000) for further details on the Comptroller of the Currency's announcement.

[4] As Hakenes and Schnabel (2010) show, lower financing costs induce large banks to behave more aggressively, increasing competition and decreasing margins and hence charter values for competing banks—developments that push these banks toward higher risk taking. See Gropp, Hakenes, and Schnabel (2011) for evidence of this effect on smaller competing banks.

[5] See Sironi (2003) and Morgan and Stiroh (2005) for further studies of bank bond spreads in Europe and the United States, respectively.

[6] Li, Qu, and Zhang (2011) also consider CDS spreads to investigate whether investors believe the largest U.S. banks are too big to fail.

[7] Molyneux, Schaeck, and Zhou (2010) also investigate the merger premiums, but their analysis is based on a sample of bank mergers and acquisitions in nine European Union economies.

Hakenes, and Schnabel (2011), for example, find support for this conclusion by looking at bank balance sheet data, and Gadanecz, Tsatsaronis, and Altunbas (2012), by looking at bank lending in the syndicated loan market. Brandao Marques et al. (2013) and Afonso, Santos, and Traina (2014), in turn, uncover evidence of bank risk taking by studying various measures of bank risk. These studies are important because they show that too-big-to-fail status does have an effect on banks' policies.

Although this article, like other studies reviewed here, focuses on the primary bond market, our approach differs from that of other researchers who look for evidence of a too-big-to-fail subsidy in bond spreads. Specifically, we ascertain whether investors perceive the largest banks to be too big to fail by investigating whether these banks benefit from a cost advantage when they raise funding in the bond market. We start by examining how the bonds issued by the largest banks over the 1985-2009 period compare with those issued by smaller banks in terms of their credit spreads over Treasury securities of the same maturity, controlling for bond risk and other factors that may affect bond spreads.

The results of this part of our investigation show that the top-five banks by asset size pay significantly lower spreads than their smaller peers. In particular, the spreads of bonds issued by the largest banks are, on average, 41 basis points below the smaller banks' bond spreads, after controlling for bond characteristics, including the credit rating, maturity, and amount of the issue, as well as conditions in the bond market at the time of issue. However, this cost difference does not necessarily imply that investors believe that the largest banks are too big to fail. For example, if the largest banks are better positioned to diversify risk because they offer more products and operate across more businesses (something not fully captured in their credit rating), this advantage could explain part of that difference in the cost of bond financing.

To address this concern, we extend the analysis and compare the largest banks' cost advantage over smaller banks in the bond market with the cost advantages that the large nonbank financial institutions (nonbanks) and the largest nonfinancial corporations enjoy relative to their smaller peers. If what drives the difference in the cost of bond issuance for the largest and smaller banks is a size-specific factor or a perception by investors that the largest firms in general are all too big to fail, then the cost advantage of the largest banks should be similar to the cost advantages possessed by the largest nonbanks and the largest nonfinancial corporations in the bond market. If, however, investors believe that the largest banks are more likely to be considered too big to fail, then the cost advantage of these banks will exceed that of the largest nonbanks and nonfinancial corporations.

The results of this part of our investigation show that the largest nonbanks and the largest nonfinancial corporations pay less than their smaller peers to raise funding in the bond market. However, in contrast to our findings on banks, that discount is generally not statistically different from zero. Given these findings, it is not surprising that our results show that the largest banks enjoy a significantly larger discount than both the largest nonbanks and the largest nonfinancial corporations. The largest banks that issue bonds rated double A and single A—the two main rating categories for these banks' bonds—benefit from a discount (relative to their smaller peers) that is larger by 92 and 16 basis points, respectively, than the discount enjoyed by the largest nonbanks that issue bonds with those same ratings (relative to their smaller peers), though the difference is statistically significant only in the former case. When compared with the largest nonfinancial corporations, the largest banks that issue bonds rated double A and single A benefit from an additional discount of 53 and 50 basis points, respectively, although only the latter difference is statistically significant.

Our finding that the largest banks, the largest nonbanks, and the largest nonfinancial corporations all benefit from a discount relative to their smaller peers in the bond market can be interpreted as some support for the view that the too-big-to-fail status does not apply solely to banks. However, our evidence that the largest banks benefit from a bigger discount than the largest nonbanks and the largest nonfinancial corporations suggests that investors believe that the largest banks are more likely to be rescued if they get into financial difficulties.

The rest of the paper is organized as follows. Section 2 describes the methodology and data sources used and characterizes the sample. Section 3 compares the spreads that the largest banks pay to raise funding in the bond market with those paid by smaller banks. Section 4 conducts a similar exercise for nonbanks and nonfinancial corporations, respectively. Section 5 compares the discount that the largest banks enjoy (relative to their smaller peers) with the discount available to the largest nonbanks and the largest nonfinancial corporations in the bond market. Section 6 summarizes our findings.

2. Methodology, Data, and Sample Characterization

2.1 Methodology

To ascertain whether too-big-to-fail banks benefit from a discount in the bond market, we begin by estimating the following model of bond spreads on the sample of bonds issued by U.S. banks:

$$SPREAD_i = c + \alpha TOP5_i + \beta BOND_i + \gamma TIME_i + \varepsilon_i,$$

where SPREAD is the bond yield over the Treasury security (with the same maturity as the bond) at the time of the bond origination. TOP5, the key variable of interest, is a dummy variable equal to 1 for bonds issued by the top-five banks (by asset size) in the year. If large banks benefit from a discount in the bond market relative to their smaller peers, then we should find that TOP5 is negative and statistically significant.

We attempt to identify that effect while controlling for a set of bond characteristics, BOND, which includes a dummy variable for the rating of the bond (AAA, AA, A . . .), the log of the size of the bond issue (LAMOUNT), and the maturity of the bond (MATURITY). Everything else equal, we should expect bonds with higher ratings to carry lower spreads. With regard to the size of the bond issue, banks that are more creditworthy usually find it easier to make larger issues, but they may have to offer higher yields to create a sufficiently large demand for their bond issues. So the effect of the size of the bond issue on the spread is ambiguous. Similarly, banks that are more creditworthy may find it easier to issue longer-term bonds, but these bonds tend to carry a higher risk. Finally, we include a set of year-quarter dummy variables to control for any effects that economic conditions at the time of the issue may have on the bond spread.

The large-bank discount identified by the model of bond spreads we presented above may not be solely attributable to a too-big-to-fail subsidy. For example, if bonds of the largest banks are safer in a way that is not captured in their credit ratings, this will lower the coefficient on TOP5; yet it is not the result of investors "offering" a discount to the largest banks because they believe these banks will be protected in the event of financial difficulties. In an attempt to disentangle these effects, we expand the sample to include bonds issued by nonbanks and nonfinancial firms. We then investigate whether the largest banks benefit from a discount relative to their smaller peers and consider how that discount compares with that of the largest nonbank issuers relative to their smaller peers. To that end, we estimate the following model of bond spreads:

$$SPREAD_i = c + \theta TOP5_i + \vartheta BK_i + \alpha BK \times TOP5_i + \delta BOND_i + \beta BK_i \times BOND_i + \gamma TIME_i + \varepsilon_i.$$

This is an extension of the previous model. TOP5 is a dummy variable equal to 1 if the bond issuer is a top-five firm by assets in its group (banks, nonbanks, and nonfinancial corporations). BK is a dummy variable equal to 1 if the bond was issued by a bank. As in the previous model, the key variable of interest is the dummy variable BK × TOP5. This variable will indicate whether the largest banks benefit from a bigger discount in the bond market than the largest nonbank issuers.

We attempt to identify that difference in the cost paid by the largest firms while using the same set of controls we use in our base model of bond spreads. To allow for the possibility that bank bonds are priced differently from the bonds of the remaining firms, we include not only the set of bond controls, BOND, but also its interactions with our bank dummy variable, BK. As in the base model, we include year-quarter dummy variables to control for the potential effects of economic conditions at the time of the bond issue.

Since there are important differences between the two control groups considered, we estimate that model separately on the sample of bonds issued by banks and by nonbanks, and on the sample of bonds issued by banks and by nonfinancial corporations. Finally, since the pool of bonds issued by the largest firms may carry a different level of risk than the set of bonds issued by the remaining firms, we estimate our bond spread model separately for bonds with the same credit rating. In this case, we restrict the sample to bonds most commonly issued by the largest banks, that is, bonds rated single A and those rated double A.

2.2 Data

The data for this analysis come from the Securities Data Corporation's Domestic New Bond Issuances (SDC) database and from Compustat. We use the SDC database to obtain information on all bonds issued in the United States, including their maturity and yield at origination, and whether they are callable or convertible or have a floating rate. We also use the SDC database to get information about the identity of the bond issuer.

We complement these data with information on issuers' assets from Compustat and from banks' *Consolidated Reports of Condition and Income* (call reports), which are used to

identify the largest firms among banks, nonbanks, and nonfinancial corporations.

2.3 Sample Characterization

To select our sample of bonds, we start out with all the bonds issued in the U.S. bond market by banks, nonbanks, and nonfinancial corporations between 1985 and 2009. We begin in 1985 since the claim that some banks were too big to fail was first made in connection with the demise of Continental Illinois in 1984. Next, we drop the bonds that do not have the information we need to estimate the bond spread model (ex ante yield to maturity, issue date, maturity date, and Standard & Poor's rating). Finally, we drop bonds with "unique" features that affect their pricing (such as floating-rate bonds, as well as callable bonds and convertible bonds). These criteria leave us with a sample of 8,399 bonds, of which 436 were issued by banks, 1,696 were issued by nonbanks, and 6,267 were issued by nonfinancial corporations.

We identify the top-five firms by asset size in each group and isolate their bonds. Of the 436 bonds issued by banks, 243 were issued by the top-five banks. Of the 1,696 bonds issued by nonbanks, 241 were issued by the top-five firms. Lastly, of the 6,267 bonds issued by nonfinancial corporations, 139 were issued by the top-five firms. Table 1 reports the rating distribution of the bonds issued by each of these groups.

Significant differences emerge in the risk profile of the sample of bonds issued by each of the three groups in the sample. For example, only about 16 percent of the bonds issued by banks are rated below investment grade. In the case of bonds issued by nonbanks, that percentage goes up to 20 percent, and it rises further to 33 percent in the case of nonfinancial corporations. These differences are even more striking when we consider the bonds issued by the top-five firms within each group. For example, none of the bonds in the sample issued by the top-five banks are rated below investment grade. It is for this reason that, when comparing the difference in credit spreads at origination across the three groups of firms, we focus on single-A- and double-A-rated bonds, which are the two most populated rating categories among bonds issued by the largest banks.

Table 1
Ratings Distribution of Bonds in the Sample

	Financials					
	Banks		Nonbanks		Nonfinancials	
	TOP5	All Others	TOP5	All Others	TOP5	All Others
	243	193	241	1,455	139	6,128
	Percentage of Bonds by Bond Rating					
AAA	0.058	0.010	0.095	0.014	0.007	0.006
AA	0.152	0.150	0.320	0.086	0.266	0.035
A	0.790	0.446	0.581	0.333	0.410	0.253
BBB		0.238	0.004	0.353	0.108	0.382
BB		0.119		0.058	0.007	0.130
B		0.031		0.054	0.007	0.116
CCC		0.006		0.037	0.122	0.053
CC				0.003		0.004
C				0.002		0.001
D				0.060	0.073	0.020

Source: Author's calculations.

Notes: Our sample includes 8,399 bonds issued by banks (436), nonbank financial institutions (1,696), and nonfinancial corporations (6,267) over the 1985-2009 time period. TOP5 is a dummy variable for the top-five issuers by asset size. AAA, AA . . . are dummy variables for the S&P rating of the bond.

3. Do the Largest Banks Issue Bonds at a Discount?

To ascertain whether the largest banks benefit from a discount in the bond market, we use our model of bond spreads to compare the credit spreads (over Treasuries with the same maturity) on their bonds in the primary market with the spreads on the bonds of the remaining banks. Table 2 reports the results. Model 1 distinguishes the bonds issued by the top-five banks (as measured by asset size) from those issued by the remaining banks, controlling only for the year-quarter when the bond was issued in order to account for the overall macroeconomic effects on the cost to issue in the bond market. According to our results, the largest banks benefit from a discount of 44 basis points relative to the spread paid by the remaining banks to issue in the bond market.

Model 2 shows that when we control for the risk of the bond as determined by its Standard & Poor's rating and for the maturity and size of the bond issue, the discount enjoyed by the largest banks drops to 41 basis points, although it continues to be statistically different from zero. As one would expect, safer bonds carry lower credit spreads, and bonds with longer maturity carry higher credit spreads, probably to compensate investors for the higher risk associated with these bonds. Lastly, our controls show that larger bond issues carry larger

Table 2

Spreads on Bonds of Banks

	Model 1: All Bonds	Model 2: All Bonds	Model 3: AA Bonds	Model 4: A Bonds
TOP5	-0.440***	-0.406***	-1.208**	-0.308*
	(3.48)	(3.01)	(2.13)	(1.84)
AAA		-4.151***		
		(7.55)		
AA		-1.433***		
		(5.25)		
A		-1.064***		
		(3.92)		
BBB		-0.45		
		(1.51)		
BB		-0.39		
		(1.40)		
B		-0.773***		
		(3.60)		
MATURITY		0.036***	0.081**	0.031***
		(3.44)	(2.65)	(2.66)
LAMOUNT		0.250***	0.319	0.329***
		(4.24)	(1.13)	(4.03)
Constant	1.620***	0.255	-3.275*	-1.169*
	(9.43)	(0.58)	(1.79)	(1.93)
Observations	436	436	66	278
R^2	0.375	0.539	0.799	0.579

Source: Author's calculations.

Notes: The dependent variable in these models is the bond spread in the primary market (computed over the Treasury security with the same maturity as the bond). TOP5 is a dummy variable for the top-five issuers by assets size. AAA, AA . . . are dummy variables for the S&P rating of the bond. Maturity is the maturity of the bond. LAMOUNT is the log of the amount of the issue. Included in all of the models are also year-quarter dummy variables. Models estimated with robust standard errors clustered at the bond issuer. The *t*-statistics are reported in parentheses.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

yields, suggesting that economies of scale are not prevalent in the bond underwriting business.

As we saw in Table 1, the largest banks issue, on average, safer bonds than their smaller peers—an observation that helps explain part of the discount that these banks enjoy in the bond market, as captured in model 2. To account for this risk difference in the pool of bonds issued by the two groups, we reestimate the bond spread model on bonds with the same credit rating. We limit this exercise to bonds rated double A and single A because they are the ones most commonly issued by the largest banks. Models 3 and 4 of Table 2 report the results of this exercise. The negative coefficient on the dummy variable that isolates the bonds issued by the largest banks, TOP5, in the new models indicates that the largest banks enjoy a discount in the bond market relative to their smaller peers that issue bonds with the same credit rating.

These last findings suggest that the status of too big to fail may give the largest banks a competitive edge by virtue of their ability to raise funding in the bond market at a discount relative to their smaller peers. However, it is possible that the discount enjoyed by the largest banks reflects only their unique ability to diversify risk because of their presence in a larger number of markets—a distinction that is not fully captured in their credit rating. We investigate this possibility next by comparing banks with nonbank financial institutions and with nonfinancial corporations, respectively.

4. Do Large Firms Enjoy a Discount in the Bond Market?

To investigate whether the largest firms outside the banking sector also benefit from a discount when they raise funding in the bond market, we repeat the same exercise we conducted for banks, but now for the bonds issued by nonbanks and nonfinancial corporations. The results of this investigation are reported in Tables 3 and 4, respectively.

We find that the largest nonbanks also appear to benefit from a discount relative to their smaller peers when they issue bonds (Table 3). The top-five nonbanks are able to issue bonds with spreads about 79 basis points lower than those issued by their smaller peers (model 1). When we control for the rating of the bond, its maturity, and the size of the issue, that discount comes down to 22 basis points (model 2). These results suggest that the largest nonbanks, like the largest banks, benefit from a discount in the bond market. As we will show, this similarity disappears when we investigate how that discount varies with the credit rating of the issuer.

For bonds rated triple A, double A, and single A (models 3-5), TOP5 is negative in all of the models, but not statistically significant.[8] Thus it appears that the largest nonbanks also benefit from a discount when they issue in the bond market; however, in contrast to banks, that discount is generally not statistically different from zero within risk categories.

[8] We omit from this exercise bonds rated triple B because the sample contains only one such bond that is issued by the largest nonbanks.

Table 3

Spreads on Bonds of Nonbank Financial Institutions

	Model 1: All Bonds	Model 2: All Bonds	Model 3: AAA Bonds	Model 4: AA Bonds	Model 5: A Bonds
TOP5	-0.788***	-0.220**	-0.156	-0.007	-0.177
	(7.92)	(2.29)	(0.90)	(0.04)	(1.53)
AAA		-1.761***			
		(4.83)			
AA		-0.448**			
		(2.42)			
A		-0.229			
		(1.39)			
BBB		0.451***			
		(2.71)			
BB		0.553***			
		(2.60)			
B		1.756***			
		(6.34)			
CCC		1.190***			
		(4.23)			
CC		-0.071			
		(0.14)			
C		4.771***			
		(4.12)			
MATURITY		0.051***	0.152***	0.077***	0.053***
		(12.71)	(7.87)	(6.40)	(6.93)
LAMOUNT		0.043**	0.025	0.025	0.064**
		(2.24)	(0.41)	(0.57)	(2.13)
Constant	1.092***	-0.275	-0.291	-2.613***	-0.940***
	(6.07)	(1.06)	(1.19)	(4.21)	(10.48)
Observations	1,696	1,696	44	202	625
R^2	0.249	0.472	0.978	0.633	0.574

Source: Author's calculations.

Notes: The dependent variable in these models is the bond spread in the primary market (computed over the Treasury security with the same maturity as the bond). TOP5 is a dummy variable for the top-five issuers by asset size. AAA, AA . . . are dummy variables for the S&P rating of the bond. Maturity is the maturity of the bond. LAMOUNT is the log of the amount of the issue. Included in all of the models are also year-quarter dummy variables. Models estimated with robust standard errors clustered at the bond issuer. The *t*-statistics are reported in parentheses.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

Turning to nonfinancial corporations (Table 4), we see that the results are very similar to those for nonbanks. The largest nonfinancial corporations enjoy a discount of about 76 basis points relative to their smaller peers when we do not account for any bond characteristics (model 1). This discount drops to 47 basis points when we account for the characteristics of the bonds (model 2). Once again, we see that this discount does not continue to hold when we estimate our model separately for the ratings of the bonds issued by the largest nonfinancial corporations (models 3-6).[9]

Overall, these results suggest that the cost advantage that the largest banks enjoy in the bond market relative to their smaller peers is unique to banks. When we do not restrict the comparison to bonds with the same credit rating, it appears as if both the largest nonbanks and the largest nonfinancial corporations benefit from a discount relative to their smaller peers, as happens with banks. This similarity is not present, however, when we restrict the comparison to bonds with the same rating. Looking at bonds rated double A or single A, we continue to find that the largest banks benefit from a statistically significant discount relative to their smaller peers. The largest nonbanks benefit from a discount, but it is not statistically different from zero, and the results show mixed effects for the largest nonfinancial corporations. The largest nonfinancials rated double A benefit from a discount, while those rated single A pay a premium, but in either case the difference relative to their smaller peers is not statistically significant.

It is unclear from these findings, however, whether the discount that the largest banks enjoy relative to their smaller peers is statistically different from the discount for the largest nonbanks or even that for the largest double-A-rated nonfinancial corporations. We investigate this issue next.

5. Do the Largest Banks Benefit from a Unique Discount?

To determine whether the discount that the largest banks enjoy in the bond market (relative to their smaller peers) is unique to banks, we estimate our expanded model of bond spreads separately on the set of bonds issued by banks and nonbanks, and on the set of bonds issued by banks and nonfinancial corporations. The results of these investigations, reported in Tables 5 and 6, reveal whether the discount for the largest banks is significantly larger than the discounts for the largest nonbanks and nonfinancial corporations.

[9] We omit from this exercise bonds rated triple A, single B, and D because of their reduced number in the sample.

Table 4

Spreads on Bonds of Nonfinancial Corporations

	Model 1: All Bonds	Model 2: All Bonds	Model 3: AA Bonds	Model 4: A Bonds	Model 5: BBB Bonds	Model 6: CCC Bonds
TOP5	-0.76***	-0.47***	-0.17	0.14	-0.17	0.52
	(6.52)	(4.30)	(1.18)	(1.34)	(0.82)	(1.21)
AAA		-3.85***				
		(15.36)				
AA		-3.64***				
		(21.08)				
A		-3.28***				
		(20.02)				
BBB		-2.73***				
		(16.03)				
BB		-1.44***				
		(8.61)				
B		-0.36**				
		(2.06)				
CCC		-0.3				
		(1.57)				
CC		0.54				
		(1.18)				
C		-0.73				
		(1.06)				
MATURITY		0.02***	0.05***	0.03***	0.02***	-0.02
		(9.7)	(7.94)	(10.89)	(7.05)	(1.38)
LAMOUNT		-0.07***	0.01	-0.02	0.03	-0.59***
		(4.24)	(0.09)	(1.30)	(1.35)	(4.36)
Constant	1.04***	4.33***	-0.45	0.46***	0.06	5.71***
	(10.17)	(15.11)	(1.15)	(3.21)	(0.4)	(4.74)
Observations	6,267	6,267	250	1,609	2,355	339
R^2	0.175	0.423	0.717	0.478	0.227	0.636

Source: Author's calculations.

Notes: The dependent variable in these models is the bond spread in the primary market (computed over the Treasury security with the same maturity as the bond). TOP5 is a dummy variable for the top-five issuers by asset size. AAA, AA . . . are dummy variables for the S&P rating of the bond. MATURITY is the maturity of the bond. LAMOUNT is the log of the amount of the issue. Included in all of the models are also year-quarter dummy variables. Models estimated with robust standard errors clustered at the bond issuer. The *t*-statistics are reported in parentheses.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

Looking at Table 5 and the variable BK × TOP5, which tells us whether the discount for the largest banks is different from the discount for the largest nonbanks (relative to their smaller peers), we see that there is no statistically significant difference between these discounts when we consider all of the bonds of these issuers together (models 1 and 2). However,

Table 5
Spreads on Bonds of Banks and Nonbanks

	Model 1: All Bonds	Model 2: All Bonds	Model 3: AA Bonds	Model 4: A Bonds
TOP5	-0.74***	-0.22**	0.1	-0.20*
	(7.68)	(2.36)	(0.59)	(1.82)
BK	-0.45***	-2.53***	-1.24	-1.32**
	(5.00)	(5.48)	(0.85)	(2.52)
BK × TOP5	0.24	-0.18	-0.92**	-0.16
	(1.61)	(1.18)	(2.15)	(0.92)
Constant	2.13***	0.19	-0.54***	0.09
	(15.07)	(0.58)	(4.33)	(0.29)
Observations	2,132	2,132	268	903
R^2	0.252	0.476	0.614	0.543

Source: Author's calculations.

Notes: The dependent variable in these models is the bond spread in the primary market (computed over the Treasury security with the same maturity as the bond). TOP5 is a dummy variable for the top-five issuers by asset size. BK is a dummy variable for bonds issued by banks. All of the models include year-quarter dummy variables. Additionally, models 2 through 4 include dummy variables for the S&P rating of the bond, MATURITY, LAMOUNT, and the interaction of these variables with BK. Models estimated with robust standard errors clustered at the bond issuer. The *t*-statistics are reported in parentheses.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

Table 6
Spreads on Bonds of Banks and Nonfinancial Corporations

	Model 1: All Bonds	Model 2: All Bonds	Model 3: AA Bonds	Model 4: A Bonds
TOP5	-0.77***	-0.49***	-0.21	0.12
	(6.71)	(4.43)	(1.49)	(1.16)
BK	-1.11***	-4.64***	-1.47	-2.17***
	(12.59)	(11.55)	(1.11)	(4.33)
BK × TOP5	0.19	0.16	-0.53	-0.50***
	(1.09)	(0.94)	(1.38)	(2.99)
Constant	1.50***	4.27***	-0.56	0.61***
	(5.1)	(16.75)	(1.47)	(3.24)
Observations	6,703	6,703	316	1,887
R^2	0.189	0.439	0.695	0.479

Source: Author's calculations.

Notes: The dependent variable in these models is the bond spread in the primary market (computed over the Treasury security with the same maturity as the bond). TOP5 is a dummy variable for the top-five issuers by asset size. BK is a dummy variable for bonds issued by banks. All of the models include year-quarter dummy variables. Additionally, models 2 through 4 include dummy variables for the S&P rating of the bond, MATURITY, LAMOUNT, and the interaction of these variables with BK. Models estimated with robust standard errors clustered at the bond issuer. The *t*-statistics are reported in parentheses.

* Significant at the 10 percent level.
** Significant at the 5 percent level.
*** Significant at the 1 percent level.

when we estimate the model separately on the bonds rated double A and single A, the most common ratings of the bonds issued by the largest institutions in the two groups, we see that largest banks benefit from a bigger discount than the largest nonbanks, which is statistically significant in the case of bonds rated double A.

We get a similar picture when we compare banks with nonfinancial corporations (Table 6). Again, the largest banks do not appear to benefit from a bigger discount when we consider all of the bonds together (models 1 and 2). However, when we estimate the model separately on the bonds of each rating category, we see that the largest banks do benefit from a bigger discount than the largest nonfinancial corporations, and the difference is statistically significant in the case of bonds rated single A.

5.1 Robustness Tests

In this exercise, we considered bonds issued since 1985 because the claim that some banks were too big to fail was first made in connection with the demise of Continental Illinois in 1984. However, our use of a long sample period may give rise to certain concerns. For example, several bank regulations were introduced in the post-1984 period. One in particular, the depositor preference rule, introduced in 1993, could be important because it likely increased the compensation that bondholders demand to invest in banks. However, we have year-quarter fixed effects in all of our models. Further, limiting the sample period to the years after 1994 does not affect our key findings in any meaningful way.

Another potential concern with the length of the sample period is that it allows for several changes in the top-five firms in each sector of activity, either because of firms' different

organic growth rates or because of mergers and acquisitions. Recall that we rank firms in each sector of activity according to their size each year. Again, shortening the sample period and restricting it to, for example, the last decade does not affect our key findings.

Yet another potential concern derives from our focus on the top-five firms in each sector of activity. The number of firms investors perceive to be too big to fail is likely to vary over time and across sectors of activity. We experimented with other cutoffs, including using the top-ten firms in each sector of activity, and obtained similar results.

5.2 Is the Too-Big-to-Fail Discount Economically Relevant?

The evidence presented thus far indicates that the largest banks do benefit from a discount in the bond market that is statistically different from zero. A related question is whether this discount is economically meaningful. A possible way to investigate this question is to compute the savings that the largest banks enjoy per bond issue relative to their smaller counterparts.

Looking at Table 2, we see that the largest banks that issue bonds rated double A benefit from a reduction in their cost of bond financing of about 121 basis points compared with smaller banks that also issue double-A-rated bonds. The largest banks that issue bonds rated single A benefit from a reduction of about 31 basis points in the cost of bond financing. Taking into account the average bond issue by the largest banks in each group, this reduction in spreads translates into savings of about $80 million and $3 million for an average issue, respectively.

As noted above, these calculations will likely overestimate the too-big-to-fail subsidy that the largest banks enjoy in the bond market. A more conservative way of estimating that subsidy is to determine the additional cost savings of the largest banks (relative to their smaller peers) as opposed to the cost savings that the largest nonbanks enjoy (also relative to their smaller peers). Table 5 shows that the discount (relative to their smaller peers) of the largest banks that issue bonds rated double A is about 91 basis points bigger than the discount for the largest nonbanks relative to their smaller peers. This translates into cost savings for the largest banks of about $60 million for an average bond issue. Doing the same exercise for the largest banks that issue bonds rated single A reveals that they enjoy cost savings of about $1.5 million.

In sum, the findings reported in this section confirm the results from models 1 and 2 that the largest banks benefit from a bigger discount (relative to smaller banks) when they raise funding in the bond market than do either the largest nonbank financial institutions or the largest nonfinancial corporations. The results reported in this section further show that the discount the largest banks enjoy is statistically different from that of the largest nonbanks or the largest nonfinancial corporations. This difference suggests that investors believe that the largest banks are likelier to be classified as too big to fail, and thus to be rescued if they run into financial trouble, than either the largest nonbanks or the largest nonfinancial corporations.

6. Conclusion

The evidence presented in this article—demonstrating the additional discount that bond investors offer the largest banks compared with the return they demand from the largest nonbanks and nonfinancial corporations—is novel and consistent with the idea that investors perceive the largest U.S. banks to be too big to fail.

Since the sample ends in 2009, these findings do not reflect any changes in bond investors' expectations resulting from the regulatory interventions that occurred during the financial crisis. Similarly, our findings do not account for any effects that the regulatory changes introduced following the financial crisis may have had, in particular those changes aimed at addressing the too-big-to-fail problem. However, our findings are pertinent to the ongoing debate on requiring bank holding companies to raise part of their funding with long-term bonds, particularly if the post-crisis regulatory changes are unable to fully address the too-big-to-fail status of the largest banks.

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