



July 2014

# LARGE BANK HOLDING COMPANIES

## Expectations of Government Support

## Why GAO Did This Study

“Too big to fail” is a market notion that the federal government would intervene to prevent the failure of a large, complex financial institution to avoid destabilizing the financial sector and the economy. Expectations of government rescues can distort investor incentives to properly price the risks of firms they view as too big to fail, potentially giving rise to funding and other advantages for these firms.

GAO was asked to review the benefits that the largest bank holding companies (those with more than \$500 billion in assets) have received from perceived government support. This is the second of two GAO reports on government support for bank holding companies. The first study focused on actual government support during the 2007-2009 financial crisis and recent statutory and regulatory changes related to government support for these firms. This report examines how financial reforms have altered market expectations of government rescues and the existence or size of funding advantages the largest bank holding companies may have received due to perceived government support.

GAO reviewed relevant statutes and rules and interviewed regulators, rating agencies, investment firms, and corporate customers of banks. GAO also reviewed relevant studies and interviewed authors of these studies. Finally, GAO conducted quantitative analyses to assess potential “too-big-to-fail” funding cost advantages.

In its comments, the Department of the Treasury generally agreed with GAO’s analysis. GAO incorporated technical comments from the financial regulators, as appropriate.

View [GAO-14-621](#). For more information, contact Lawrence Evans, Jr. at (202) 512-4802, or [EvansL@gao.gov](mailto:EvansL@gao.gov).

# LARGE BANK HOLDING COMPANIES

## Expectations of Government Support

## What GAO Found

While views varied among market participants with whom GAO spoke, many believed that recent regulatory reforms have reduced but not eliminated the likelihood the federal government would prevent the failure of one of the largest bank holding companies. Recent reforms provide regulators with new authority to resolve a large failing bank holding company in an orderly process and require the largest bank holding companies to meet stricter capital and other standards, increasing costs and reducing risks for these firms. In response to reforms, two of three major rating agencies reduced or removed the assumed government support they incorporated into some large bank holding companies’ overall credit ratings. Credit rating agencies and large investors cited the new Orderly Liquidation Authority as a key factor influencing their views. While several large investors viewed the resolution process as credible, others cited potential challenges, such as the risk that multiple failures of large firms could destabilize markets. Remaining market expectations of government support can benefit large bank holding companies if they affect investors’ and customers’ decisions.

GAO analyzed the relationship between a bank holding company’s size and its funding costs, taking into account a broad set of other factors that can influence funding costs. To inform this analysis and to understand the breadth of methodological approaches and results, GAO reviewed selected studies that estimated funding cost differences between large and small financial institutions that could be associated with the perception that some institutions are too big to fail. Studies GAO reviewed generally found that the largest financial institutions had lower funding costs during the 2007-2009 financial crisis but that the difference between the funding costs of the largest and smaller institutions has since declined. However, these empirical analyses contain a number of limitations that could reduce their validity or applicability to U.S. bank holding companies. For example, some studies used credit ratings which provide only an indirect measure of funding costs.

GAO’s analysis, which addresses some limitations of these studies, suggests that large bank holding companies had lower funding costs than smaller ones during the financial crisis but provides mixed evidence of such advantages in recent years. However, most models suggest that such advantages may have declined or reversed. GAO developed a series of statistical models that estimate the relationship between bank holding companies’ bond funding costs and their size or systemic importance, controlling for other drivers of bond funding costs, such as bank holding company credit risk. Key features of GAO’s approach include the following:

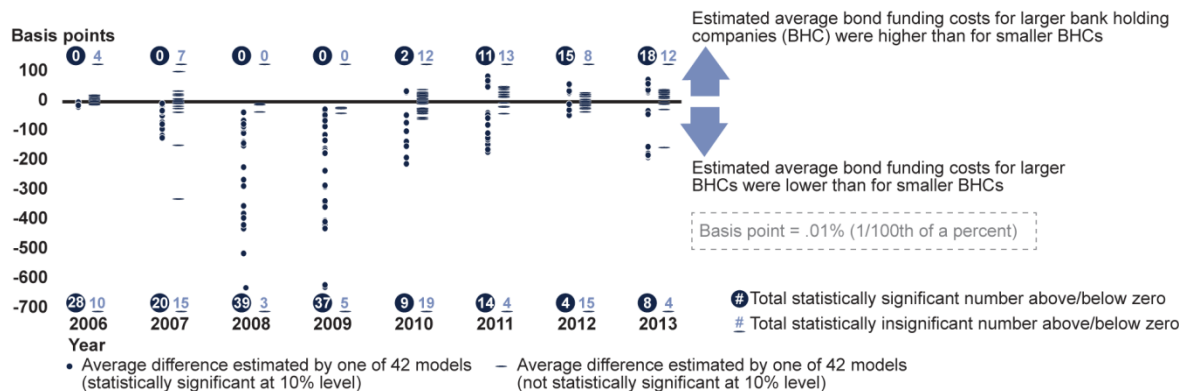
- **U.S. Bank Holding Companies:** The models focused on U.S. bank holding companies to better understand the relationship between funding costs and size in the context of the U.S. economic and regulatory environment.
- **Bond Funding Costs:** The models used bond yield spreads—the difference between the yield or rate of return on a bond and the yield on a Treasury bond of comparable maturity—to measure funding costs because they are a risk-sensitive measure of what investors charge bank holding companies to borrow.

- **Extensive Controls:** The models controlled for credit risk, bond liquidity, and other variables to account for factors other than size that could affect funding costs.
- **Multiple Models:** GAO used 42 models for each year from 2006 through 2013 to assess the impact of using alternative measures of credit risk, bond liquidity, and size and to allow the relationship between size and bond funding costs to vary over time with changes in the economic and regulatory environment.

- **Credit Risk Levels:** GAO compared bond funding costs for bank holding companies of different sizes at the average level of credit risk for each year, at low and high levels of credit risk for each year, and at the average level of credit risk during the financial crisis.

The figure below shows the differences between model-estimated bond funding costs for bank holding companies with \$1 trillion in assets and bank holding companies with \$10 billion in assets, with average levels of credit risk in each year. Circles represent statistically significant model-estimated differences.

**Estimates from 42 Models of Average Bond Funding Cost Differences between Bank Holding Companies with \$1 Trillion and \$10 Billion in Assets, 2006-2013**



Source: GAO analysis of data from Bloomberg and the Financial Stability Board. | GAO-14-621

Notes: GAO estimated econometric models of the relationship between BHC size and funding costs using data for U.S. BHCs and their outstanding senior unsecured bonds for the first quarter of 2006 through the fourth quarter of 2013. The models used bond yield spreads to measure funding costs and controlled for credit risk factors such as capital adequacy, asset quality, earnings, maturity mismatch, and volatility, as well as bond liquidity and other characteristics of bonds and BHCs that can affect funding costs. GAO estimated 42 models for each year from 2006 through 2013 to assess the sensitivity of estimated funding cost differences to using alternative measures of capital adequacy, volatility, bond liquidity, and size or systemic importance. GAO used the models to compare bond funding costs for BHCs of different sizes but the same levels of credit risk, bond liquidity, and other characteristics. This figure compares bond funding costs for BHCs with \$1 trillion and \$10 billion in assets, for each model and for each year, with average levels of credit risk. Each circle and dash shows the comparison for a different model, where circles and dashes below zero suggest BHCs with \$1 trillion in assets have lower bond funding costs than BHCs with \$10 billion in assets, and vice versa.

All 42 models found that larger bank holding companies had lower bond funding costs than smaller ones in 2008 and 2009, while more than half of the models found that larger bank holding companies had higher bond funding costs than smaller ones in 2011 through 2013, given the average level of credit risk each year (see figure). However, the models' comparisons of bond funding costs for bank holding companies of different sizes varied depending on the level of credit risk. For example, in hypothetical scenarios where levels of credit risk in every year from 2010 to 2013 are assumed to be as high as they were during the financial crisis, GAO's analysis suggests that large bank holding companies might have had lower funding costs than smaller ones in recent years. However, reforms in the Dodd-Frank Wall Street Reform and Consumer Protection Act, such as enhanced

standards for capital and liquidity, could enhance the stability of the financial system and make such a credit risk scenario less likely.

This analysis builds on certain aspects of prior studies, but important limitations remain and these results should be interpreted with caution. GAO's estimates of differences in funding costs reflect a combination of several factors, including investors' beliefs about the likelihood a bank holding company will fail and the likelihood it will be rescued by the government if it fails, and cannot precisely identify the influence of each factor. In addition, these estimates may reflect factors other than investors' beliefs about the likelihood of government support and may also reflect differences in the characteristics of bank holding companies that do and do not issue bonds. Finally, GAO's estimates, like all past estimates, are not indicative of future trends.

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# Contents

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Letter		1
	Scope and Methodology	2
	Background	11
	Reforms Have Reduced Expectations of Government Support among Key Market Observers and Increased Regulation for Large Institutions	24
	Evidence Suggests Large Banks Had a Funding Cost Advantage over Small Ones during the Financial Crisis That May Have Declined or Reversed Since	40
	Agency Comments and Our Evaluation	58
Appendix I.	Methodology for Analysis of Funding Cost Differences between Large and Small Bank Holding Companies	63
Appendix II	Comments from the Department of the Treasury	84
Appendix III	GAO Contact and Staff Acknowledgments	86
Tables		
	Table 1: Overview of Variables Used in Econometric Models	8
	Table 2: Empirical Studies of Too-Big-to-Fail Funding Cost Differences	41
	Table 3: Numbers of Bank Holding Companies and Bonds, 2006-2013	65
	Table 4: Summary Statistics for Bank Holding Companies and Bonds Analyzed, 2008 and 2013	69
	Table 5: Parameter Estimates for Baseline Regressions, 2008 and 2013	72
	Table 6: Baseline Comparisons of Bond Yield Spreads for Bank Holding Companies of Different Sizes by Year, 2008 and 2013 (basis points)	77
	Table 7: Comparisons of Bond Yield Spreads for Bank Holding Companies with \$1 trillion versus \$10 billion in Assets, All 42 Models, 2008 and 2013 (basis points)	79

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## Figures

Figure 1: Estimates from 42 Models of Average Bond Funding Cost Differences between Bank Holding Companies with \$1 Trillion and \$10 Billion in Assets, 2006-2013	50
Figure 2: Difference in Estimated Bond Funding Costs for Average Credit Risk Bank Holding Companies with \$1 Trillion versus \$10 Billion in Assets by Indicator of Size or Systemic Importance, 2013	52
Figure 3: Difference in Estimated Bond Funding Costs for Bank Holding Companies with \$1 Trillion versus \$10 Billion in Assets by Level of Credit Risk, 2013	55
Figure 4: Difference in Estimated Bond Funding Costs for Average Credit Risk Bank Holding Companies with \$1 Trillion versus \$10 Billion in Assets by Model Specification, by Year, 2006-2013	82

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### Abbreviations

AIG	American International Group, Inc.
BHC	bank holding company
CCAR	Comprehensive Capital Analysis and Review
FDIC	Federal Deposit Insurance Corporation
FDICIA	FDIC Improvement Act of 1991
FSOC	Financial Stability Oversight Council
GSIB	global systemically important bank
IDI	insured depository institution
LTCM	Long-Term Capital Management
OCC	Office of the Comptroller of the Currency
OFR	Office of Financial Research
OLA	Orderly Liquidation Authority
S&P	Standard & Poor's
SIFI	systemically important financial institution
SPOE	Single Point-of-Entry
TARP	Troubled Asset Relief Program

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July 31, 2014

The Honorable Sherrod Brown  
Chairman  
Subcommittee on Financial Institutions and Consumer Protection  
Committee on Banking, Housing, and Urban Affairs  
United States Senate

The Honorable David Vitter  
United States Senate

“Too big to fail” refers to a market notion that the federal government would intervene to prevent the failure of a large, interconnected financial institution to avoid harm to the economy. Events during the 2007-2009 financial crisis heightened concerns that market participants had come to view several of the largest U.S. financial institutions as too big to fail. Most notably, the U.S. government intervened to provide tens of billions of dollars of capital and other support to a few large troubled financial institutions out of concern that allowing these firms to go into bankruptcy would have further disrupted troubled credit markets and damaged confidence in the U.S. financial system.<sup>1</sup> Market expectations of government rescues can distort the incentives of investors and counterparties to properly price and restrain the risks of firms they believe to be too big to fail, potentially giving rise to funding cost and other advantages for these firms relative to smaller competitors. For example, creditors may be willing to accept lower interest rates on debt issued by these firms if they believe the possibility of a government rescue reduces the likelihood that they could suffer losses. If creditors and other counterparties do not fully charge a firm for the risks it is taking, that firm may have incentives to take on greater risks in the pursuit of higher returns. Excessive risk-taking in response to such incentives can increase the likelihood that such a firm could become distressed and disrupt financial markets.

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<sup>1</sup>Bankruptcy is a federal court procedure conducted under rules and requirements of the U.S. Bankruptcy Code. The goal of bankruptcy is to give individuals and businesses a “fresh start” from burdensome debts by eliminating or restructuring debts they cannot repay and helping creditors receive some payment in an equitable manner through liquidation or reorganization of the debtor.

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The Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) prohibits rescues of individual failing financial institutions and provides new tools and authorities for the Federal Deposit Insurance Corporation (FDIC) to resolve a large failing financial institution in a manner that imposes losses on the firm's creditors and other investors while minimizing adverse impacts to the economy.<sup>2</sup> Nevertheless, market observers have continued to debate whether some of the largest and most complex financial institutions may continue to benefit from beliefs among their investors and counterparties that the government might intervene to prevent their failure.

You asked us to review any economic benefits that the largest bank holding companies (those with more than \$500 billion in total consolidated assets) have received as a result of actual or perceived government support. This is the second of two reports we are issuing on this topic.<sup>3</sup> In this report, we review (1) what is known about how financial reforms have altered market expectations of government rescues and the relative advantages or disadvantages of being a large bank holding company and (2) the extent to which the largest bank holding companies have received funding cost advantages as a result of perceptions that the government would not allow them to fail.

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## Scope and Methodology

To address our first objective, we reviewed information from relevant statutory provisions and regulations and prior GAO reports to describe financial reforms that could impact market expectations of government rescues or relative advantages or disadvantages of being a large bank

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<sup>2</sup>Pub. L. No. 111-203, 124 Stat. 1376 (2010).

<sup>3</sup>In November 2013, we issued the first report, which examined (1) actual government support for banks and bank holding companies during the financial crisis and (2) recent statutory and regulatory changes related to government support for banks and bank holding companies. See GAO, *Government Support for Bank Holding Companies: Statutory Changes to Limit Future Support Are Not Yet Fully Implemented*, [GAO-14-18](#) (Washington, D.C.: Nov. 14, 2013). At a January 2014 hearing, we provided testimony based on this report. See GAO, *Government Support for Bank Holding Companies: Statutory Changes to Limit Future Support Are Not Yet Fully Implemented*, [GAO-14-174T](#) (Washington, D.C.: Jan. 8, 2014).

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holding company.<sup>4</sup> We obtained perspectives on the potential impacts of these reforms from credit rating agencies, investment firms, and corporations that are customers of banks. Where available and relevant, we reviewed some public statements, reports, and other analyses by these groups. For example, to obtain information about credit rating agencies' assessments of the likelihood and level of government support for large bank holding companies, we reviewed relevant publications by the three largest credit rating agencies: Fitch Ratings (Fitch), Moody's Investors Service (Moody's), and Standard & Poor's (S&P). We interviewed representatives from each of these rating agencies to obtain their perspectives on factors contributing to changes in their assessments of government support over time.

We conducted interviews with representatives from 10 investment firms and six corporations to learn about (1) factors that influence their decisions to invest in or do business with bank holding companies of various sizes; (2) how they assess the risks of banks and the extent to which they rely on credit rating agencies' assessments of these risks; (3) their views on the likelihood that the federal government would intervene to prevent the failure of a large bank holding company and factors that have influenced these views over time; and (4) how, if at all, expectations of government support have impacted their decisions to invest in or do business with banks of various sizes. In selecting investment firms and large corporations for interviews, we selected nonrepresentative samples of firms. As a result, the views we present from these firms are not generalizable to the broader community of bank investors and customers and do not indicate which views are most prevalent. We selected investment firms with experience investing in debt or equity securities of banks and bank holding companies and selected different types of investment firms to obtain perspectives reflecting a range of investing strategies. Specifically, we selected three large asset management firms (each with more than \$1 trillion in assets under management); three public pension funds (each with more than \$50 billion in assets under management); three hedge funds; and one large insurance company. We

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<sup>4</sup>For example, we reviewed [GAO-14-18](#), which describes Dodd-Frank Act provisions intended to place limits on agency authorities to provide emergency assistance to financial firms and strengthen regulatory oversight of large bank holding companies. We also reviewed prior GAO work on potential impacts of the Dodd-Frank Act. See GAO, *Financial Regulatory Reform: Financial Crisis Losses and Potential Impacts of the Dodd-Frank Act*, [GAO-13-180](#) (Washington, D.C.: Jan. 16, 2013).



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selected U.S. corporations from different industry sectors and with a range of banking needs. We identified four of these firms and contacted them with the assistance of the U.S. Chamber of Commerce, which reached out to its members on our behalf, and selected two additional firms to achieve additional diversity across industry sectors. The corporations we interviewed included four multinational corporations (a chemical company, a delivery and logistics company, an energy company, and a technology company) and two corporations with all or close to all of their operations in the United States (a regional electric utility company and a national retail services company).

To obtain additional information and perspectives on how financial reforms or credit ratings could impact the relative advantages or disadvantages of being a large bank holding company, we reviewed relevant publicly available information in the financial statements of bank holding companies and conducted interviews with bank holding companies of various sizes, bank industry associations, public interest groups, academics, and other experts. For example, we reviewed bank holding companies' financial disclosures about how Dodd-Frank reforms could increase certain fees and how a credit rating downgrade could impact the amount of collateral required of them under certain financial contracts. We also reviewed our prior work on potential impacts of Dodd-Frank Act implementation.<sup>5</sup>

As part of our first objective, we reviewed regulators' efforts to assess their progress in addressing too-big-to-fail perceptions and market distortions that can result. We reviewed Dodd-Frank Act provisions that outline statutory responsibilities for the Financial Stability Oversight Council (FSOC) and reviewed relevant sections of the FSOC annual report. We interviewed officials from FSOC, the Department of the Treasury (Treasury), the Board of Governors of the Federal Reserve System (Federal Reserve Board), FDIC, and the Office of the Comptroller of the Currency (OCC) about their efforts to analyze the impacts of Dodd-Frank reforms on too-big-to-fail perceptions and to evaluate whether additional policy actions may be needed to address any remaining market distortions. We also reviewed relevant congressional testimonies and other public statements by agency officials.

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<sup>5</sup>See [GAO-13-180](#).

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To assess the extent to which the largest bank holding companies have received funding cost advantages as a result of perceptions that the government would not allow them to fail, we conducted an econometric analysis of the relationship between a bank holding company's size and its funding costs. To inform our econometric approach and understand the breadth of results and methodological approaches, we reviewed studies that estimated the funding cost difference between large and small financial institutions that could be associated with the perception that some institutions are too big to fail. We evaluated studies that met the following criteria: (1) used a comparative empirical approach that attempted to account for differences across financial institutions that could influence funding costs, (2) included U.S. bank holding companies, and (3) included analysis of data from 2002 or later. We chose these criteria to identify the most relevant and rigorous studies related to our research objective. To identify studies that met these criteria, we sought input from individuals, agencies, and groups that we interviewed, identified studies cited in an initial set of studies we had already identified, and conducted a systematic search of research databases (including Google Scholar and SSRN).

Our criteria excluded studies that used option-pricing approaches—that is, techniques that use tools for pricing stock options to estimate the value associated with possible government interventions to assist distressed banks—because these studies assume a too-big-to-fail funding cost advantage exists and only estimate its magnitude. We also excluded two studies that otherwise met our criteria, but did not attempt to control for important differences between financial institutions. We were aware of potential conflicts of interest associated with a number of studies in our review. For example, one study was conducted by researchers at a large bank holding company and two others were sponsored by a trade group representing large commercial banks. We considered the potential impact these conflicts of interest might have on their methods and results. We ultimately included 16 studies in our review that we determined were sufficiently reliable for the purposes of this report.

In reviewing these studies, we assessed what they identified as the level of funding cost differences and how that level has changed over time and we identified the strengths and limitations of the studies' approaches. Because of limitations of the methodologies of these studies, their results, while suggestive of general trends, are not definitive and thus should be interpreted with caution. We interviewed authors of selected studies, federal financial regulators, and other experts to obtain perspectives on

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the strengths and limitations of relevant quantitative approaches that have been used.

Taking into consideration the strengths and limitations of different methodologies, we developed our own econometric approach to evaluate the extent to which the largest bank holding companies may have received funding cost advantages as a result of perceptions that the government would not allow them to fail. In addition, we selected three experts with relevant expertise to review our econometric approach and assess its strengths and limitations. These experts reviewed our approach before we implemented it and provided comments on our methodology. In many instances, we made changes or additions to our models to address their comments, and in other instances, we disclosed additional limitations of the models. Before selecting these experts, we reviewed potential sources of conflicts of interest, and we determined that the experts we selected did not have any material conflicts of interest for the purpose of reviewing our work.

We used a multivariate regression model to estimate the relationship between bank holding companies' funding costs and their size while controlling for factors other than size that may also influence funding costs. Our general regression model is the following:

$$\text{funding cost}_{bq} = \alpha + \beta \cdot \text{size}_{bq} + \gamma \cdot \text{credit risk}_{bq} + \delta \cdot (\text{size}_{bq} \times \text{credit risk}_{bq}) + X'_{bq} \cdot \Theta + \varepsilon_{bq}$$

In this model,  $b$  denotes the bank holding company,  $q$  denotes the quarter,  $\text{funding cost}_{bq}$  is the bank holding company's cost of funding in a quarter,  $\text{size}_{bq}$  is a measure of the bank holding company's size at the beginning of the quarter,  $\text{credit risk}_{bq}$  is a list of proxies for the bank holding company's credit risk—the risk that the bank holding company will not repay the funds it borrowed as agreed,  $X_{bq}$  is a list of other variables that may influence funding costs,  $\varepsilon_{bq}$  is an idiosyncratic error term, and  $\alpha, \beta, \gamma, \delta,$  and  $\Theta$  are parameters to be estimated. The parameter  $\beta$  captures the direct relationship between a bank holding company's funding cost and its size. The parameter  $\delta$  captures the indirect relationship between a bank holding company's funding cost and its size that exists if the size of a bank holding company affects the relationship between its funding cost and credit risk. If investors view larger bank

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holding companies as less risky than smaller bank holding companies due to beliefs that the government is more likely to rescue larger bank holding companies in distress, then either  $\beta$  is less than zero,  $\delta$  is less than zero, or both.<sup>6</sup> However, the parameters  $\beta$  and  $\delta$  may also reflect factors other than these beliefs.

We used a measure of funding costs based on bonds issued by bank holding companies. Bank holding companies use a variety of funding types from different sources, including various types of deposits, bonds, and equity. We used bond yield spreads—the difference between the yield on a bond and the yield on a Treasury bond of comparable maturity—to measure a bank holding company’s cost of bond funding. Treasury securities are widely viewed as a risk-free asset, so the yield spread measures the price that investors charge a bank holding company to borrow to compensate them for credit risk and other factors. We focused on bond yield spreads because they are a measure of funding costs that is available for bank holding companies of a range of sizes, including bank holding companies with less than \$10 billion in assets. Furthermore, bonds are traded in secondary markets, so changes in bond yield spreads can be publicly observed in a timely manner. Finally, bond yield spreads are a direct measure of funding costs, unlike alternatives such as credit ratings.

We used Bloomberg to identify U.S. bank holding companies with more than \$500 million in assets that were operating in 1 or more years from 2006 through 2013, and to identify all plain vanilla, fixed-rate, senior unsecured bonds issued by these bank holding companies, excluding bonds with an explicit government guarantee.<sup>7</sup> We collected data on bond yield spreads, bank holding company size, variables associated with bank holding company credit risk, and bond characteristics from Bloomberg. We used these data to assemble a dataset with one observation for each bond in each quarter from the first quarter of 2006 through the fourth quarter of 2013. We constructed alternative measures to control for size, bond liquidity, and credit risk due to uncertainty about how to

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<sup>6</sup>Negative values of  $\beta$  and  $\delta$  are consistent with these beliefs as long as greater values of the size measure are associated with larger bank holding companies and greater values of the credit risk proxies are associated with greater credit risk.

<sup>7</sup>Plain vanilla bonds refer to bonds that pay interest at regular intervals and return the principal at maturity with no additional features such as convertibility to stock or options to redeem the bond before maturity. Such bonds are also known as straight bonds.

appropriately capture these important factors influencing bond yields and because the regression results may be sensitive to alternative specifications (see table 1). The numbers of bank holding companies and bonds we analyzed and summary statistics for our indicators of size, credit risk, and other factors are in appendix I.

**Table 1: Overview of Variables Used in Econometric Models**

Funding costs	Size	Credit risk <sup>a</sup>	Other bond and bank holding company characteristics
<p>Quarterly average bond yield spreads based on prices from executed trades, executable quotes, and composites derived from executable and indicative quotes.<sup>b</sup></p> <p>Quarterly average bond yield spreads based on executed trades only.</p>	<p>Total assets.</p> <p>Total assets and total assets squared.</p> <p>An indicator for whether or not a bank holding company had \$50 billion or more in assets.<sup>c</sup></p> <p>An indicator for whether or not a bank holding company was designated a globally systemically important bank in November 2013.</p>	<p><i>Capital adequacy</i>: Equity capital and subordinated debt as percentages of assets and risk-weighted assets.<sup>d</sup></p> <p><i>Asset quality</i>: Nonperforming assets as a percentage of tangible common equity plus loan loss reserves.<sup>e</sup></p> <p><i>Earnings</i>: Net income as a percentage of assets.</p> <p><i>Maturity mismatch</i>: Volatile liabilities minus liquid assets as a percentage of total liabilities.<sup>f</sup></p> <p><i>Volatility</i>: Standard deviation of equity prices over the quarter, option-implied volatility for the quarter, the standard deviation of equity returns over the quarter, the standard deviation of excess equity returns over the quarter, and the standard deviation of earnings.<sup>g</sup></p>	<p><i>Bond liquidity</i>: Issue size, total volume traded during a quarter, and average bid-ask spread over a quarter.<sup>h</sup></p> <p><i>Coupon rate</i>: The current interest rate on the bond.</p> <p><i>Time to maturity</i>: The number of quarters until the bond matures.</p> <p><i>Operating expenses</i>: Noninterest expense as a percentage of total assets.</p>

Source: GAO. | GAO-14-621

Note: Unless otherwise noted, all balance sheet and income statement variables—such as assets, liabilities, and net income—are measured as of the beginning of the quarter.

<sup>a</sup>Credit risk increases with higher values of our asset quality, maturity mismatch, and volatility measures and with lower values of our capital adequacy and earnings measures.

<sup>b</sup>Bond yield spreads are the difference between the yield on a bond and the yield on a comparable Treasury bond. Executed trades are completed transactions for which the terms have been agreed upon and assets have been exchanged. Executable quotes (or firm quotes) are prices quoted by dealers at which they would be willing to trade. Indicative quotes are prices quoted by dealers that give an indication of the price at which a bond might trade but at which they are not obligated to trade. Composite quotes or prices are derived from quantitative algorithms that aggregate information on prices from executed trades, executable quotes, and indicative quotes to give an indication of the market price of a bond.

<sup>c</sup>The Dodd-Frank Act requires bank holding companies with \$50 billion or more in total assets to be subjected to enhanced regulatory standards and supervision. Pub. L. No. 111-203, § 165, 124 Stat. 1376, 1423 (2010) (codified at 12 U.S.C. § 5365).

<sup>d</sup>Regulators generally require that banks maintain certain ratios of capital as a share of assets to ensure that they have sufficient capital to absorb losses. Under the Basel approaches, banks may

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weight certain assets based on their risks, and use these risk-weighted assets to calculate their capital adequacy ratios.

<sup>e</sup>Nonperforming assets include assets in nonaccrual status, other real estate owned, restructured loans, and restructured loans in compliance. Tangible common equity is total capital minus perpetual preferred stock minus goodwill and other intangibles.

<sup>f</sup>Volatile liabilities include federal funds purchased and repurchase agreements, trading liabilities, other borrowed funds, foreign deposits, and jumbo deposits less derivatives with negative fair value. Liquid assets include cash, securities, federal funds sold and reverse repurchase agreements, and trading assets less pledged securities.

<sup>g</sup>Option-implied volatility is a measure of a security's expected volatility as reflected by the market price of traded options on that security. The theoretical price of an option is a function of the underlying price, strike price, historical volatility of the underlying, the risk-free rate, and the time to expiration. Implied volatility is calculated by using the market price of the option and solving for volatility. Excess return is a security's return minus the return from a no-risk security during the same time period.

<sup>h</sup>The bid-ask spread is the difference between the best buying price and the best selling price.

We developed a variety of econometric models that use alternative measures of bond liquidity, bank holding company credit risk, and the size or systemic importance of a bank holding company. We estimated the parameters for each of our models separately for each year from 2006 through 2013 to allow the relationship between bank holding company size and bond funding costs to vary over time.<sup>8</sup> Our baseline models used average yield spreads on senior unsecured bonds based on actual trades, executable quotes, and composites derived from executable and indicative quotes to measure bond funding costs; total assets to measure size; equity capital and subordinated debt as percentages of total assets to measure capital adequacy; and issue size and total volume to measure bond liquidity. We estimated the baseline model for each year and for each of our five measures of volatility, as well as for each year without a measure of volatility. We also estimated models that added average bid-ask spread to our baseline indicators of bond liquidity, models that used average yield spreads based only on actual trades, models that used equity capital and subordinated debt as percentages of risk-weighted assets as our indicators of capital adequacy, models that used global systemically important bank (GSIB) designation as an indicator of size, models that used the \$50 billion asset threshold as an indicator of size, and models that used both total assets and the square of total assets as

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<sup>8</sup>We estimated the parameters of our models using the least squares estimator, which is a standard statistical and econometric technique that calculates the values of the parameters of our regression model that minimize the sum of the squared errors—the differences between bond funding costs observed in the data and bond funding costs predicted by the model.

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indicators of size.<sup>9</sup> Altogether, we used 42 separate models for each year from 2006 through 2013. For all models, we included indicators for each quarter to control for the influence on yield spreads of economic conditions, the regulatory environment, and other factors that vary over time but not across bank holding companies. The details of the models we estimated and the results for our baseline models for select years are in appendix I.

We used our models to compare bond funding costs for bank holding companies of different sizes, all else being equal.<sup>10</sup> Because our models account for the possibility that investors' beliefs about government rescues depend on the credit risk level of the bank holding company, we made comparisons for bank holding companies with the average level of credit risk that prevailed each year. In addition, we assessed the impact of credit risk on our comparisons by making comparisons at credit risk levels higher and lower than the average for each year and also while holding the level of credit risk constant over time at the average level for 2008—the year when the financial crisis peaked and credit risk for bank holding companies was high. By holding credit risk constant, we can assess the extent to which changes in average credit risk over time may have influenced changes in funding costs relative to other factors.

Our approach is limited by several factors. Investors' beliefs about the likelihood of government support are composed of several different elements, including the likelihood that a bank holding company will fail, the likelihood that it will be rescued by the government if it fails, and the

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<sup>9</sup>The Dodd-Frank Act requires bank holding companies with \$50 billion or more in total assets to be subjected to enhanced regulatory standards and supervision. Pub. L. No. 111-203, § 165, 124 Stat. 1376, 1423 (2010) (codified at 12 U.S.C. § 5365). In addition, the Financial Stability Board designated 29 GSIBs, including eight U.S. bank holding companies, for the purpose of identifying firms that should be subject to resolution planning requirements and heightened regulatory supervision. The GSIBs generally comprise the largest and most complex internationally active financial firms. The bid-ask spread is the difference between the best buying price and the best selling price.

<sup>10</sup>Our models allow the size of a bank holding company to influence its bond funding costs directly and also indirectly through the interactions between size and the credit risk variables. As a result, no single parameter is sufficient to describe the relationship between bond funding costs and size. To summarize the overall relationship between bond funding costs and size reflected in each specification, we calculated bond funding costs for bank holding companies of different sizes and credit risk levels using our estimates of the parameters for each specification for each year. See appendix I for more details on the calculations.

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size of the losses that the government may impose on investors if it rescues the bank holding company, but our methodology—like the methodologies used by other researchers—does not allow us to precisely identify the influence of each of these components. Although we have taken into account many factors that may influence bond yield spreads and that differ for bank holding companies of different sizes, our estimates of differences in bond yield spreads for bank holding companies of different sizes may reflect factors other than investors' beliefs about the likelihood of government support because our control variables are imperfect or may be incomplete. In addition, our estimates of differences in bond yield spreads for bank holding companies of different sizes may reflect differences in the characteristics of bank holding companies that choose to issue bonds. The section of this report that addresses our second objective contains a fuller discussion of the limitations associated with our empirical work.

For parts of our work that involved the analysis of computer-processed data, such as market data used in our analysis of funding cost differences, we assessed the reliability of these data by reviewing relevant documentation and conducting interviews with data providers to review steps they took to collect and ensure the reliability of the data. In addition, we electronically tested data fields for missing values, outliers, and obvious errors. We determined that these data were sufficiently reliable for our purposes.

We conducted this performance audit from January 2013 to July 2014 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

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## Background

While the 2007-2009 financial crisis highlighted concerns about the market distortions that can result from too-big-to-fail perceptions, concern about such distortions pre-dated the crisis. A key factor giving rise to the too-big-to-fail dilemma has been the emergence of financial institutions of such size, interconnectedness, and market importance that their failure could threaten to severely disrupt the financial system and damage the economy. Although the federal government's policy responses to failing financial institutions in recent decades have not formed a clear pattern in terms of the availability or structure of government support, these



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responses may have influenced market views on the likelihood of government support. Several observers trace too-big-to-fail concerns back to 1984 when FDIC provided support to Continental Illinois National Bank, then the sixth largest U.S. bank in terms of total assets, to prevent its failure and losses to its depositors and creditors.<sup>11</sup> The Federal Reserve Board's response to the near failure of a large U.S. hedge fund, Long-Term Capital Management (LTCM), in 1998 was another significant event that may have contributed to too-big-to-fail perceptions.<sup>12</sup> While LTCM was not itself a large bank, the Federal Reserve Board's intervention in helping to facilitate private-sector assistance to LTCM may have signaled the willingness of federal government authorities to intervene to avoid potential systemic consequences from a large, interconnected financial firm's failure. Other factors may have contributed to some ambiguity surrounding the likely recipients and circumstances of government support in the years leading up to the 2007-2009 financial crisis. For example, failures and near-failures of large financial firms had been infrequent and occurred under varying circumstances, making it difficult to discern a clear pattern of government support.

During the 2007-2009 crisis, the federal government took actions to stabilize the financial system by creating new emergency programs with broad-based eligibility and providing firm-specific assistance to prevent the failures of large financial institutions.<sup>13</sup> Notably, however, U.S. government authorities' initial responses to impending failures of large financial institutions did not send a clear signal about the availability of government support. In March 2008, the Federal Reserve Board authorized emergency assistance to prevent the failure of one large

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<sup>11</sup>For more information about the government rescue of Continental Illinois National Bank, see GAO, *Financial Markets and Institutions: Views on the Federal Rescue of the Continental Illinois National Bank and Trust Co.*, Testimony by the Comptroller General of the U.S. before the Subcommittee on Financial Institutions Supervision, Regulation, and Insurance of the Committee on Banking, Finance and Urban Affairs of the U.S. House of Representatives (Washington, D.C.: Dec. 14, 1984); and GAO, *Financial Crisis Management: Four Financial Crises in the 1980s*, [GAO/GGD-97-96](#) (Washington, D.C.: May 1, 1997).

<sup>12</sup>For more information on the near-collapse of Long-Term Capital Management and broader issues it raised, see GAO, *Long-Term Capital Management: Regulators Need to Focus Greater Attention on Systemic Risk*, [GAO/GGD-00-3](#) (Washington, D.C.: Oct. 29, 1999).

<sup>13</sup>For more discussion of the federal government's emergency actions to assist the financial sector, see [GAO-14-18](#).

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investment bank (Bear Stearns Companies, Inc.), but 6 months later, Federal Reserve Board officials determined that they could not assist another large failing investment bank, Lehman Brothers Holdings, Inc. (Lehman Brothers).<sup>14</sup> Following Lehman Brothers' bankruptcy announcement on September 15, 2008, which triggered an intensification of the financial crisis, U.S. government authorities took actions that signaled a stronger near-term commitment to prevent the failure of systemically important financial institutions. On the day after Lehman Brothers' bankruptcy announcement, the Federal Reserve Board authorized up to \$85 billion of credit assistance for American International Group, Inc. (AIG) to prevent its failure.<sup>15</sup> In addition, on September 29, 2008, the Secretary of the Treasury invoked the systemic risk exception for the first time since the enactment of the FDIC Improvement Act of 1991 (FDICIA) to authorize FDIC to provide assistance to avert the failure of Wachovia Corporation—then the fourth-largest banking organization in

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<sup>14</sup>At the time, Bear Stearns was one of the largest investment banks. For further discussion of this assistance, see GAO, *Federal Reserve System: Opportunities Exist to Strengthen Policies and Processes for Managing Emergency Assistance*, [GAO-11-696](#) (Washington, D.C.: July 21, 2011). During the weekend of September 13-15, 2008, government officials met with leaders of major financial firms to devise a private-sector solution to Lehman Brothers' likelihood of defaulting on its obligations, but they were unable to find a solution. While the Federal Reserve Board was able to provide liquidity to Lehman Brothers against collateral through its emergency credit programs, according to the Federal Reserve Board Chairman at that time, neither the Federal Reserve Board nor any other agency had the authority to provide the capital or unsecured guarantee of its obligations that they believed Lehman Brothers needed to avert failure. See Ben S. Bernanke, Board of Governors of the Federal Reserve System, "Lessons from the Failure of Lehman Brothers" (testimony before the Committee on Financial Services, U.S. House of Representatives, Washington, D.C., Apr. 20, 2010).

<sup>15</sup>Subsequent to the announcement of the \$85 billion credit assistance, Treasury and the Federal Reserve provided new forms of assistance and restructured the assistance package for AIG over time. For more information about the federal government's assistance to AIG, see GAO, *Troubled Asset Relief Program: Status of Government Assistance Provided to AIG*, [GAO-09-975](#) (Washington, D.C.: Sept. 21, 2009).

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terms of assets in the United States—by facilitating Citigroup Inc.’s acquisition of its banking operations.<sup>16</sup>

At the height of the crisis in late 2008, the United States and other G7 countries announced an agreement to implement a comprehensive action plan to provide liquidity to financial markets and prevent the failure of any systemically important institution, among other objectives.<sup>17</sup> That month, U.S. government agencies launched two of the largest U.S. emergency initiatives: the Troubled Asset Relief Program, through which Treasury provided capital and other assistance to eligible financial institutions, and the Temporary Liquidity Guarantee Program, through which FDIC guaranteed certain uninsured deposits and newly issued unsecured debt of eligible financial institutions.<sup>18</sup> In late 2008 and early 2009, Treasury, the Federal Reserve Board, and FDIC authorized packages of firm-specific assistance for two of the largest U.S. bank holding companies, Citigroup Inc. and Bank of America Corporation. Foreign governments launched parallel initiatives to provide broad-based liquidity support and

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<sup>16</sup>A few days after the announcement of the proposed Citigroup acquisition, Wachovia announced that it would instead merge with Wells Fargo in a transaction that would include all of Wachovia’s operations and require no FDIC assistance. As a result, the FDIC loss-sharing agreement on Wachovia assets was not implemented. FDICIA included a systemic risk exception to the requirement that FDIC resolve failed banks using the least costly method. Pub. L. No. 102-242, § 141, 105 Stat. 2236, 2275 (codified at 12 U.S.C. § 1823(c)(4)(G)). Under this exception, FDIC could provide assistance to a failing bank if compliance with its requirements to resolve the bank using the least costly approach would have “serious adverse effects on economic conditions or financial stability”—that is, would cause systemic risk—and if such assistance would “avoid or mitigate such adverse effects.” *Id.* FDIC could act under the exception only under a process that included recommendations from the FDIC Board of Directors and Federal Reserve Board and approval by the Secretary of the Treasury. The Dodd-Frank Act restricts FDIC’s authority to provide open bank assistance to an individual failing bank outside of receivership and replaces it with a new authority, subject to certain restrictions and a joint resolution of congressional approval, to create a debt-guarantee program with broad-based eligibility. Pub. L. No. 111-203, § 1105(a), 124 Stat. 1376, 2121 (2010) (codified at 12 U.S.C. §§ 5612(a) and 5613(b)).

<sup>17</sup>The G7 is an informal forum of coordination among Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States.

<sup>18</sup>For more about the Troubled Asset Relief Program, see GAO, *Troubled Asset Relief Program: One Year Later, Actions Are Needed to Address Remaining Transparency and Accountability Challenges*, [GAO-10-16](#) (Washington, D.C.: Oct. 8, 2009). For more about the Temporary Liquidity Guarantee Program, see GAO, *Federal Deposit Insurance Act: Regulators’ Use of Systemic Risk Exception Raises Moral Hazard Concerns and Opportunities Exist to Clarify the Provision*, [GAO-10-100](#) (Washington, D.C.: Apr. 15, 2010).

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also took steps to prevent the failures of large financial institutions. Examples of large foreign financial institutions that received firm-specific assistance from their governments include Royal Bank of Scotland Group PLC (United Kingdom) and UBS (Switzerland).

Since the onset of the financial crisis, the largest banks have grown bigger in many major advanced economies, even as the financial sector has shrunk, and U.S. and foreign policymakers have acknowledged that crisis policy interventions raised moral hazard concerns.<sup>19</sup> As discussed earlier, market perceptions that some firms are too big to fail can distort market participants' incentives to properly price and restrain risk-taking by these firms. U.S. regulators have coordinated with foreign counterparts through the G20 and the Financial Stability Board to develop a policy framework for addressing the risks posed by large, complex financial institutions.<sup>20</sup> In November 2010, G20 leaders endorsed the Financial Stability Board's framework for addressing too-big-to-fail concerns. The framework aims to reduce the probability and impact of the failure of systemically important firms.<sup>21</sup> Key elements of this framework include developing effective resolution regimes and strengthening capital standards for systemically important financial institutions. FDIC, the Federal Reserve Bank of New York, and Treasury helped to develop standards the Financial Stability Board issued for effective resolution regimes in October 2011.<sup>22</sup> In addition, U.S. banking regulators have worked with their foreign counterparts to develop a strengthened capital regime that will require global systemically important banks to have

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<sup>19</sup>The share of total bank assets held by the five largest global banks has increased in many advanced countries and highlights concerns about too big to fail.

<sup>20</sup>The G20, established in 1999, is a forum for international cooperation on important issues of the global economic and financial agenda. Its members include 19 countries and the European Union. The G20 leaders established the Financial Stability Board as the successor to the Financial Stability Forum and made it responsible for coordinating and promoting the implementation of the G20 reform commitments.

<sup>21</sup>Financial Stability Board, "Reducing the Moral Hazard Posed by Systemically Important Financial Institutions – FSB Recommendations and Time Lines," October 20, 2010. In September 2013, the Financial Stability Board issued a report providing an update on progress in implementing this framework. See Financial Stability Board, "Progress and Next Steps Towards Ending 'Too-Big-to-Fail' (TBTF) – Report of the Financial Stability Board to the G20," September 2, 2013.

<sup>22</sup>Financial Stability Board, "Key Attributes of Effective Resolution Regimes for Financial Institutions," October 2011.

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additional loss absorbing capacity.<sup>23</sup> U.S. federal financial regulators are implementing these and other elements of the Financial Stability Board’s framework for addressing too big to fail as part of the process of implementing relevant Dodd-Frank Act provisions.

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## Dodd-Frank Act Provisions

U.S. federal financial regulators have made progress in implementing Dodd-Frank Act provisions and related reforms to restrict future government support and reduce the likelihood and impacts of the failure of a systemically important financial institution (SIFI).<sup>24</sup> These reforms can be grouped into four general categories: (1) restrictions on regulators’ emergency authorities to provide assistance to financial institutions; (2) new tools and authorities for regulators to resolve a failing SIFI outside of bankruptcy if its failure would have serious adverse effects on the U.S. financial system; (3) enhanced regulatory standards for SIFIs related to capital, liquidity, and risk management; and (4) other reforms intended to reduce the potential disruptions to the financial system that could result from a SIFI’s failure.

*Restrictions on Emergency Authorities.* The Dodd-Frank Act revised Federal Reserve Board and FDIC emergency authorities so that emergency assistance can no longer be provided to assist a single and specific firm but rather can only be made available through a program with broad-based eligibility—that is, a program that provides funding support to institutions that meet program requirements and that choose to participate.<sup>25</sup>

*New Tools and Authorities for Resolving SIFIs.* The Dodd-Frank Act includes two key reforms intended to facilitate the orderly resolution of a

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<sup>23</sup>For more information about the U.S. role in international financial reform efforts, including the development of international financial standards, see GAO, *International Financial Reforms: U.S. and Other Jurisdictions’ Efforts to Develop and Implement Reforms*, [GAO-14-261](#) (Washington, D.C.: Apr. 3, 2014).

<sup>24</sup>While the Dodd-Frank Act does not use the term “systemically important financial institution,” this term is commonly used by academics and other experts to refer to bank holding companies with \$50 billion or more in total consolidated assets and nonbank financial companies designated by FSOC for Federal Reserve supervision and enhanced prudential standards.

<sup>25</sup>Pub. L. No. 111-203, §§ 1101 and 1105, 124 Stat. 1376, 2113 and 2121 (2010) (codified at 12 U.S.C. §§ 343(3)(A) and 5612). For more information about changes to these authorities, see [GAO-14-18](#).

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large failing firm without a taxpayer-funded rescue: (1) requirements for SIFIs to formulate and submit to regulators resolution plans (or “living wills”) that detail how the companies could be resolved in bankruptcy in the event of material financial distress or failure; and (2) the Orderly Liquidation Authority (OLA), through which FDIC can resolve large financial firms, and which provides an alternative to bankruptcy if resolution under the bankruptcy code would have serious adverse effects on financial stability.<sup>26</sup>

- *Living wills.* Title I of the Dodd-Frank Act requires bank holding companies with \$50 billion or more in consolidated assets and nonbank financial companies designated by FSOC to formulate and submit to FDIC, the Federal Reserve Board, and FSOC resolution plans (or “living wills”) that detail how the companies could be resolved in bankruptcy in the event of material financial distress or failure.<sup>27</sup> The Federal Reserve Board and FDIC have finalized rules relating to resolution plans, and the large bank holding companies that were the first firms required to prepare and submit such plans submitted these to regulators as expected in July 2012.<sup>28</sup> Regulators reviewed these initial plans and developed guidance on what information should be included in 2013 resolution plan submissions.<sup>29</sup> If FDIC and the Federal Reserve Board jointly determine that a resolution plan is not credible or would not facilitate an orderly resolution of the company under the bankruptcy code, after giving the company an opportunity to remedy the plan’s deficiencies, the

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<sup>26</sup>§ 165(d), 124 Stat. at 1426 (codified at 12 U.S.C. § 5365(d)); § 204, 124 Stat. at 1454-56 (codified at 12 U.S.C. § 5384). During the financial crisis, several large financial institutions became insolvent and filed for bankruptcy when no private-sector solution was found. For example, Lehman Brothers filed for Chapter 11 bankruptcy on September 15, 2008. Lehman had \$639 billion in total assets and \$613 billion in total liabilities as of May 31, 2008. The bankruptcy proceedings highlighted inconsistencies in laws and regulations across countries and limitations on the ability of countries to coordinate effectively during the reorganization or liquidation of international financial institutions.

<sup>27</sup>§ 165(d)(1), 124 Stat. at 1426 (codified at 12 U.S.C. § 5365(d)(1)).

<sup>28</sup>Resolution Plans Required, 76 Fed. Reg. 67323 (Nov. 1, 2011).

<sup>29</sup>In October 2013, the Federal Reserve Board and FDIC released the public sections of filed annual resolution plans for 11 firms. “Federal Reserve Board and FDIC, Agencies Release Public Sections of the Second Submission of Resolution Plans for 11 Institutions,” accessed on November 7, 2013, <http://www.federalreserve.gov/newsevents/press/bcreg/20131003a.htm>.

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agencies may jointly decide to impose more stringent regulatory requirements on the company.<sup>30</sup>

- *Orderly Liquidation Authority.* OLA gives FDIC the authority, subject to certain constraints, to resolve large financial firms, including nonbanks, outside of the bankruptcy process.<sup>31</sup> This authority allows for FDIC to be appointed receiver for a financial firm if the Secretary of the Treasury determines, among other things, that the firm's failure and its resolution under applicable federal or state law, including bankruptcy, would have serious adverse effects on U.S. financial stability and no viable private-sector alternative is available to prevent the default of the financial company.<sup>32</sup> While the Dodd-Frank Act does not specify how FDIC must exercise this authority, FDIC is developing an approach to resolving a firm under OLA that it refers to as the Single Point-of-Entry (SPOE) approach.

Under the SPOE approach, FDIC would be appointed receiver of the top-tier U.S. parent holding company of a financial group determined to be in default or in danger of default following the completion of the appointment process set forth under the Dodd-Frank Act. Immediately after placing the parent holding company into receivership, FDIC would transfer assets (primarily the equity and investments in subsidiaries) from the receivership estate to a bridge financial holding company. By allowing FDIC to take control of the firm at the holding

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<sup>30</sup>§ 165(d)(4)-(5), 124 Stat. at 1426-27 (codified at 12 U.S.C. § 5365(d)(4)-(5)). Further, if, after 2 years following the imposition of the more stringent standards, the resolution plan still does not meet the statutory standards, FDIC and the Federal Reserve Board may, in consultation with FSOC, direct a company to divest certain assets or operations. *Id.*

<sup>31</sup>§ 204, 124 Stat. at 1454-1456 (codified at 12 U.S.C. § 5384).

<sup>32</sup>§ 204(b), 124 Stat. at 1455 (codified at 12 U.S.C. § 5384(b)). The factors to be considered by the Secretary of the Treasury are set forth in Section 203(b) of the Dodd-Frank Act. § 203(b), 124 Stat. at 1451 (codified at 12 U.S.C. § 5383(b)). Before the Secretary of the Treasury, in consultation with the President, makes a decision to seek the appointment of FDIC as receiver of a financial company, at least two-thirds of those serving on the Board of Governors of the Federal Reserve System and at least two-thirds of those serving on the Board of Directors of FDIC must vote to make a written recommendation to the Secretary of the Treasury to appoint FDIC as receiver. § 203(a)(1)(A), 124 Stat. at 1450 (codified at 12 U.S.C. § 5383(a)(1)(A)). In the case of a broker-dealer, the recommendation must come from the Federal Reserve Board and the Securities and Exchange Commission, in consultation with FDIC, and in the case of an insurance company, from the Federal Reserve Board and the Director of the Federal Insurance Office, in consultation with FDIC. § 203(a)(1)(B)-(C), 124 Stat. at 1450 (codified at 12 U.S.C. § 5383(a)(1)(B)-(C)).

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company level, this approach is intended to allow subsidiaries (domestic and foreign) carrying out critical services to remain open and operating. In a SPOE resolution, at the parent holding company level, shareholders would be wiped out, and unsecured debt holders would have their claims written down to reflect any losses that shareholders cannot cover. Under the Dodd-Frank Act, officers and directors responsible for the failure cannot be retained.<sup>33</sup>

The new resolution authority under the Dodd-Frank Act provides a back-up source for liquidity support, the Orderly Liquidation Fund, which could provide liquidity support to the bridge financial company if customary sources of liquidity are unavailable.<sup>34</sup> The law requires FDIC to recover any losses arising from a resolution by collecting assessments from bank holding companies with \$50 billion or more in consolidated assets, nonbank financial holding companies designated for supervision by the Federal Reserve Board, and other financial companies with \$50 billion or more in consolidated assets.<sup>35</sup>

*Enhanced Regulatory Standards.* The Dodd-Frank Act also introduced a number of regulatory changes designed to reduce the risks that the largest financial institutions pose to the financial system. The act requires the Federal Reserve Board to create enhanced capital and prudential standards for SIFIs.<sup>36</sup> According to Federal Reserve Board officials, in implementing these reforms, the Federal Reserve Board aims to design prudential standards that will both reduce the likelihood of a covered institution's failure and create incentives for these institutions to reduce their systemic footprint. The act's provisions related to enhanced prudential standards for these covered firms include, but are not limited to, the following:

- *Risk-based capital requirements and leverage limits.* The act required the Federal Reserve Board to establish capital and leverage standards, which, as finalized, include a requirement for covered firms to develop capital plans to help ensure that they maintain capital

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<sup>33</sup>§ 204(a)(2), 124 Stat. at 1454 (codified at 12 U.S.C. § 5384(a)(2)).

<sup>34</sup>§ 210(n), 124 Stat. at 1506 (codified at 12 U.S.C. § 5390(n)).

<sup>35</sup>§ 210(o)(1), 124 Stat. at 1509 (codified at 12 U.S.C. § 5390(o)(1)).

<sup>36</sup>§165(a)(1), 124 Stat. at 1423 (codified at 12 U.S.C. § 5365(a)(1)).



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ratios above specified standards, under both normal and adverse conditions.<sup>37</sup> In addition, the Federal Reserve Board has announced its intention to apply capital surcharges to some or all firms based on the risks these firms pose to the financial system.<sup>38</sup>

- *Liquidity requirements.* The act required the Federal Reserve Board to establish liquidity standards, which as finalized include requirements for covered firms to hold liquid assets that can be used to cover their cash outflows over short periods and in stressed conditions.<sup>39</sup> In addition, the Federal Reserve Board, FDIC, and OCC have issued a proposed rule that would implement a minimum liquidity requirement that is consistent with the Basel III liquidity coverage ratio and would apply to internationally active U.S. banking organizations and U.S. depository institutions with \$250 billion or more in total consolidated assets.<sup>40</sup>
- *Risk management requirements.* Publicly traded covered firms must establish a risk committee and be subject to enhanced risk management standards.<sup>41</sup>
- *Stress testing requirements.* The Federal Reserve Board is required to conduct an annual evaluation of whether covered firms have

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<sup>37</sup>§165(b)(1)(A)(i), 124 Stat. at 1424; Enhanced Prudential Standards for Bank Holding Companies and Foreign Banking Organizations; Final Rule, 79 Fed. Reg. 17240 (Mar. 27, 2014) (codified at 12 C.F.R. pt. 252).

<sup>38</sup>The Federal Reserve Board plans to issue a proposal to impose graduated common equity risk-based capital surcharges on U.S. bank holding companies designated as global systemically important banks (GSIB). The Federal Reserve Board has said this proposal will be based on the GSIB capital surcharge framework developed by the Basel Committee, under which the size of the surcharge for an individual GSIB would vary from 1 percent to 2.5 percent, depending on the firm's systemic importance.

<sup>39</sup>§165(b)(1)(A)(ii), 124 Stat. at 1424 (codified at 12 U.S.C. § 5365(b)(1)(A)(ii)). Enhanced Prudential Standards for Bank Holding Companies and Foreign Banking Organizations; Final Rule, 79 Fed. Reg. 17240 (Mar. 27, 2014) (codified at 12 C.F.R. pt. 252).

<sup>40</sup>Liquidity Coverage Ratio: Liquidity Risk Measurement, Standards, and Monitoring; Proposed Rule, 78 Fed. Reg. 71818 (Nov. 29, 2013). The requirement is designed to promote the short-term resilience of the liquidity risk profile of internationally active banking organizations, thereby improving the banking sector's ability to absorb shocks arising from financial and economic stress. *Id.*

<sup>41</sup>§§ 165(b)(1)(A)(iii) and 165(h), 124 Stat. at 1424 and 1429 (codified at 12 U.S.C. §§ 5365(b)(1)(A)(iii) and 5365(h)).

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sufficient capital to absorb losses that could arise from adverse economic conditions.<sup>42</sup>

The Federal Reserve Board has been implementing the enhanced standards required by the Dodd-Frank Act in conjunction with its implementation of Basel III, a set of risk-based capital, leverage, and liquidity standards developed by the Basel Committee on Banking Supervision.<sup>43</sup> The Basel capital reforms include a risk-based capital surcharge that will apply to financial institutions that have been designated as GSIBs. Further, the U.S. banking agencies have already adopted a leverage capital surcharge that will apply to the eight U.S. banking organizations that are GSIBs.<sup>44</sup>

*Other Reforms.* The act includes other reforms that could help reduce the likelihood or impacts of a SIFI's failure.

- *Authorities related to SIFI size and complexity.* The Dodd-Frank Act grants regulators new authorities to take certain actions if they determine that a SIFI poses risks of serious adverse effects on the stability of the financial system. These include the authority for the Federal Reserve Board to require a SIFI to meet even stricter

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<sup>42</sup>§165(i)(1), 124 Stat. at 1430 (codified at 12 U.S.C. § 5365(i)(1)). Companies subject to enhanced prudential standards as well as regulated financial firms with more than \$10 billion in consolidated assets also must conduct their own semiannual or annual stress tests, respectively. § 165(i)(2), 124 Stat. at 1430-31 (codified at 12 U.S.C. § 5365(i)(2)).

<sup>43</sup>The Basel Committee has developed international standards for bank capital for its member economies since the 1980s. In recent years, U.S. federal banking regulators have worked with other members of the Basel Committee to strengthen the regulatory capital regime for internationally active banks and develop a framework for a risk-based capital surcharge for the world's largest, most interconnected banking companies. The new regime, known as Basel III, seeks to improve the quality of regulatory capital and introduces a new minimum common equity requirement. Basel III also raises the numerical minimum capital requirements and introduces capital conservation and countercyclical buffers to require banking organizations to hold capital in excess of regulatory minimums. In addition, Basel III establishes for the first time an international leverage standard for internationally active banks. Federal banking regulators recently finalized capital reforms in the United States that are generally consistent with Basel III. The Federal Reserve Board will separately implement consistent capital and liquidity standards for nonbank financial companies designated for enhanced supervision by FSOC.

<sup>44</sup>Regulatory Capital Rules: Regulatory Capital, Enhanced Supplementary Leverage Ratio Standards for Certain Bank Holding Companies and Their Subsidiary Insured Depository Institutions, 79 Fed. Reg. 24528 (May 1, 2014).

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regulatory standards, the authority for the Federal Reserve Board to limit (with the approval of FSOC) the ability of a SIFI to merge with another company if it determines that the merger would pose a grave threat to U.S. financial stability, and, as noted above, the joint authority for the Federal Reserve Board and FDIC to require a firm to take steps to become more resolvable in bankruptcy.<sup>45</sup>

- *Volcker rule.* Section 619 of the Dodd-Frank Act (also known as the Volcker rule) generally prohibits proprietary trading by insured depository institutions and their affiliates and places restrictions on sponsorship or investment in hedge and private equity funds.<sup>46</sup> The Volcker rule's restrictions may have greater impacts on larger bank holding companies that have been more involved in the types of activities the rule restricts. To the extent that Volcker rule implementation prevents these large institutions from engaging in certain risky activities, it could serve to reduce the likelihood of their failure.
- *Swaps clearing and margin requirements.* Title VII of the Dodd-Frank Act establishes a new regulatory framework for swaps to reduce risk, increase transparency, and promote market integrity in swaps markets.<sup>47</sup> As we previously reported, requirements for swaps to be cleared through clearinghouses can reduce the vulnerability of the financial system to the failure of one or a few of the major swap dealers by transferring credit risk from the swap counterparties to the clearinghouse.<sup>48</sup> At the same time, experts have pointed out that clearinghouses concentrate credit risk and thus represent a potential

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<sup>45</sup>§ 121(a)(1), 124 Stat. at 1410 (codified at 12 U.S.C. § 5331(a)(1)); § 165(a)(1), 124 Stat. at 1423 (codified at 12 U.S.C. § 5365(a)(1)); § 165(d)(4)-(5), 124 Stat. at 1426-27 (codified at 12 U.S.C. § 5365(d)(4)-(5)).

<sup>46</sup>§ 619, 124 Stat. at 1620-31 (codified at 12 U.S.C. § 1851). Proprietary trading includes trading activities conducted by banking entities for their own account as opposed to those of their clients.

<sup>47</sup>A swap is a type of derivative that involves an ongoing exchange of one or more assets, liabilities, or payments for a specified period. Financial and nonfinancial firms use swaps and other over-the-counter derivatives to hedge risk, or speculate, or for other purposes.

<sup>48</sup>See [GAO-13-180](#). Counterparty credit risk is the risk to each party in an over-the-counter derivatives contract that the other party will not perform the contractual obligations. Technically, the clearing house members interact with the counterparties.

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source of systemic risk.<sup>49</sup> A benefit of the central clearing requirement is that clearinghouses require members to post margin for their trades and the Dodd-Frank Act also includes provisions that require regulators to develop margin requirements for uncleared swaps.<sup>50</sup> These new requirements could help reduce systemic risk by preventing the build-up of large, undercollateralized exposures.

Although federal financial regulators have finalized a number of rules related to these reforms, implementation of some key reforms has not yet been completed. For example, FDIC has largely completed the core rulemakings necessary to carry out its systemic resolution responsibilities, and is continuing to develop its SPOE approach. FDIC requested public comments on its SPOE resolution strategy in December 2013, and the comment period closed in March 2014.<sup>51</sup> In addition, regulators have not finalized certain rules that would subject SIFIs to enhanced prudential standards. For example, regulators have not finalized rules on single-counterparty credit limits.<sup>52</sup>

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<sup>49</sup>FSOC has identified certain clearinghouses as systemically important financial market utilities, which are subject to risk management and other enhanced supervisory and prudential requirements under the Dodd-Frank Act and may be afforded access to collateralized emergency liquidity from Federal Reserve Banks in unusual or exigent circumstances.

<sup>50</sup>In May 2011, OCC, the Federal Reserve Board, FDIC, the Farm Credit Administration, and the Federal Housing Finance Agency issued a notice of proposed rule-making on margin and capital requirements for covered swap entities. Margin and Capital Requirements for Covered Swap Entities; Proposed Rule, 76 Fed. Reg. 27564 (May 11, 2011).

<sup>51</sup>Resolution of Systemically Important Financial Institutions: The Single Point of Entry Strategy, 78 Fed. Reg. 243 (Dec. 18, 2013); Resolution of a Systemically Important Financial Institution: The Single Point of Entry Strategy, 79 Fed. Reg. 9899 (Feb. 21, 2014).

<sup>52</sup>In March 2014, the Basel Committee published a standardized approach to measuring counterparty credit risk exposures. This standardized approach will take effect starting on January 1, 2017.

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## Reforms Have Reduced Expectations of Government Support among Key Market Observers and Increased Regulation for Large Institutions

While views among investment firms we interviewed and credit rating agencies varied, many believe the Dodd-Frank Act has reduced but not eliminated the possibility of a government rescue of one of the largest bank holding companies. Two of the three largest credit rating agencies cited FDIC's resolution process as a key factor in their decisions to reduce or eliminate "uplift"—an increase in the credit rating—they had assigned to the credit ratings of eight of the largest bank holding companies due to their assumptions of government support for these firms. Several representatives from large investment firms with whom we spoke told us that FDIC's resolution process makes significant progress in reducing expectations of government support, but several agreed that uncertainty around its implementation or the circumstances of its use remains. As such, some market perceptions that the government might not allow the largest bank holding companies to fail remain and can give rise to advantages for these firms if these perceptions affect decisions by investors, counterparties, and customers of these firms. For example, credit rating agencies' assignment of higher credit ratings due to assumed government support can create benefits for these firms, but because investors may rely on credit ratings to varying degrees, the impact of such benefits may vary accordingly. In addition, Dodd-Frank Act provisions and related rules subject the largest firms to higher fees and stricter regulation that may reduce their risk of failure and increase costs on them relative to smaller competitors. Officials from FSOC and some of its member agencies have stated that financial reforms have not completely removed too-big-to-fail perceptions, but have made significant progress toward doing so. They anticipate that remaining expectations of government support will decline as Dodd-Frank implementation progresses.

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## Some Credit Rating Agencies and Large Investors Believe Dodd-Frank Has Reduced the Likelihood of Government Rescues

While views among credit rating agencies and investment firms varied, many believe the Dodd-Frank Act has reduced but not eliminated the possibility of a government rescue of one of the largest bank holding companies. During the financial crisis, credit rating agencies assigned or increased "uplift"—or an increase in the credit rating—for several large bank holding companies' credit ratings to reflect their view that the increased possibility of government support for these firms reduced the risk that the firms' creditors would suffer losses.<sup>53</sup> We reviewed changes

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<sup>53</sup>For example, in December 2008, S&P introduced government support as a factor that could affect a financial institution's ratings. Moody's had assigned uplift in ratings for some bank holding companies before the financial crisis and during the crisis increased the amount of uplift for these firms and began to assign uplift to several other financial institutions.

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in credit rating agencies' assumptions about government support over time and interviewed credit rating agency representatives. Because large investors do not necessarily rely on credit ratings or rating agencies' assessments of government support, we obtained perspectives from representatives of large asset management firms, pension funds, hedge funds, and other investment firms that purchase debt and equity issued by bank holding companies.<sup>54</sup>

Citing progress in Dodd-Frank implementation and other changes, two credit rating agencies have reduced or eliminated their rating uplift for the largest bank holding companies since the end of the 2007-2009 financial crisis, and a third rating agency has noted that regulatory developments may lead it to reduce or eliminate the uplift it assigns to these bank holding companies' ratings. The three largest credit rating agencies—Fitch, Moody's, and S&P—have incorporated government support into their ratings over time, with the amount of increase in credit rating being driven by their assessment of the firm's standalone credit rating—the credit rating that assumes no government support—and the impact on the firm's creditworthiness they attribute to the likelihood of government support.<sup>55</sup> These three rating agencies have incorporated government support into their ratings using different approaches and under Fitch's approach, assumptions of extraordinary government support have not led to an increase in rating for U.S. bank holding companies in all cases. Fitch incorporates government support into its ratings by assigning a "support rating floor," a minimum credit rating that reflects its view about the likelihood an entity will receive company-specific government support in case of need, though the entity only receives "uplift" in its rating if its standalone credit rating is below the "support rating floor." Following the July 2010 enactment of the Dodd-Frank Act, Fitch and Moody's removed their assumptions of government support for several large regional bank holding companies and their subsidiary banks and reduced (but did not eliminate) their assumptions of support for eight of the largest U.S. bank

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<sup>54</sup>As explained earlier in this report's scope and methodology section, we selected nonrepresentative samples of investment firms for interviews. As a result, the views of investment firm representatives we interviewed are not generalizable to the broader universe of investors.

<sup>55</sup>A firm with a lower standalone credit rating may receive a bigger increase in its rating from government support than a firm with a stronger standalone rating.

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holding companies.<sup>56</sup> Fitch and Moody's reports cited FDIC's new resolution authority and a reduced willingness by the U.S. government to assist a failing bank holding company as key factors influencing these changes in assumed government support. As of June 2014, S&P had not changed its level of assumed government support since the financial crisis.<sup>57</sup> However, in June 2013, S&P noted that regulatory developments may lead it to reassess its assumptions of government support for the eight bank holding companies.<sup>58</sup> The three credit rating agencies each noted that their remaining assumptions of government support reflected continued uncertainty about the ability of the U.S. government to effectively resolve one of the largest bank holding companies in OLA. In September 2013, Fitch indicated that it would conduct a global review of its support ratings and in March 2014, Fitch reported that it expects to remove its support rating floor for several of the largest U.S. bank holding companies within the next one or two years.<sup>59</sup> In November 2013, Moody's removed all uplift from assumed government support from its

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<sup>56</sup>These eight companies were Bank of America Corporation, Bank of New York Mellon, Citigroup Inc., Goldman Sachs Group, JPMorgan Chase & Co., Morgan Stanley, State Street Corporation, and Wells Fargo & Company. While Fitch continued to assign a support rating floor to eight bank holding companies, only 3 of these companies had standalone credit ratings below the support rating floor and thus received a higher credit rating from Fitch as a result of assumed government support. These three companies were Bank of America Corporation, Citigroup Inc., and Morgan Stanley. Following a March 2014 upgrade to Citigroup Inc.'s rating, only Bank of America Corporation and Morgan Stanley continued to have a standalone rating below the support rating floor.

<sup>57</sup>In a July 2013 report, S&P noted that regulatory developments may lead it to reassess its assumptions of extraordinary government support on the holding company ratings of the eight systemically important banks, but it was not considering removing such support assumptions at the subsidiary level.

<sup>58</sup>Accordingly, S&P revised its rating outlook on the holding company of JPMorgan Chase & Co. to negative from stable, while maintaining negative rating outlooks on the holding companies of the other seven bank holding companies. S&P noted that it is monitoring FDIC's progress in developing a resolution mechanism that aims to ensure that market confidence will not erode with the failure of a big bank and its resolution through Title II of Dodd-Frank. Furthermore, it indicated that it would consider the required level of long-term debt at the holding company as another factor in removing government support from those ratings.

<sup>59</sup>In March 2014, Fitch revised its outlook on Bank of America Corporation from "stable" to "negative," reflecting its expectation that its assumption of weakening sovereign support is likely to result in a downgrade. Fitch also upgraded Citigroup Inc.'s standalone rating, after which only Bank of America Corporation and Morgan Stanley—which Fitch noted was likely to be upgraded—had standalone ratings below the support rating floor and thus benefitted from an uplift.

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credit ratings for the remaining eight large bank holding companies.<sup>60</sup> Moody's cited regulators' substantial progress in establishing the SPOE receivership framework as a main consideration in their decision to remove the uplift. They noted that the SPOE framework would allow FDIC to impose losses on the creditors of a U.S. bank holding company to recapitalize and preserve the operations of the bank's systemically important subsidiaries in a stress scenario. As a result, they believe that the holding company creditors of systemically important U.S. banks are unlikely to receive government support.

Representatives of large investment firms with whom we spoke said that they rely primarily on their own assessments of government support when investing in financial institutions, and they identified OLA and other reforms as factors influencing their views. While representatives of several firms said that Dodd-Frank reforms have significantly reduced or eliminated expectations of government rescues, others said they continue to expect that the government would rescue one of the largest bank holding companies under certain scenarios if policymakers judged the potential costs to the economy from such a failure to be too great.

Investors generally cited progress on OLA and enhanced regulatory standards for the largest bank holding companies as among the most important factors influencing their views on the likelihood of government support, and many considered living wills and other reforms to be less significant factors.

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<sup>60</sup>While Moody's removed rating uplift at the holding company level, it retained uplift in its ratings for the senior and subordinated debt of bank subsidiaries of these bank holding companies. Moody's did not change its assignment of uplift for bank-level senior debt, explaining that it continued to believe that the disorderly failure of one of these large bank subsidiaries would create the risk of contagion to the broader financial system. In contrast, Moody's reduced but did not eliminate uplift for subordinated debt of these banks' subsidiaries. Moody's attributed differences in its assessment of uplift for senior and subordinated debt to potential differences in the level of government support for senior and subordinated creditors. Moody's noted that it expects support for bank-level creditors to come primarily from the protection provided by holding company creditors, who take losses before the bank-level creditors under the SPOE framework. However, if imposing losses on holding company creditors does not prove sufficient to ensure the viability of the bank subsidiary, Moody's believes it is unlikely that bank-level subordinated creditors would receive direct government support. In contrast, in such a scenario, Moody's believes senior creditors might still be supported by the government.



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**FDIC's resolution process.** Investors with whom we spoke said that FDIC's progress in developing its resolution process to implement OLA as an alternative to bankruptcy has caused them to significantly reduce their expectations of government support, but uncertainty around its implementation and circumstances of its use remains. Although several investors believed that FDIC's resolution process is credible for managing a single large failure, two expressed doubts about whether it could be used to resolve multiple failing firms in a systemic crisis. They noted that if the economic costs of a large firm's failure were judged to be too high, the federal government might not want to risk using OLA if regulators believed it would destabilize markets. Two investors noted that in the event that concerns about destabilizing markets led the federal government to provide emergency assistance to a failing firm in lieu of using OLA, policymakers might face political pressure to structure the assistance in a manner that imposed losses on creditors.<sup>61</sup> Other factors being equal, an investor's belief that there is a possibility of incurring losses even if the government prevents a firm's failure would reduce that investor's willingness to provide funds to that firm on more favorable terms because of a too-big-to-fail perception. Because OLA is untested, some uncertainty may exist about its viability as an alternative to bankruptcy and government rescues until it is used.

Some investors identified areas where further progress is needed to enhance the credibility of OLA. First, some market observers have pointed to opportunities to further minimize the adverse market impacts that could result from resolving a firm under OLA. For example, although OLA provides for a 1-day stay on qualified financial contracts to allow for the selection of contracts to transfer to the bridge company, derivatives contracts written under the laws of other countries could allow counterparties to close out those contracts immediately, possibly posing liquidity issues for the firm and leading it to sell assets at depressed

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<sup>61</sup>While the Dodd-Frank Act contains provisions that prohibit rescues of individual failing institutions, a few investment firm representatives believed that, under certain scenarios, the federal government might intervene to provide capital injections to distressed bank holding companies, which would require an act of Congress. These representatives said they did not know what form a government intervention would take, but indicated that elected officials could face pressure to intervene as the U.S. Congress did in October 2008 when it passed legislation authorizing TARP. One representative of a large asset management firm said that while the political cost to elected officials of rescuing large financial institutions would be high, the costs to the economy of not intervening could also be high.

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prices into the market. Some regulatory officials have said that cross-border agreements that create conformity in the treatment of derivatives contracts in resolution processes would enhance OLA's effectiveness and practicality as a resolution tool. In addition, some investors noted that progress on the Federal Reserve's planned proposal for a minimum long-term debt requirement could create greater certainty that the largest bank holding companies would have enough equity and debt to absorb losses and recapitalize their operating subsidiaries under OLA.<sup>62</sup>

**Enhanced regulatory standards.** Many investment firm representatives credited enhanced regulatory standards for the largest bank holding companies with improving the safety and soundness of these firms and reducing the likelihood that they would experience distress that could result in failure or government support. One representative from a large investment firm said that the best defense against banks needing government support is to make sure they are well-capitalized. Similarly, another investment firm representative said that higher capital ratios and strengthened balance sheets have given confidence to the markets that the institutions are more sound, in turn reducing the likelihood that they would fail and potentially receive government assistance. A representative from one large asset management firm said that enhanced capital and liquidity standards are a positive from a debt holder's perspective because increased capital provides a bigger buffer to absorb losses and increased liquidity makes a run on the firm less likely.

**Living wills.** Several investors said the living wills may have positive effects, but some investors have expressed doubts about the effectiveness of the plans, with one investor citing a lack of public transparency. In a public comment letter to FDIC, The Credit Roundtable, a financial industry association, noted that additional living will disclosures would improve the market's ability to gauge the level of risk under a SPOE scenario. Additionally, while the purpose of living wills is to make

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<sup>62</sup>In his February 6, 2014, testimony to the Senate Banking Committee, Federal Reserve Governor Daniel Tarullo said that in the event that the equity of a financial firm is wiped out, successful resolution without taxpayer assistance would be most effectively accomplished if a firm has sufficient long-term, unsecured debt to absorb additional losses and to recapitalize the business transferred to a bridge operating company. In a public comment to FDIC on OLA's single-point-of-entry framework, former FDIC Chair Sheila Bair identified the long-term debt requirement as a key component to ensure that a firm in OLA has sufficient loss-absorbing capacity.

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SIFIs resolvable in bankruptcy, several large investors said they assume that a failing SIFI would be resolved through OLA.

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## Remaining Market Expectations of Government Support Can Have Benefits for Large Firms

Remaining market assumptions about government support can give rise to advantages for the largest bank holding companies in three broad categories to the extent these assumptions affect decisions by investors, counterparties, and customers of these firms. Those categories are funding costs, financial contracts that reference ratings, and ability to attract customers.

### Funding Costs

Market beliefs about government support could benefit a firm by lowering its funding costs. However, the extent to which this occurs depends in part on the extent to which providers of funds—such as depositors, bond investors, and stockholders—rely on credit ratings that assume government support or incorporate their own expectations of government support into their decisions to provide funds. For example, an investor that relies on credit ratings may view a firm with a rating that incorporates implied government support as having lower risk—other factors being equal—and may be more inclined to invest in the firm and accept a lower interest rate or return on the firm’s obligations. These effects can be more pronounced during a financial crisis, particularly if market strains cause credit rating agencies to reduce ratings more for firms they believe the government would not rescue and if providers of funds seek to reduce their risk exposures to firms they believe are not too big to fail.

Several factors influence the extent to which investors rely on ratings. For example, an investor’s reliance on credit ratings can depend on the extent to which the investor conducts its own credit analysis. While representatives of large investment firms with whom we spoke said they rely primarily on their own assessments of credit risk and do not rely on credit ratings, smaller investors lacking the resources to do their own credit analysis may rely more on credit ratings and rating agencies’ assessments of the impact of possible government support on a firm’s risk profile. In addition, while an investment firm’s assessment of government support can be relevant to funds that it actively manages, it may not incorporate this factor into the investment decisions of funds that

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it manages using passive investment strategies.<sup>63</sup> Finally, some representatives of large investment firms said that while they do not rely on credit ratings for investment decisions, they pay attention to them when managing funds for clients whose investments must meet minimum credit rating requirements and for clients who may use credit ratings to assess their performance.

Representatives of large investment firms with whom we spoke generally said their views on the likelihood of government support do not affect their investment decisions. Some representatives of investment firms said that while they believe some probability of government rescues remains, there is too much uncertainty surrounding future government support to factor it into their current investment decisions. Several bond investors said it is difficult to distinguish any pricing impacts from market expectations of government support from the variety of other factors related to firm size that can impact debt pricing and investors' investment decisions. For example, compared to smaller institutions, large bank holding companies issue bonds more frequently and in larger amounts, which increases the liquidity of their bonds. Investors may accept lower interest rates on more liquid bonds because more liquid bonds can be sold more easily without reducing the price. In the section addressing the second objective of this report, we analyze the existence and size of potential funding cost advantages for the largest bank holding companies using quantitative approaches that control for factors outside of government support that can influence funding cost differences.

## Financial Contracts That Reference Ratings

Higher credit ratings from assumed government support can also benefit firms through private contracts that reference credit ratings. For example, derivative contracts often tie collateral requirements to a firm's credit rating. Representatives of some large bank holding companies said that reduced credit ratings would require them to post more collateral. Additional collateral requirements would demand additional funds that could otherwise be used in other investments. The largest bank holding companies disclose information in their financial statements about how a credit rating downgrade could cause them to post more collateral. While

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<sup>63</sup>For example, an investment firm may employ a passive investment strategy by managing the selection and allocation of investments in a particular fund with the goal of matching the returns of a benchmark index. In contrast, the firm may actively manage other funds by choosing investments with the goal of generating returns that outperform a benchmark index.

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estimates of these collateral impacts have varied over time and across firms, several of these firms have estimated that a downgrade in their credit rating could require them to post between \$1 billion and \$4 billion of additional collateral, depending on the size of the downgrade. Another way that private contracts can reference credit ratings is by setting minimum credit rating requirements. Examples of such requirements include investment funds that cannot purchase securities that are below minimum ratings requirements and counterparties that will not accept a letter of credit from a bank with a low credit rating.

### Ability to Attract Customers

Corporate customers with whom we spoke expressed varying views on the degree to which expectations of government support influence their banking decisions. Two corporate customers with whom we spoke said that they believe the government would intervene to prevent the failure of the largest bank holding companies, but that potential government support is only one of several factors they consider in choosing a bank and is not necessarily a decisive factor. Several corporate treasurers identified size-related factors that are unrelated to government support that make them more inclined to use the largest banks for their banking needs. For example, treasurers of global firms noted that the largest U.S. banks have the geographic presence and ability to provide funding on the scale they need to support their operations around the world. One corporate customer noted that although the company's credit facility includes both regional banks and some of the largest banks, they tend to use the services of large banks more because of their capacity for handling large transactions and the variety of their business lines.

However, while two treasurers said that they tend to select the largest U.S. banks primarily for reasons that are unrelated to government support, their beliefs about which banks would be rescued by the government can impact how they manage their risk exposures to banks of different sizes. For example, a treasurer for a large domestic corporation said that the possibility of government rescues can be a factor when evaluating counterparty risk and the safety of deposits. She noted that in normal economic conditions, the likelihood of government support for banks is not a significant factor, but when markets become strained, her company may reduce its deposits and other exposures to regional banks they believe the government would allow to fail. Outside of these treasurers, a treasurer from a large global company said that potential government support may impact his company's banking decisions indirectly through credit ratings. He noted that the company uses credit ratings as a factor in assessing a bank's creditworthiness and adjusting its exposures to banks. For example, if a bank's credit rating falls, the

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company may reduce its intraday exposure to that bank by shifting deposits and other exposures away from that bank. A few corporate customers told us they do not consider the possibility of government support for large banks when they decide how to allocate their banking business.

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### Stricter Capital and Other Regulatory Standards May Reduce Risk of Failure and Increase Costs for Largest Firms

The Dodd-Frank Act imposes new and higher fees on large bank holding companies and requires the Federal Reserve Board to subject large bank holding companies to enhanced regulatory standards for capital, liquidity, and risk management. These enhanced standards may help to reduce the likelihood and potential market impacts of the failure of a large bank holding company. Taken together, higher fees, stricter regulatory standards, and other reforms could increase costs for the largest bank holding companies relative to smaller competitors.<sup>64</sup> New or revised fees and assessments impose higher direct costs on bank holding companies with more than \$50 billion in total assets.

- **Deposit insurance assessments.** The Dodd-Frank Act required FDIC to change the definition of an insured depository institution's assessment base, which can affect the amount of deposit insurance assessment the institution pays into the deposit insurance fund.<sup>65</sup> According to FDIC, this change shifted some of the overall assessment burden from smaller banks to larger institutions that rely less on deposits but did not affect the overall amount of assessment revenue collected. The base was changed from total domestic deposits to average consolidated total assets minus average tangible equity. The largest bank holding companies generally saw the largest percentage increases in their deposit insurance assessments

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<sup>64</sup>In this report, we do not attempt to quantify the extent to which such higher costs for the largest firms could offset benefits they receive as a result of expectations of government support. For example, we did not attempt to determine the differential impacts of various Dodd-Frank Act provisions on bank holding companies of different sizes. Implementation of some Dodd-Frank Act provisions specifically targets only SIFIs, while other provisions affect both SIFIs and non-SIFIs. Representatives of community banks and other non-SIFIs have noted that while some Dodd-Frank Act provisions—such as the Volcker rule—were intended to target activities at the largest bank holding companies, smaller banks can still face burdens associated with ensuring they comply with these rules. Federal financial regulators have acknowledged the importance of minimizing regulatory burdens for financial institutions and particularly for smaller banks, whose fixed costs arising from regulatory compliance must be spread over a smaller base of revenues.

<sup>65</sup>Pub. L. No. 111-203, § 331(b), 124 Stat. 1376, 1538 (2010).

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because they rely less on domestic deposits for their funding than smaller institutions. One of the largest bank holding companies reported that the change to the assessment calculation resulted in a \$600 million increase in its deposit insurance assessments in 2011. In the quarter after the rule became effective, those banks with less than \$10 billion in assets saw a 33 percent drop in their assessments (from about \$1 billion to about \$700 million), while those banks with over \$10 billion in assets saw a 17 percent rise in their assessments (from about \$2.4 billion to about \$2.8 billion).

- **Fees on SIFIs.** In addition, the Dodd-Frank Act directs the Federal Reserve Board to collect fees from bank SIFIs equal to the expenses the Federal Reserve Board estimates are necessary or appropriate to carry out its supervision and regulation of those companies.<sup>66</sup> In addition, the Dodd-Frank Act directs Treasury to collect assessments from bank and nonbank SIFIs to fund the operations of the Office of Financial Research. These assessments totaled \$137 million in 2012 and \$35 million in 2013.

The Dodd-Frank Act requires the Federal Reserve Board to subject large bank holding companies to heightened standards for capital, liquidity, and stress testing, as well as other provisions, all of which could reduce the risk of their failure and the costs that their distress could impose on the financial system. Following Dodd-Frank enactment, bank SIFIs significantly increased their capital and liquidity in advance of finalization of new rules for capital, leverage, and liquidity standards. As of December 31, 2013, the six largest U.S. GSIBs had an average tier 1 common equity capital ratio of 12.1 percent, compared to the 4.5 percent minimum required under Basel III and an average of 8.4 percent among these firms

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<sup>66</sup>§ 318(c), 124 Stat. at 1527. In addition to these fee assessments related to Federal Reserve Board supervision, in April 2014 OCC proposed increasing the assessments it collects for national banks and federal savings associations with more than \$40 billion in total assets. Assessment of Fees, 79 Fed. Reg. 23297 (Apr. 28, 2014). Under the proposal, the assessment increases would range from 0.32 percent to 14 percent, depending on the total assets of the institution reflected in its June 30, 2014, call report. *Id.* The proposed rule presented estimates of the size of the increase for institutions of various sizes. For example, a national bank with assets of \$2 trillion would see its semiannual assessment increase by an estimated \$9.3 million, or 14 percent.

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as of December 31, 2009.<sup>67</sup> In addition, pursuant to the Dodd-Frank Act, the Federal Reserve Board conducts stress testing and evaluates the capital planning process of large bank holding companies to help ensure these firms are resilient to periods of economic or financial stress. In the most recent round of capital planning reviews, the Federal Reserve Board rejected the capital plan of one U.S. GSIB and required another to resubmit its capital plan after errors were discovered.<sup>68</sup> Pending approval of their revised capital plans, the Federal Reserve Board did not allow proposed actions by these firms, such as dividend increases, that would have reduced their capital. In April 2014, U.S. bank regulators adopted a new rule that strengthens the leverage ratio standards for the largest, most interconnected U.S. banking organizations.<sup>69</sup>

Beyond the new rules and regulatory reviews to ensure capital adequacy, the Federal Reserve Board has indicated that eight of the largest U.S.

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<sup>67</sup>National banking regulators classify capital as either Tier 1—currently the highest-quality form of capital and includes common equity—or Tier 2, which is weaker in absorbing losses. Tier 1, or core, capital consists primarily of common equity. Tier 2 is supplementary capital and includes limited amounts of subordinated debt, loan loss reserves, and certain other instruments.

<sup>68</sup>On March 26, 2014, the Federal Reserve Board announced that it approved the capital plans of 25 bank holding companies participating in its Comprehensive Capital Analysis and Review (CCAR) program. It objected to the capital plans of 5 bank holding companies, including Citigroup Inc., one of the U.S. GSIBs. On April 28, 2014, the Federal Reserve Board announced that it was requiring Bank of America Corporation to resubmit its capital plan and to suspend planned increases in dividend distributions. The decision related to the disclosure by Bank of America that it incorrectly reported data used in the calculation of regulatory capital ratios and submitted as inputs for the most recent stress tests conducted by the Federal Reserve. The Federal Reserve Board can require a banking organization that is part of the annual CCAR program to resubmit its capital plan at any time if there has been or likely will be a material change in a firm's capital position. 12 C.F.R. § 225.8(d)(4)(i)(C)(2).

<sup>69</sup>Regulatory Capital Rules: Regulatory Capital, Enhanced Supplementary Leverage Ratio Standards for Certain Bank Holding Companies and Their Subsidiary Insured Depository Institutions, 79 Fed. Reg. 24528 (May 1, 2014). The final rule applies to U.S. bank holding companies with more than \$700 billion in consolidated total assets or more than \$10 trillion in assets under custody (covered BHCs) and their insured depository institution (IDI) subsidiaries. Covered BHCs must maintain a leverage buffer greater than 2 percentage points above the minimum supplementary leverage ratio requirement of 3 percent, for a total of more than 5 percent, to avoid restrictions on capital distributions and discretionary bonus payments. IDI subsidiaries of covered BHCs must maintain at least a 6 percent supplementary leverage ratio to be considered “well capitalized” under the agencies’ prompt corrective action framework. The final rule, which has an effective date of January 1, 2018, currently applies to eight large U.S. banking organizations that meet the size thresholds and their IDI subsidiaries.



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bank holding companies will be subject to a capital surcharge—an increase in their risk-based capital requirement—based on their size, complexity, and interconnectedness.<sup>70</sup> Federal Reserve Board officials have stated that the capital surcharge is intended to force the largest bank holding companies to internalize the costs they could impose on the financial system from their systemic footprint. Federal Reserve Board and Treasury officials said that this capital surcharge could also help to offset any funding cost advantages that remain from market perceptions that the government would not allow the largest bank holding companies to fail.

Higher capital and liquidity requirements for banks can increase their funding and other costs. For example, higher capital requirements can require banks to increase the portion of their funding that comes from equity capital rather than debt, which can increase funding costs.<sup>71</sup> In prior work, we have summarized the results of studies by the Bank for International Settlements and others on the benefits and costs of increasing capital requirements for banks, but these studies generally estimated cost impacts to the economy rather than the incidence of increased costs for the institutions themselves. While banks can respond to additional costs in a variety of ways, including passing on some costs to borrowers by charging higher interest rates on loans, a Federal Reserve Board official noted that costs associated with the GSIB capital surcharges—which will not apply to most banks and will not apply evenly among the GSIBs—may be more difficult for the largest bank holding companies to pass on to customers.

Dodd-Frank also imposes additional compliance costs on large bank holding companies required to comply with other Dodd-Frank provisions. For example, as previously discussed, Dodd-Frank requires SIFIs to

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<sup>70</sup>As noted earlier in this report, the Federal Reserve Board has said its proposal will be based on the G-SIB capital surcharge framework developed by the Basel Committee, under which the size of the surcharge for an individual G-SIB would vary from 1 percent to 2.5 percent, depending on the firm's systemic importance.

<sup>71</sup>In theory, increasing the required proportion of equity funding relative to debt funding should not affect a firm's overall cost of funding as it reduces the risk that the firm will fail, thereby reducing the returns demanded by both equity and debt holders. However, certain government policies make equity financing (such as through issuing stock to investors) more expensive for financial institutions than debt financing. For example, interest on debt is tax deductible, while dividends on equity securities are not. In addition, bank deposits benefit from federal guarantees and the interest rates a bank pays on its insured deposits may not fall as capital levels and the perceived safety of the firm increases.

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periodically submit resolution plans to the Federal Reserve and FDIC, as well as to conduct company-run stress tests semiannually. Regulators and industry officials have stated that SIFIs have devoted significant staffing resources to developing these resolution plans. According to industry representatives, stress testing requires newly covered firms to incur significant compliance costs associated with building information systems, contracting with outside vendors, recruiting personnel, and developing stress testing models that are unique to their organization. Furthermore, changes to the market infrastructure for swaps—such as clearing and exchange-trading requirements—and real-time reporting requirements for designated major swap dealers or major swap participants will require firms to purchase or upgrade information systems. Industry representatives and regulators said that while some compliance costs of the derivatives reforms could be recurring, a large part of these costs will come from one-time upfront investments to update processes and technology. Additionally, by generally prohibiting banks from engaging in proprietary trading and limiting their ability to sponsor or invest in hedge and private equity funds, the Volcker rule restrictions could eliminate past sources of trading and fee income for some banks.

As we have noted in prior work, measuring the costs of financial regulation is challenging because of the multitude of intervening variables, the complexity of the financial system, and data limitations.<sup>72</sup> For example, the extent to which regulated institutions pass on a portion of their increased costs to their customers may be impacted by competitive forces or other factors. Other sources of uncertainty, such as the potential for regulatory arbitrage, add to the challenges of estimating the act's potential costs. For example, increased regulation could cause certain financial activities in the United States to move to foreign jurisdictions with less stringent regulations. U.S. regulators have acknowledged the importance of harmonizing international regulatory standards and noted that it can be advantageous for the United States to be the leader in implementing new regulatory safeguards.

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<sup>72</sup>See [GAO-13-180](#).

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## Agencies See Progress in Addressing Too-Big-to-Fail Perceptions and Expect Further Progress as Reforms Are More Fully Implemented

Officials from FSOC and its member agencies have stated that financial reforms have not completely removed too-big-to-fail perceptions but have made significant progress toward doing so. In a December 2013 speech, Treasury Secretary Jack Lew said there is growing recognition of the Dodd-Frank reforms and that market analysts are factoring them into their assumptions. However, he noted that there is still more work to be done.

Under the Dodd-Frank Act, FSOC is, among other things, charged with promoting market discipline by eliminating expectations on the part of shareholders, creditors, and counterparties of large bank holding companies that the U.S. government will shield them from losses in the event of failure. FSOC and its member agencies monitor progress in addressing expectations of government support primarily through monitoring progress in implementing relevant Dodd-Frank reforms. FSOC's 2014 annual report includes a discussion of progress made on OLA, enhanced prudential standards, and other relevant reforms. According to Treasury officials, several key areas require continued progress:

- **International regulatory reform.** In its 2013 annual report, FSOC writes that international coordination of financial regulation is essential to mitigate threats to financial stability. FDIC officials said they continue to work with foreign regulators to address issues related to creating a viable process for effecting the orderly resolution of a failing financial institution with significant cross-border activities. For example, FDIC is working with foreign counterparts on changes needed to ensure that derivatives contracts under other countries' laws include a stay similar to that which applies to U.S. contracts under Dodd-Frank to prevent termination of these contracts by counterparties of a firm pulled into resolution. Federal Reserve Board staff said U.S. regulators are considering steps that may be needed to help ensure that foreign regulators do not take disruptive actions with respect to foreign operations of a U.S. firm pulled into resolution. They noted that global U.S. SIFIs may need to create intragroup loss absorbency arrangements that provide clarity and assurance to foreign regulators about how loss absorbency from the U.S. holding company will be made available to support foreign operations during a resolution.
- **The Federal Reserve's long-term debt requirement.** The Federal Reserve Board has identified the implementation of a long-term debt requirement as a regulatory priority that it and other agencies are actively considering. In testimony before the Senate Banking

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Committee, Federal Reserve Board Governor Daniel Tarullo said that successful resolution without taxpayer assistance would be most effectively accomplished if a firm has sufficient long-term, unsecured debt to absorb additional losses and to recapitalize the business transferred to a bridge operating company.

- **General education of market participants on reforms.** Treasury officials identified the education of market participants as a key area for progress. Public outreach and education often take the form of speeches from agency officials and meetings with industry stakeholders. Regulators also solicit feedback on proposed rulemakings and regulations during public comment periods. For example, on December 18, 2013, FDIC published a public notice on the framework for a SPOE approach for resolution of failed financial institutions under OLA and solicited comments from the public through February 18, 2014, before subsequently extending the comment period through March 20, 2014.<sup>73</sup>

Treasury officials also monitor market trends and outside research to inform their assessment of progress in addressing too-big-to-fail perceptions. Treasury staff have looked at trends in bond prices, credit-default-swap prices, and other market data for bank holding companies of different sizes for evidence that investors have reduced their expectations of government support. Treasury staff also monitor relevant outside research, including a growing body of research by academics and others that has used quantitative approaches to analyze the existence and size of potential funding cost advantages that the largest bank holding companies could receive because of market expectations of government support. The next section of this report includes a summary of selected studies in this literature and discusses the strengths and limitations of the methods they use. FSOC and Treasury staff have reviewed these studies and noted that while the studies have limitations, their findings are consistent with a reduction in expectations of government support following the Dodd-Frank Act.

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<sup>73</sup>Resolution of Systemically Important Financial Institutions: The Single Point of Entry Strategy, 78 Fed. Reg. 243 (Dec. 18, 2013); Resolution of a Systemically Important Financial Institution: The Single Point of Entry Strategy, 79 Fed. Reg. 9899 (Feb. 21, 2014).

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## Evidence Suggests Large Banks Had a Funding Cost Advantage over Small Ones during the Financial Crisis That May Have Declined or Reversed Since

Our analysis and the results of studies we reviewed provide evidence that the largest bank holding companies had lower funding costs than smaller bank holding companies during the 2007-2009 financial crisis but that differences may have declined or reversed in more recent years. To inform our econometric approach, we reviewed studies that estimated funding cost differences between large and small financial institutions that could be associated with the perception that some institutions are too big to fail. Studies we reviewed generally found that the largest financial institutions had lower funding costs during the 2007-2009 financial crisis but that the difference between the funding costs of the largest and smaller financial institutions has since declined. In some cases these findings could be interpreted as evidence of advantages driven by too-big-to-fail perceptions; however, these empirical analyses are imperfect and contain a number of limitations that could reduce their validity or applicability to U.S. bank holding companies. Our analysis, which addresses certain limitations of these studies, also provides evidence that large or systemically important bank holding companies had lower funding costs than smaller bank holding companies during the 2007-2009 financial crisis, which may have been associated with expectations of government assistance. In addition, our analysis provides some evidence that funding cost differences may have declined or reversed in recent years and that large bank holding companies may have had higher funding costs since the crisis. However, we also analyzed what funding cost differences might have been since the crisis in hypothetical scenarios where levels of credit risk in every year from 2010 to 2013 are assumed to be as high as they were during the financial crisis. This analysis suggests that large bank holding companies might have had lower funding costs than smaller bank holding companies since the crisis if levels of credit risk had remained high, indicating that changes in funding cost differences over time may be due in part to improvements in bank holding companies' financial conditions. Although our analysis improves on certain aspects of prior studies, important limitations remain and our results should be interpreted with caution.

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## Studies Generally Found the Largest Banks Had Lower Funding Costs during the Financial Crisis but Results Have Limitations

Studies we reviewed generally found that the largest financial institutions had lower funding costs than smaller ones during the 2007-2009 financial crisis but that the difference between the funding costs of the largest and smaller financial institutions has since declined. In some cases these findings could be interpreted as evidence of advantages driven by too-big-to-fail perceptions; however, these empirical analyses are imperfect and contain a number of limitations that could reduce their validity or applicability to U.S. bank holding companies.

We reviewed studies that estimated the funding cost difference between large and small financial institutions that could be associated with the perception that some institutions are too big to fail. We evaluated studies that met the following criteria: (1) used a comparative empirical approach that attempted to account for differences across financial institutions that could influence funding costs, (2) included U.S. bank holding companies, and (3) included analysis of data from 2002 or later. See our scope and methodology section for more information on our criteria and approach.

The 16 studies we reviewed made a wide variety of methodological decisions and came to a range of conclusions. We present the variety of methodological decisions along two key dimensions—which source of funding is analyzed (e.g., deposits, bonds) and time period of analysis—in table 2 below. The source of funding that is analyzed is an important methodological decision because investors may have differing expectations regarding the likelihood that various sources of funding might receive government support, and these expectations could differ by the size of the financial institution. Results could differ across studies because of differences in creditor priority (subordinated debt versus senior debt) or maturity (bonds that mature several years in the future versus deposits that can be demanded at any time). We also include information in table 2 on the reported affiliations of the study authors.

**Table 2: Empirical Studies of Too-Big-to-Fail Funding Cost Differences**

Study authors (Year)	Measure of funding cost	Time period	Affiliation category
Acharya, Anginer & Warburton (2013)	Bonds	1990-2011	Academic
Araten & Turner (2012)	Combination of funding sources	2002-2011	Private <sup>a</sup>
Balasubramnian & Cyree (2014)	Bonds <sup>b</sup>	2009-2011	Academic
Balasubramnian & Cyree (2013)	Bonds <sup>c</sup>	2009-2011	Academic
Barth & Schnabel (2013)	Credit default swaps	2005-2011	Academic
Bertay, Demirgüç-Kunt & Huizinga (2013)	Combination of funding sources	1990-2011	Academic and public
International Monetary Fund (2014)	Credit ratings, credit default swaps	2005-2014	Public
Jacewitz & Pogach (2012)	Deposits	2005-2010	Public
Keppo & Yang (2013)	Bonds, deposits	1990-2011	Academic and public
Kumar & Lester (2014a)	Deposits	2006-2012	Private <sup>d</sup>
Kumar & Lester (2014b)	Bonds	2009-2013	Private <sup>d</sup>
Li et al. (2011)	Credit default swaps	2001-2010	Private
Santos (2014)	Bonds	1985-2009	Public
Tsesmelidakis & Merton (2012)	Credit default swaps	2002-2010	Academic and private
Ueda & Di Mauro (2012)	Credit ratings	2007, 2009	Academic and public

Study authors (Year)	Measure of funding cost	Time period	Affiliation category
Völz & Wedow (2009)	Credit default swaps	2002-2007	Public

Source :GAO | GAO-14-621

Note: We read and evaluated studies that met the following criteria: (1) used a regression or similar comparative empirical methodology to estimate any funding cost difference, (2) included U.S. bank holding companies, and (3) included analysis of data from 2002 or later. Our criteria excluded studies that used option-pricing approaches—this methodology assumes a too-big-to-fail funding cost advantage exists and only estimates its magnitude. We identified author affiliations based on information included in the papers, which may not reflect all relevant affiliations. Academic affiliation includes authors at universities or research institutes. Private affiliation includes authors at financial institutions and other private firms. Public affiliation includes authors at government and regulatory agencies (including the regional Federal Reserve banks which are private corporations), and international financial institutions such as the World Bank. We also excluded two studies that otherwise met our criteria but did not attempt to control for important differences between financial institutions. We were aware of potential conflicts of interest associated with a number of studies in our review. As with other studies we reviewed, these studies must have attempted to address factors that might account for differences in funding costs in order to be included, and we also considered the potential impact these conflicts of interest might have on their methods and results. See our scope and methodology for more details on our approach.

<sup>a</sup>This study was conducted by researchers at JP Morgan Chase.

<sup>b</sup>This study focused on subordinated bonds.

<sup>c</sup>This study focused on senior bonds.

<sup>d</sup>This study was conducted by researchers at Oliver Wyman and sponsored by the Clearinghouse Association, a trade association of the world's largest commercial banks.

Studies we reviewed generally found that the largest financial institutions had lower funding costs than smaller ones during the 2007-2009 financial crisis, but that the difference between the funding costs of the largest and smaller financial institutions has since declined. For example, one study estimated that large U.S. financial institutions had roughly 100 basis points lower bond funding costs than smaller ones in 2009, but this difference had declined to around 40 basis points by 2011.<sup>74</sup> Similarly, a study of U.S. bank credit default swaps found that large U.S. bank holding companies had roughly 100 basis points lower funding costs in 2009, but this difference had declined to around 15 basis points in 2013.<sup>75</sup> In some cases these differences could be interpreted as evidence of funding cost advantages driven by too-big-to-fail perceptions. In other cases, limitations in the studies make it difficult to eliminate other explanations of

<sup>74</sup>A basis point is one one-hundredth of a percentage point. Viral V. Acharya, Deniz Anginer and A. Joseph Warburton, "The End of Market Discipline? Investor Expectations of Implicit State Guarantees," *Social Science Research Network Working Paper* (December 2013).

<sup>75</sup>International Monetary Fund, "How Big is the Implicit Subsidy for Banks Considered Too Important to Fail?" *Global Financial Stability Report*, Ch. 3 (Washington, D.C.: 2014).

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why funding cost differences might exist—such as greater liquidity or diversification that could be associated with size or spurious results driven by imperfect measures of funding costs. Time period of analysis was another important difference across studies we reviewed. Few studies in our review included data beyond 2011. Therefore, most results may not reflect recent changes in the regulatory environment and market expectations discussed earlier in the report.

Studies also varied in their approach to identifying financial institutions that might be perceived as too big to fail, using a variety of size and other thresholds. For example, some studies measured too-big-to-fail status by a bank's assets; however, the threshold between too-big-to-fail and other banks varied from \$50 billion to \$500 billion. Several papers estimated too-big-to-fail status by size relative to industry, such as the largest 20 banks or top 10 percent by assets. These different approaches indicate that there is no consensus within the literature on which financial institutions may be considered too big to fail for the purposes of comparing funding costs.

The studies we reviewed can be grouped into categories based on their approaches. While all studies included in our review used standard approaches and attempted to address factors that might account for differences in funding costs, these empirical analyses remain imperfect.

- **Regression.** Most studies we reviewed adopted a regression methodology in which some measure of funding costs was explained by a variety of control variables, such as risk, liquidity, and maturity, to attempt to account for differences across financial institutions. These models are standard empirical tools and are flexible in terms of the information about financial institutions and markets that they can incorporate. In some instances these models rely on a small number of indicators that may only imperfectly measure underlying default risks. As a result, some analyses may not correctly estimate the size of any too-big-to-fail advantages because they omit important factors that influence funding costs. In other studies that account for a more thorough set of factors that influence funding costs, results may be sensitive to alternative measurements of these factors.<sup>76</sup> For example,

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<sup>76</sup>Results of these models will also be sensitive to the typical assumption that the impact of variables on funding costs is linear—that is, changes in credit risk and liquidity have a constant and proportional impact on funding costs.



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default risk is an underlying driver of funding costs, and studies may produce different results by using a bank's earnings volatility as an indicator for default risk as opposed to other indicators such as the quality of a bank's assets. In addition, liquidity is another important factor to account for when attempting to explain funding cost differences—investors charge banks more for less liquid sources of funding—and some studies do not adequately control for the liquidity of the funding source. Challenges similar to those involved in accurately capturing default risk arise in finding appropriate indicators for a bond's liquidity.

- **Equity-based.** Three papers we reviewed measured the difference between observed credit default swap spreads (which approximate bond funding costs) and hypothetical credit default swap spreads (which are estimated based on information implied by equity prices).<sup>77</sup> This approach estimates hypothetical spreads with a standard theoretical model used in finance that uses the risk of a firm's equity to estimate the risk of a firm's debt.<sup>78</sup> In doing so, the approach assumes that hypothetical spreads derived from equity prices are *not* influenced by any expectations of government support, but that observed credit default swap spreads *are* influenced by such expectations. By comparing the two spreads the approach can estimate the magnitude of expectations of government support. While this approach has some advantages, it relies on critical assumptions about how a limited number of factors influence the risk of default.<sup>79</sup>

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<sup>77</sup>International Monetary Fund, "How Big is the Implicit Subsidy for Banks Considered Too Important to Fail?" *Global Financial Stability Report*, Ch. 3 (Washington, D.C.: 2014), Zoe Tsesmelidakis and Robert C. Merton, "The value of implicit guarantees," *Social Science Research Network working paper*, September 1, 2012, and Zan Li, Shisheng Qu and Jing Zhang, *Quantifying the Value of Implicit Government Guarantees for Large Financial Institutions* (Moody's Analytics, 2011).

<sup>78</sup>This approach can be referred to as a "Merton model" based on Robert C. Merton, "On the pricing of corporate debt: the risk structure of interest rates," *Journal of Finance* vol. 29, 1974. Holders of equity and debt in a bank both face a risk of loss. Equity holders face a higher risk because they are the first to take losses in a failure (i.e., debt holders have higher priority). However, the risk that a debt holder will take a loss is likely to be proportional to—but smaller than—the risk facing an equity holder. As a result, one can estimate the risk of default on a debt based in part on the volatility of the stock price of the bank.

<sup>79</sup>Another weakness of this model is that the market pricing of credit default swaps may not be reliable during a crisis.

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As a result, these analyses may also omit important factors that influence funding costs, such as earnings.<sup>80</sup>

- **Ratings-based.** Two papers used Fitch credit ratings to estimate the funding cost difference that could be associated with potential government support.<sup>81</sup> Models based on credit ratings offer a convenient way to incorporate all the factors the rating agency considers relevant to default risk and take advantage of the rating agency's explicit separation of the impact of expected government support through, for example, the assignment of a standalone credit rating (assuming no government support) and a higher credit rating assuming government support.<sup>82</sup> However, this approach assumes that all information about market expectations of default risk and government support are incorporated into credit ratings, which is a potentially weak assumption. Credit ratings had a limited impact on the views of large investors we interviewed, as previously discussed. Moreover, funding costs vary for firms within a particular rating. As a result, these studies may estimate funding costs with considerable error. Finally, results of these studies are sensitive to the credit rating agency used—for example, results based on Moody's ratings could be quite different than other rating agencies because Moody's removed expectations of government support for U.S. bank holding companies in 2013.

In addition to the approach-specific limitations, a number of general limitations related to implementation of the various approaches exist across studies we reviewed that could reduce their validity or applicability to U.S. bank holding companies. For example, studies varied in the

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<sup>80</sup>See Sreedhar T. Bharath and Tyler Shumway, "Forecasting default with the Merton distance to default model," *Review of Financial Studies*, vol. 21, no. 3, May 2008.

<sup>81</sup>International Monetary Fund, "How Big is the Implicit Subsidy for Banks Considered Too Important to Fail?" *Global Financial Stability Report*, Ch. 3 (Washington, D.C.: 2014), and Kenichi Ueda and Beatrice Weder di Mauro, "Quantifying structural subsidy values for systemically important financial institutions," *Journal of Banking & Finance* vol. 37, no. 10, October 2013.

<sup>82</sup>In assessing the creditworthiness of bank holding companies, all three major rating agencies discuss the extent to which a rating is influenced by potential government support, though the specific approach differs by rating agency. By comparing a bank holding company's credit rating—with and without expected government support—to the average historical funding cost for corporations at those ratings, one can estimate the benefit of the amount of government support associated with the rating uplift.

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countries that were included in the analysis—some studies focused on the United States, while others included a broad cross-section of more than 20 countries. Studies that pooled a large number of countries in their analysis have results that may not be applicable to U.S. bank holding companies. For example, studies that included Switzerland and Iceland in their analyses may not apply to the United States because banking sectors in those countries are much larger relative to the economy. As noted above, because few studies included data past 2011, results may not reflect recent changes in the regulatory environment and market sentiment; for example, the Federal Reserve’s rule for enhanced prudential standards for large bank holding companies and FDIC’s proposed strategy for orderly liquidation.

As a result of the limitations associated with these methodological choices, estimates of the size of the funding cost difference associated with a too-big-to-fail advantage based on this literature—while suggestive of general trends—are not definitive and should be interpreted with caution.

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### GAO Analysis Suggests Large Banks Had Lower Funding Costs during the Financial Crisis but This Advantage May Have Declined or Reversed Since

We conducted our own analysis to assess the extent to which the largest bank holding companies have had lower funding costs as a result of perceptions that the government would not allow them to fail. Overall, our analysis provides some evidence that large or systemic bank holding companies had lower funding costs than smaller ones during the 2007-2009 financial crisis that may have been associated with expectations of government assistance. Our analysis provides only limited evidence that large bank holding companies had lower funding costs since the crisis and instead provides some evidence that the opposite may have been true at the levels of credit risk that prevailed in those years. However, in hypothetical scenarios where levels of credit risk in every year from 2010 to 2013 are assumed to be as high as they were during the financial crisis, our analysis suggests that large bank holding companies might have had lower funding costs than smaller bank holding companies. Although our analysis improves on certain aspects of prior studies, important limitations remain and our results should be interpreted with caution.

To conduct our analysis, we developed a series of econometric models—models that use statistical techniques to estimate the relationships between quantitative economic and financial variables—based on our assessment of relevant studies and expert views. These models estimate the relationship between bank holding companies’ bond funding costs

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and their size, while also controlling for other drivers of bond funding costs, including credit risk and bond liquidity. Key features of our econometric approach include the following:

- **U.S. bank holding companies.** To better understand the relationship between bank holding company funding costs and size in the context of the U.S. economic and regulatory environment, we only analyzed U.S. bank holding companies. In contrast, some of the literature we reviewed analyzed nonbank financial companies and foreign companies.
- **2006-2013 time period.** To better understand the relationship between bank holding company funding costs and size in the context of the current economic and regulatory environment, we analyzed the period from 2006 through 2013, which includes the recent financial crisis as well as years before the crisis and following the enactment of the Dodd-Frank Act. In contrast, some of the literature we reviewed did not analyze data in the years after the financial crisis.
- **Bond funding costs.** We used bond yield spreads as our measure of bank holding company funding costs because they are a direct measure of what investors charge bank holding companies to borrow money and because they are sensitive to credit risk and hence expected government support. This indicator of funding costs has distinct advantages over certain other indicators used in studies we reviewed, including credit ratings, which do not directly measure funding costs, and total interest expense, which mixes the costs of funding from multiple sources.
- **Alternative measures of size.** Size or systemic importance can be measured in multiple ways, as reflected in our review of the literature. Based on that review and the comments we received from external reviewers, we used four different measures of size or systemic importance: total assets, total assets and the square of total assets, whether or not a bank holding company was designated a GSIB by the Financial Stability Board in November 2013, and whether or not a bank holding company had assets of \$50 billion or more.
- **Extensive controls for bond liquidity, credit risk, and other key factors.** To account for the many factors that could influence funding costs, we controlled for credit risk, bond liquidity, and other key factors in our models. We included a number of variables that are associated with the risk of default, including measures of capital adequacy, asset quality, earnings, and volatility. We also included a number of

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variables that can be used to measure bond liquidity. Finally, we included variables that measure other key characteristics of bonds, such as time to maturity, and key characteristics of bank holding companies, such as operating expenses. Our models include a broader set of controls for credit risk and bond liquidity than some studies we reviewed and, as we discuss later, we directly assess the sensitivity of our results to using alternative controls on our estimates of funding costs.

- **Multiple model specifications.** In order to assess the sensitivity of our results to using alternative measures of size, bond liquidity, and credit risk discussed above, we estimated multiple different model specifications. We developed models using four alternative measures of size, two alternative sets of measures of capital adequacy, six alternative measures of volatility, and three alternative measures of bond liquidity to assess the impact of using alternative measures on our results. In contrast, some of the studies we reviewed estimated a more limited number of model specifications.
- **Annual estimates of models.** To allow for changes in investors' beliefs about the likelihood of government rescues between the years of the financial crisis—when emergency government programs designed to assist financial institutions were available—and the years following the crisis, our models allow the relationship between bank holding company funding costs and size to vary over time. In contrast, some of the studies we reviewed assumed that the relationship between bank holding company funding costs and size was constant over time.
- **Link between size and credit risk.** To account for the possibility that investors' beliefs about government rescues affect their responsiveness to credit risk, our models allow the relationships between bank holding company funding costs and credit risk to depend on size.

Altogether, we estimated 42 different models for each year from 2006 through 2013 and then used these models to compare bond yield spreads—our measure of bond funding costs—for bank holding

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companies of different sizes but with the same level of credit risk.<sup>83</sup> Figure 1 shows our models' comparisons of the difference between bond funding costs for bank holding companies with \$1 trillion in assets and average credit risk and bond funding costs for similar bank holding companies with \$10 billion in assets, for each model and for each year.<sup>84</sup> Each circle and dash in figure 1 shows the comparison of bond funding costs for a different model. Circles show model-estimated differences that were statistically significant at the 10 percent level, while dashes represent differences that were not statistically significant at that level.<sup>85</sup> Circles and dashes below zero correspond to models suggesting that bank holding companies with \$1 trillion in assets have lower bond funding costs than bank holding companies with \$10 billion in assets, and vice versa.

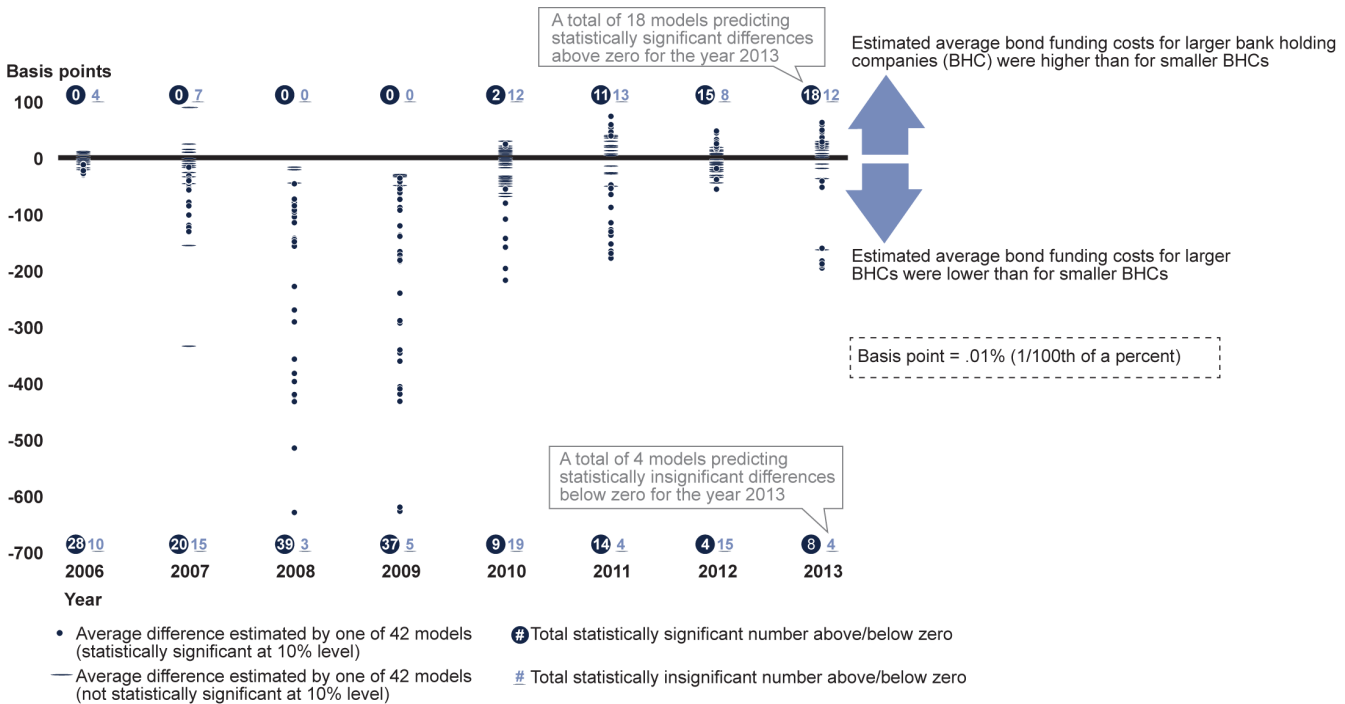
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<sup>83</sup>Our models allow the size of a bank holding company to influence its bond funding costs directly and also indirectly through the interaction between size and credit risk. As a result, no single parameter is sufficient to describe the relationship between bond funding costs and size. To summarize the overall relationship between bond funding costs and size reflected in each specification, we calculated bond funding costs for bank holding companies of different sizes and credit risk levels using our estimates of the parameters for each specification for each year. See appendix I for more details on these calculations.

<sup>84</sup>We also compared funding costs for bank holding companies with \$50 billion, \$100 billion, \$250 billion, and \$500 billion in assets to bank holding companies with \$10 billion in assets. See appendix I.

<sup>85</sup>Many of the estimates that were statistically significant at the 10 percent level were also statistically significant at the 5 percent or 1 percent level. See table 5 in appendix I.

**Figure 1: Estimates from 42 Models of Average Bond Funding Cost Differences between Bank Holding Companies with \$1 Trillion and \$10 Billion in Assets, 2006-2013**



Source: GAO analysis of data from Bloomberg and the Financial Stability Board. | GAO-14-621

Notes: We estimated econometric models of the relationship between bank holding company size and funding costs using data for U.S. bank holding companies and their outstanding senior unsecured bonds for the first quarter of 2006 through the fourth quarter of 2013. The models used bond yield spreads to measure funding costs and controlled for credit risk factors such as capital adequacy, asset quality, earnings, maturity mismatch, and volatility, as well as bond liquidity and other characteristics of bonds and bank holding companies that can affect funding costs. We estimated 42 models for each year from 2006 through 2013 to assess the sensitivity of estimated funding cost differences to alternative measures of capital adequacy, volatility, bond liquidity, and size or systemic importance. We used the models to compare bond funding costs for bank holding companies of different sizes but the same levels of credit risk, bond liquidity, and other characteristics. This figure compares bond funding costs for bank holding companies with \$1 trillion and \$10 billion in assets, for each model and for each year, with average levels of credit risk. Each circle and dash shows the comparison for a different model, where circles and dashes below zero suggest bank holding companies with \$1 trillion in assets have lower bond funding costs than bank holding companies with \$10 billion in assets, and vice versa.

Our analysis provides evidence that the largest bank holding companies had lower funding costs during the 2007-2009 financial crisis but that differences may have declined or reversed in recent years. However, we found that the outcomes of our econometric models varied with the various controls we used to capture size, credit risk, and bond liquidity. This variation indicates that uncertainty related to how to model funding costs has an important impact on estimated funding cost differences

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between large and small bank holding companies. As figure 1 shows, most models found that larger bank holding companies had lower bond funding costs than smaller bank holding companies during the 2007-2009 financial crisis, but the magnitude of the difference varied widely across models, as indicated by the range of results for each year. For example, for 2008, our models suggest that bond funding costs for bank holding companies with \$1 trillion in assets and average credit risk were from 17 to 630 basis points lower than bond funding costs for similar bank holding companies with \$10 billion in assets. For 2009, our models suggest that bond funding costs for bank holding companies with \$1 trillion in assets and average credit risk were from 30 to 628 basis points lower than bond funding costs for similar bank holding companies with \$10 billion in assets.

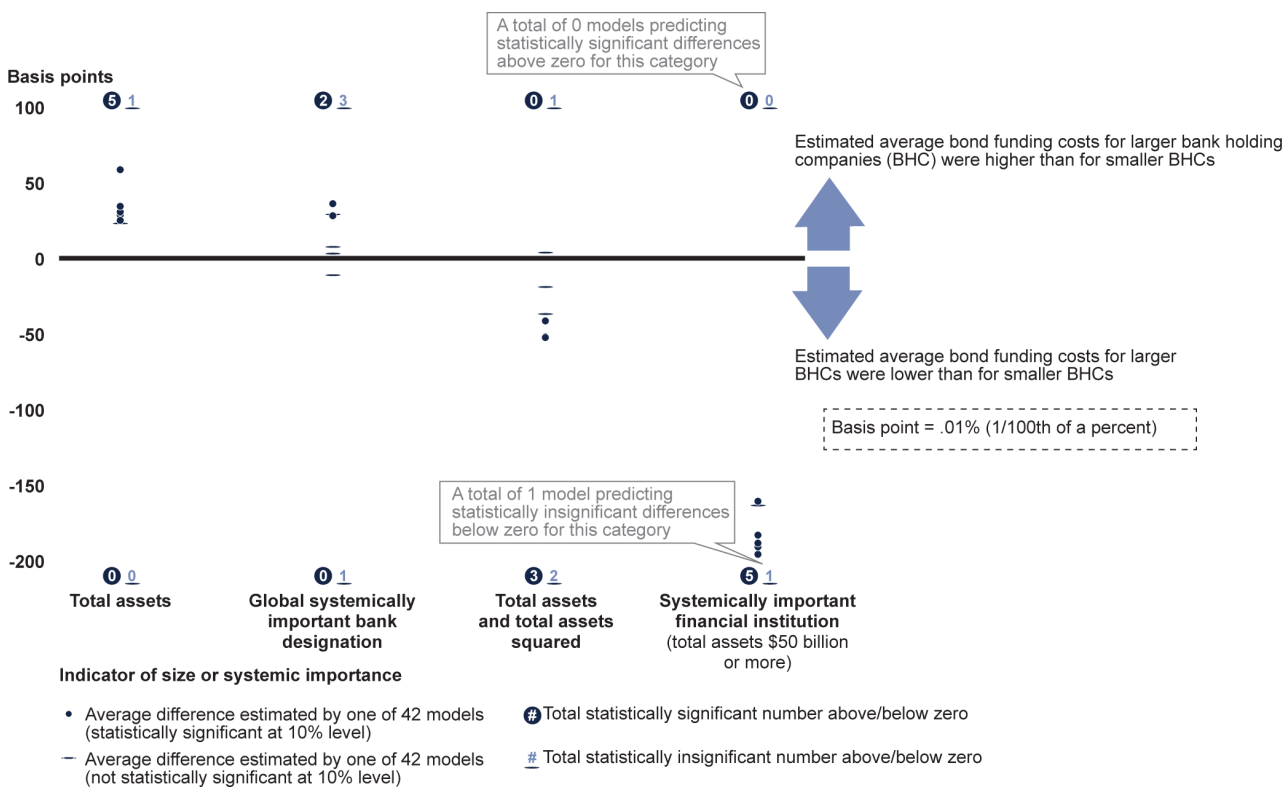
Our models' comparisons of bond funding costs for different-sized bank holding companies for 2010 through 2013 also vary widely. For bank holding companies with average credit risk, more than half of our models suggest that larger bank holding companies had higher bond funding costs than smaller bank holding companies from 2011 through 2013, but many models suggest that larger bank holding companies still had lower bond funding costs than smaller ones during this period. For example, for 2013, our models suggest that bond funding costs for average credit risk bank holding companies with \$1 trillion in assets ranged from 196 basis points lower to 63 basis points higher than bond funding costs for similar bank holding companies with \$10 billion in assets (see fig. 1). For 2013, thirty of our models suggest that the larger banks had higher funding costs, and 12 of our models suggest that the larger banks had lower funding costs.

Our models' comparisons were particularly sensitive to the measure of size or systemic importance we used. For example, for 2013, models that used total assets as the indicator of size or systemic importance suggest that bond funding costs for bank holding companies with \$1 trillion in assets and average credit risk ranged from 23 to 59 basis points higher than bond funding costs for similar bank holding companies with \$10 billion in assets (see fig. 2). Models that used the GSIB designation suggest that bond funding costs for bank holding companies with \$1 trillion ranged from 11 basis points lower to 36 basis points higher than bond funding costs for bank holding companies with \$10 billion in assets. Models that used total assets and the square of total assets—which allows for a nonlinear relationship between size and yield spreads—suggest that bond funding costs for bank holding companies with \$1 trillion in assets ranged from 52 basis points lower to 4 basis points higher



than bond funding costs for bank holding companies with \$10 billion in assets. Finally, models that used whether or not a bank holding company had \$50 billion in assets suggest that bond funding costs for bank holding companies with \$1 trillion ranged from 161 to 196 basis points lower than bond funding costs for bank holding companies with \$10 billion in assets.

**Figure 2: Difference in Estimated Bond Funding Costs for Average Credit Risk Bank Holding Companies with \$1 Trillion versus \$10 Billion in Assets by Indicator of Size or Systemic Importance, 2013**



Source: GAO analysis of data from Bloomberg and the Financial Stability Board. | GAO-14-621

Notes: We estimated econometric models of the relationship between bank holding company size and funding costs using data for U.S. bank holding companies and their outstanding senior unsecured bonds for the first quarter of 2006 through the fourth quarter of 2013. The models used bond yield spreads to measure funding costs and controlled for credit risk factors such as capital adequacy, asset quality, earnings, maturity mismatch, and volatility, as well as bond liquidity and other characteristics of bonds and bank holding companies that can affect funding costs. We estimated multiple models for each year from 2006 through 2013 to assess the sensitivity of estimated funding cost differences to alternative measures of capital adequacy, volatility, bond liquidity, and size or systemic importance. We used the models to compare bond funding costs for bank holding companies of different sizes but the same levels of credit risk, bond liquidity, and other characteristics. This figure compares bond funding costs for bank holding companies with \$1 trillion and \$10 billion in assets with average levels of credit risk for 2013 for models that differ in how they measure size. Each circle and dash shows the comparison for a different model, where circles and dashes below zero suggest bank holding companies with \$1 trillion in assets have lower bond funding costs than bank holding companies with \$10 billion in assets, and vice versa.

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We also found that our models' comparisons of bond funding costs for bank holding companies of different sizes varied depending on bank holding companies' level of credit risk. For low credit risk bank holding companies, most models suggest that bond funding costs for larger bank holding companies were lower than bond funding costs for smaller bank holding companies during the 2007-2009 financial crisis and that bond funding costs for larger bank holding companies were higher than bond funding costs for smaller bank holding companies from 2010 through 2013. Depending on the year, 25 to 42 of our 42 models suggest that bond funding costs for larger, low risk bank holding companies were lower during the financial crisis, while 31 to 41 of our 42 models suggest that bond funding costs for larger low risk bank holding companies were higher following the crisis. However, for high credit risk bank holding companies, most models suggest that bond funding costs for larger bank holding companies were lower than bond funding costs for smaller bank holding companies in every year (28 to 41 of our 42 models, depending on the year).

Given that most models suggest that large bank holding companies' bond funding costs are typically lower than small bank holding companies' bond funding costs at high levels of credit risk, this suggests that size-related funding cost differences that favor large bank holding companies are more likely to emerge when the likelihood that a bank holding company will fail increases. As we discuss later, investors' overall beliefs about the likelihood of government support may have several components, including beliefs about whether or not a bank holding company will fail—which is related to its credit risk—and beliefs about whether or not a bank holding company will be supported by the government if it fails. For example, investors may believe that larger bank holding companies are more likely to be supported than smaller bank holding companies in the event of failure, but investors may also believe that all bank holding companies are relatively safe and unlikely to fail. In this case, investors' overall expectations of government support for all bank holding companies are likely to be low, and differences in funding costs due to varying expectations of government support for bank holding companies of different sizes are likely to be small or nonexistent. In contrast, if investors believe that all bank holding companies are risky and prone to fail, then investors' overall expectations of government support for larger bank holding companies are likely to be higher than for smaller bank holding companies, and differences in funding costs are likely to be greater.

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To assess how investors' beliefs that the government will support failing bank holding companies have changed over time, we compared bond funding costs for bank holding companies of various sizes while holding the level of credit risk constant over time at the average for 2008—a relatively high level of credit risk that prevailed during the financial crisis.<sup>86</sup> In these hypothetical scenarios, most models suggest that bond funding costs for larger bank holding companies would have been lower than bond funding costs for smaller bank holding companies in most years. For example, most models for 2013 predict that bond funding costs for larger bank holding companies would be higher than for smaller bank holding companies at the average level of credit risk in that year, but would be lower at financial crisis levels of credit risk (see fig. 3). These results suggest that changes over time in funding cost differences we estimated (depicted in fig. 1) have been driven at least in part by improvements in the financial condition of bank holding companies.<sup>87</sup> At the same time, more models predict lower bond funding costs for larger bank holding companies in 2008 than in 2013 when we assume that financial crisis levels of credit risk prevailed in both years, which suggests that investors' expectations of government support have changed over time.<sup>88</sup> However, it is important to note that the relationships between variables estimated by our models could be sensitive to the average level of credit risk among bank holding companies, making these estimates of the potential impact of the level of credit risk from 2008 in the current environment even more uncertain. Moreover, Dodd-Frank Act reforms discussed earlier in this report, such as enhanced regulatory standards for capital and liquidity, could enhance the stability of the U.S. financial system and make such a credit risk scenario less likely. However, the extent to which such benefits will materialize depends on many factors that remain difficult to predict.

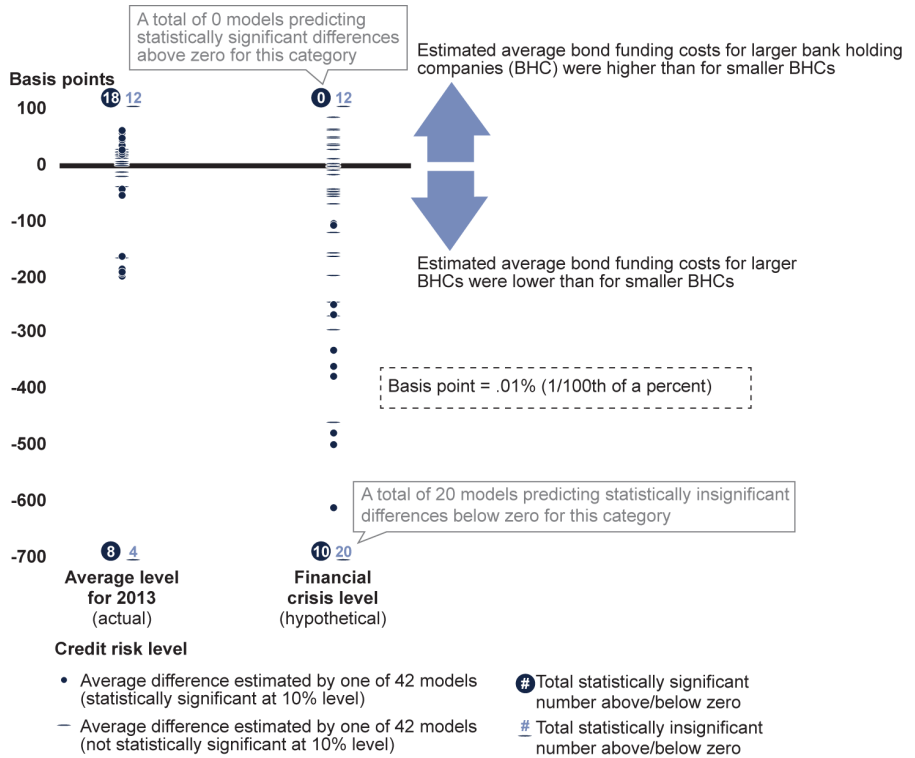
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<sup>86</sup>Although higher, credit risk in 2008 was not outside the range of credit risk in 2013 in every dimension. Specifically, the average values of the credit risk variables for 2008 were less than the maximum values of the credit risk variables for 2013, with the exceptions of the variables measuring equity price volatility, option implied volatility, equity return volatility, and excess equity return volatility.

<sup>87</sup>As discussed earlier in this report, many investment firm representatives with whom we spoke credited enhanced regulatory standards with improving the safety and soundness of the largest bank holding companies and reducing the likelihood that they would experience distress that could result in failure or government support.

<sup>88</sup>To see this, compare the 2008 estimates in figure 1 to the “financial crisis level” estimates for 2013 in figure 3. Both sets of estimates are derived assuming that the level of credit risk is equal to the average for 2008.

**Figure 3: Difference in Estimated Bond Funding Costs for Bank Holding Companies with \$1 Trillion versus \$10 Billion in Assets by Level of Credit Risk, 2013**



**Notes:** We estimated econometric models of the relationship between bank holding company size and funding costs using data for U.S. bank holding companies and their outstanding senior unsecured bonds for the first quarter of 2006 through the fourth quarter of 2013. The models used bond yield spreads to measure funding costs and controlled for credit risk factors such as capital adequacy, asset quality, earnings, maturity mismatch, and volatility, as well as bond liquidity and other characteristics of bonds and bank holding companies that can affect funding costs. We estimated 42 models for each year from 2006 through 2013 to assess the sensitivity of estimated funding cost differences to alternative measures of capital adequacy, volatility, bond liquidity, and size or systemic importance. We used the models to compare bond funding costs for bank holding companies of different sizes but the same levels of credit risk, bond liquidity, and other characteristics. This figure compares bond funding costs for bank holding companies with \$1 trillion and \$10 billion in assets, for each model for 2013, with the average level of credit risk in 2013 and the average level of credit risk in 2008 during the financial crisis. Each circle and dash shows the comparison for a different model, where circles and dashes below zero suggest bank holding companies with \$1 trillion in assets have lower bond funding costs than bank holding companies with \$10 billion in assets, and vice versa.

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## Estimates of Size-Related Funding Cost Differences Should Be Interpreted with Caution

Our estimates of the relationship between the size of a bank holding company and the yield spreads on its bonds are limited by several factors and should be interpreted with caution. These factors present challenges to using our results and the results of other studies as the basis for public policy responses to concerns about the risks posed by large financial institutions.

Investors' beliefs about the likelihood of government support are composed of several different elements, including the likelihood that a bank holding company will fail, the likelihood that it will be rescued by the government if it fails, and the size of the losses that the government may impose on investors if it rescues the bank holding company. Like the methodologies used in the literature we reviewed, our methodology does not allow us to precisely identify the influence of each of these factors. As a result, changes over time in our estimates of the relationship between bond funding costs and size may reflect changes in one or more of these components, but we cannot identify which with certainty. For example, if bond funding costs for a bank holding company with \$1 trillion are less than those for a bank holding company with \$10 billion but the difference decreases over time, this trend may indicate that investors believe that the larger bank holding company is relatively less likely to fail, which could be the case if the level of credit risk is falling over time, either due to market pressure, regulatory requirements, or other reasons. This trend could also indicate that investors believe that the government has become less likely to rescue the larger bank holding company if it fails or more likely to impose losses on investors in a rescue.

In addition, our estimates of differences in bond funding costs for bank holding companies of different sizes may reflect factors other than investors' beliefs about the likelihood of government support. We have taken into account many of the factors that may help explain differences in yield spreads for bank holding companies of different size, such as credit risk and bond liquidity. However, we may not have taken into account all possible factors. If a factor that we have not taken into account is associated with size, then our results may reflect the relationship between bond funding costs and this omitted factor instead of, or in addition to, the relationship between bond funding costs and bank holding company size.

Our estimates of differences in bond funding costs for bank holding companies of different sizes may also reflect differences in the characteristics of bank holding companies that choose to issue bonds. Bank holding companies that issue bonds may differ from those that do

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not in ways that may or may not be observable. If such differences exist and are unobservable, then our models' comparisons are likely to be consistently either too high or too low depending on the relationship between size and the relevant unobservable characteristic. However, if bank holding companies that issue bonds differ from those that do not in ways that are observable in our model, then our models' comparisons of bond funding cost differences for bank holding companies of different sizes are unlikely to be consistently either too high or too low. We found some evidence that this may be the case. Investors with whom we spoke told us that larger bank holding companies are generally more likely to issue bonds than smaller ones because they can issue a large enough quantity of debt to satisfy investors' demand for liquidity and to allow investors to make a large enough investment to cover their transaction costs. Thus, size, which is observable, may be an important difference between bank holding companies that issue bonds and those that do not. Importantly, bank holding company size matters in this case because it is associated with bond issue size, which we control for, not because it is associated with investors' beliefs about government rescues.

In general, our estimates of the impact of size on bond funding costs may reflect a relationship between size, credit risk, or other explanatory variables and the part of bond funding costs that is not explained by our model (endogeneity). This could occur if any of our control variables are influenced by bond funding costs. In this case, our estimates of the magnitude of the association between size and bond funding costs will be imperfect and our ability to infer a causal relationship between size and bond funding costs will be limited.

Historical estimates of differences in bond funding costs for bank holding companies of different sizes are not indicative of future differences. As we have discussed, our estimates of the historical relationship between bank holding company size and bond funding costs vary from year to year. Thus, it is likely that the relationship between bond funding costs and bank holding company size may change in the future. As we have noted, the Dodd-Frank Act imposes new and higher fees on large bank holding companies and requires the Federal Reserve Board to subject large bank holding companies to enhanced regulatory standards for capital, liquidity, and risk management. These enhanced standards may help to reduce the likelihood that a large bank holding company will fail, which may in turn alter investors' beliefs about the likelihood of government support and thus affect the size of any differences in yield spreads on bonds issued by large and small bank holding companies. Improvements in economic conditions, such as faster economic growth and lower

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unemployment, may have a similar effect. Finally, changes in the structure of financial markets, such as an increase in the share of credit provided by nonbank financial companies that reduces the systemic importance of large bank holding companies, could also lead investors to change their beliefs about government rescues in future episodes of individual or system-wide distress.

Finally, our estimates of the differences in bond funding costs for bank holding companies of different sizes do not necessarily reflect the harm that the failure of a large bank holding company could do to the economy. Bond funding costs reflect the risk that a bank holding company might fail and not be able to fully repay its investors. However, parties other than investors may be harmed if a bank holding company fails. For example, the customers of a failed bank holding company may be harmed if they have less access to credit or to specialized services provided by the bank holding company, which could be the case if the bank holding company has a large enough share of the market.

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## Agency Comments and Our Evaluation

We made copies of the draft report available to FDIC, the Federal Reserve Board, FSOC, OCC and Treasury for their review and comment. We also provided excerpts of the draft report for technical comment to Fitch, Moody's, Standard and Poor's, and the International Monetary Fund. All of these agencies and third parties, except for FSOC, provided technical comments, which we have incorporated, as appropriate.

In its written comments, which are reprinted in appendix II, Treasury generally agreed with the results of our analysis and commented that our draft report represents a meaningful contribution to the literature. Treasury further commented that the Dodd-Frank Act makes clear that shareholders, creditors and executives—not taxpayers—will be responsible if a large company fails and that our results reflect increased market recognition that the Dodd-Frank Act ended “too big to fail” as a matter of law. While our results do suggest bond funding cost differences between large and smaller bank holding companies may have declined or reversed since the 2007-2009 financial crisis, we also report that a higher credit risk environment could be associated with lower bond funding costs for large bank holding companies than for small ones. Furthermore, as we have noted, many market participants we spoke with believe that recent regulatory reforms have reduced but not eliminated the perception of “too big to fail” and both they and Treasury officials indicated that additional steps were required to address “too big to fail.” As discussed in the final section of our report on page 56, changes over time in our estimates of

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the relationship between bond funding costs and size may reflect changes in one or more components of investors' beliefs about government support—such as their views on the likelihood that a bank holding company will fail and the likelihood it will be rescued if it fails—but we cannot precisely identify the influence of each of these components with certainty. A decline or reversal of funding cost advantages for large bank holding companies could indicate that investors believe that the government has become less likely to rescue a large bank holding company if it fails or more likely to impose losses on investors in a rescue. This trend could also indicate that investors believe that large bank holding companies are less likely to fail.

On separate dates in July 2014, Treasury, the Federal Reserve Board, OCC and FDIC provided via email technical comments related to the draft report's analysis of funding cost differences between large and small bank holding companies. We summarize their most significant comments and our responses below.

- Treasury provided comments on our presentation of the impact of a higher credit risk environment on our analysis of bond funding costs and the statistical robustness of these results. In response to these comments, we revised text on the Highlights and in the report body to clarify that the results of this analysis reflect hypothetical scenarios and to provide greater attention to the potential impacts of regulatory reforms. With respect to the statistical robustness of these results, we note that the draft report contained clear information about the statistical significance of our results. Importantly, we note that whether one considers the estimates from all 42 models for 2013 or only the 10 models with statistically significant results, higher credit risk substantially increases (1) the number of models that suggest bond funding costs would have been lower for the largest bank holding companies than for smaller bank holding companies and (2) the size of funding cost differences in 2013. In addition, we amended the draft to clarify that our results for the hypothetical scenario for 2013 differ from our results for 2008, in which all 42 models predicted lower funding costs for larger bank holding companies.
- Treasury and the Federal Reserve Board provided comments related to the draft report's presentation of statistical significance in figures 1, 2, and 3. In response to these comments, we made formatting changes to the figures to more clearly differentiate estimates that are statistically significant from those that are not.



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In addition, we note that table 7 on pages 79-81 of the report contains some of the data used to create figures 1, 2 and 3 and differentiates between estimates that are statistically significant at the 1 percent, 5 percent, and 10 percent levels. Finally, while statistically insignificant estimates may be viewed as weaker evidence than statistically significant estimates and may influence how our results are interpreted, we note that statistical significance is not the only relevant characteristic of an econometric estimate and that by presenting the full range of results one can better assess their magnitude and economic significance.

- Treasury and the Federal Reserve Board also commented that in comparing bond funding costs for large and small bank holding companies, a bank holding company with \$10 billion in assets is too small to make a meaningful comparison to a bank holding company with \$1 trillion in assets. They commented that a bank holding company with at least \$50 billion in assets would provide a more relevant comparison for this analysis. While we agree that bank holding companies with \$50 billion in assets may be more similar to \$1 trillion bank holding companies than bank holding companies with \$10 billion in assets, we used a smaller size for small bank holding companies because bank holding companies with \$50 billion or more in assets may be viewed by investors as “large” and systemically important, in part because \$50 billion in assets is the size threshold for Dodd-Frank Act requirements related to enhanced regulatory standards. While we agree that bank holding companies of different sizes have different characteristics, we compared estimated funding costs for bank holding companies assuming their credit risk and other characteristics are identical. Finally, increasing the size of the small bank holding company in our comparisons would not have a substantive impact on the sign or statistical significance of our estimated differences in funding costs, nor would it change the trends in estimated differences in funding costs over time.
- The Federal Reserve Board and OCC commented that few of the estimated coefficients on the variables measuring size and size interacted with credit risk reported in table 5 were individually statistically significant, suggesting that there is little statistical evidence of a relationship between bond funding costs and size. To address this concern, we conducted hypothesis tests that the coefficients on the size and size-credit risk interaction terms are

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jointly equal to zero. The results of these hypothesis tests suggest that the coefficients on the size and size-credit risk interaction terms are jointly significant at the 5 percent level, suggesting that there is statistical evidence of a relationship between bond funding costs and size. We report the results of our joint hypothesis tests in table 5 on pages 74 and 76 of the report. In addition, we note that the draft report only contains coefficient estimates for the 6 baseline models of the 42 total models for 2008 and 2013 and that those 6 models are presented as examples and do not fully reflect the impact of size in all the specifications in those years or in other years. However, we believe the regression-level detail on the 6 baseline models included in the report is sufficient to assist readers looking to understand our methodology and conclusions.

- OCC suggested that selection bias and omitted variables bias could reduce the validity of our econometric results. We agree that these biases are potential limitations of the model and are among the reasons the results should be interpreted with caution. We discuss the potential impact of these concerns on pages 56-57.
- OCC and FDIC commented on the endogeneity of some independent variables and the impact this could have on our results. We agree that endogeneity is a potential limitation of the model and is among the reasons the results should be interpreted with caution. In response to this comment, we added a paragraph discussing the potential impact of endogeneity on our results on page 57 of the report.

We are sending copies of this report to FDIC, the Federal Reserve Board, FSOC, OCC, Treasury, interested congressional committees, members, and others. In addition, the report is available at no charge on the GAO website at <http://www.gao.gov>.

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If you or your staffs have any questions regarding this report, please contact me at (202) 512-4802 or [EvansL@gao.gov](mailto:EvansL@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. GAO staff who made major contributions to this report are listed in appendix III.



Lawrance L. Evans, Jr., PhD  
Director, Financial Markets  
and Community Investment

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# Appendix I. Methodology for Analysis of Funding Cost Differences between Large and Small Bank Holding Companies

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To assess the extent to which the largest bank holding companies have received funding cost advantages as a result of perceptions that the government would not allow them to fail, we conducted an econometric analysis of the relationship between a bank holding company's size or systemic importance and its funding costs. Bank holding companies obtain funds from investors—such as depositors, creditors, or shareholders—which they use to finance assets, such as various types of credit. The prices that bank holding companies pay to obtain these funds are influenced by several factors, including credit risk—the likelihood that bank holding companies will repay the funds they borrowed as agreed—and other factors. Funding cost advantages may arise if investors believe that the government is more likely to support larger bank holding companies in distress than smaller bank holding companies in distress. This belief may lead investors to view larger bank holding companies as having less credit risk than smaller bank holding companies and thus charge larger bank holding companies a lower price to borrow than smaller bank holding companies.

We used a multivariate regression model to estimate the relationship between bank holding companies' funding costs and their size while controlling for factors other than size that may also influence funding costs. Our general regression model is the following:

$$\text{funding cost}_{bq} = \alpha + \beta \cdot \text{size}_{bq} + \gamma \cdot \text{credit risk}_{bq} + \delta \cdot (\text{size}_{bq} \times \text{credit risk}_{bq}) + X'_{bq} \cdot \Theta + \varepsilon_{bq}$$

In this model,  $b$  denotes the bank holding company,  $q$  denotes the quarter,  $\text{funding cost}_{bq}$  is the bank holding company's cost of funding in a quarter,  $\text{size}_{bq}$  is a measure of the bank holding company's size at the beginning of the quarter,  $\text{credit risk}_{bq}$  is a list of proxies for the bank holding company's credit risk,  $X_{bq}$  is a list of other variables that may influence funding costs,  $\varepsilon_{bq}$  is an idiosyncratic error term, and  $\alpha, \beta, \gamma, \delta,$  and  $\Theta$  are parameters to be estimated. The parameter  $\beta$  captures the direct relationship between a bank holding company's funding cost and its size. The parameter  $\delta$  captures the indirect relationship between a bank holding company's funding cost and its size that exists if the size of a bank holding company affects the relationship between its funding cost and credit risk. If greater values of the size measure are associated with larger bank holding companies, if greater values of the credit risk proxies

are associated with greater credit risk, and if investors view larger bank holding companies as less risky than smaller bank holding companies due to beliefs that the government is more likely to rescue larger bank holding companies in distress, then either  $\beta$  is less than zero,  $\delta$  is less than zero, or both. However, the parameters  $\beta$  and  $\delta$  may also reflect factors other than these beliefs.

We used a measure of funding costs based on bonds issued by bank holding companies that is available for bank holding companies with a wide variety of sizes. Bank holding companies use a variety of funding types from different sources, including various types of deposits, bonds, and equity. We used bond yield spreads—the difference between the rate of return on a bond and the rate of return on a Treasury bond of comparable maturity to measure a bank holding company’s cost of bond funding. Treasury securities are widely viewed as a risk-free asset, so the yield spread measures the price that investors charge a bank holding company to borrow to compensate them for credit risk and other factors. We focused on bond funding costs for several reasons. First, bonds are traded in secondary markets, so timely information about changes in their yield spreads, which reflect investors’ perceptions of the credit risk of the bond’s issuing bank holding company, is easily observable.<sup>1</sup> In contrast, some uninsured deposit products are not traded in secondary markets, so changes in the prices of those deposits, which may reflect depositors’ perceptions of the riskiness of the bank holding company, may be less easy to observe. Second, bond yield spreads are a direct measure of bank holding companies’ funding costs. In contrast, credit ratings are indirect measures of bank holding companies’ funding costs because funding costs can vary for firms with the same rating. Similarly, total interest expense as reported on a bank holding company’s balance sheet is an imperfect measure of funding costs because total interest expense may aggregate the prices of liabilities with many important differences, including term and creditor priority. Third, bonds generally rank higher in a bank holding company’s capital structure than equity, so bondholders are less likely to suffer losses and more likely to be repaid if a bank holding company becomes distressed. Bondholders are thus more likely to benefit if a distressed bank holding company is rescued by the government. In contrast, equity holders generally rank lowest in a bank holding company’s capital structure and are the first to suffer losses if a

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<sup>1</sup>Secondary markets are markets where investors purchase securities or assets from other investors, rather than from issuing companies themselves.

**Appendix I. Methodology for Analysis of Funding Cost Differences between Large and Small Bank Holding Companies**

bank holding company becomes distressed. Shareholders are thus the least likely to benefit if a distressed bank holding company is rescued by the government. It follows that the cost of bond funding is more likely to reflect investors' beliefs about the likelihood of government support than the cost of equity funding. Fourth, bank holding companies with a wide variety of sizes issue bonds, including some with less than \$10 billion in assets. In contrast, credit default swaps—the prices of which likely reflect perceptions of a bank holding company's credit risk—are available for only a small number of large bank holding companies.<sup>2</sup>

We used Bloomberg to identify U.S. bank holding companies with more than \$500 million in assets that were active in one or more years from 2006 to 2013, and to identify all plain vanilla, fixed-rate, senior unsecured bonds issued by these bank holding companies, excluding bonds with a government guarantee.<sup>3</sup> See table 3 for the numbers of bank holding companies and bonds we analyzed.<sup>4</sup>

**Table 3: Numbers of Bank Holding Companies and Bonds, 2006-2013**

<b>Year</b>	<b>Number of bank holding companies</b>	<b>Number of bank holding companies with senior unsecured bonds outstanding</b>	<b>Number of senior unsecured bonds outstanding</b>
2006	1178	22	166
2007	1209	23	202
2008	1192	22	203

<sup>2</sup>A credit default swap is a credit derivative in which two parties enter into an agreement whereby one party pays the other a fixed periodic coupon for the specified life of the agreement and the other party makes no payments unless a credit event relating to a predetermined reference asset occurs. If such an event occurs, the party will then make a payment to the first party and the swap will terminate. The size of the payment is usually linked to the decline in the reference asset's market value following the determination of the occurrence of a credit event.

<sup>3</sup>A plain vanilla bond, also known as a straight bond, is a bond that pays interest at regular intervals and at maturity pays back the principal that was originally invested. These bonds are debt instruments because they are essentially loaning money (creating debt) to an entity, which promises to pay the interest on the debt and at maturity pay back the original loan.

<sup>4</sup>Our sample includes only bank holding companies, so it excludes companies like Goldman Sachs and Morgan Stanley before they became bank holding companies. Similarly, our sample excludes other financial companies that were never bank holding companies.

**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

<b>Year</b>	<b>Number of bank holding companies</b>	<b>Number of bank holding companies with senior unsecured bonds outstanding</b>	<b>Number of senior unsecured bonds outstanding</b>
2009	1178	26	333
2010	1133	29	368
2011	1038	29	374
2012	1046	31	447
2013	1033	30	510

Source: GAO analysis of Bloomberg data. | GAO-14-621

Notes: We used Bloomberg to identify U.S. bank holding companies that reported positive average assets as of the end of at least one year from 2006 to 2013, where average assets consist of the quarterly average for total assets, less goodwill, other disallowed intangible assets, disallowed deferred tax assets, and any other assets that are deducted in determining Tier 1 capital in accordance with the capital standards issued by the reporting bank's primary federal supervisory authority and are reported on form FR Y-9C. Only bank holding companies with \$500 million in assets or more are required to file form FR Y-9C. We also used Bloomberg to identify all plain vanilla, fixed-rate, senior unsecured bonds issued by these bank holding companies, where "plain vanilla" bonds are bonds without any derivative or equity features. We excluded bonds guaranteed by either the Federal Deposit Insurance Corporation (FDIC) or the U.S. government.

We collected data on bond yield spreads, bank holding company size, other variables associated with bank holding company credit risk, and bond characteristics from Bloomberg and used these data to assemble a dataset with one observation for each bond in each quarter from the first quarter of 2006 to the fourth quarter of 2013.

**Yield spreads.** For each bond, we collected daily data on its yield spread based on prices from executed trades, executable quotes, and composites derived from executable and indicative quotes.<sup>5</sup> For each bond and for each quarter from 2006 to 2013, we calculated the average yield spread for each bond based on (1) executed trades, executable quotes, and composites derived from executable and indicative quotes; and (2) actual trades only.<sup>6</sup>

**Size.** We constructed four alternative indicators of a bank holding company's size or systemic importance: (1) total assets as of the

<sup>5</sup>Executed trades are trades that have been completed. Executable quotes are quotes provided by bond dealers at which they are willing to trade. Indicative quotes are quotes provided by bond dealers to give an indication of the price at which a bond might trade, but at which they are not obligated to trade. Composites are aggregates of quotes from multiple sources that are suggestive of the price at which a bond might trade.

<sup>6</sup>The correlation between the two measures of bond yield spreads was 0.96.

beginning of the quarter; (2) an indicator for whether or not a bank holding company had \$50 billion or more in assets, i.e., is a systemically important financial institution (SIFI), as of the beginning of the quarter, which captures those bank holding companies that are subject to enhanced prudential standards under the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act); (3) an indicator for whether or not the Financial Stability Board designated a bank holding company a global systemically important bank (GSIB) in November 2013 based on its size, interconnectedness, lack of readily available substitutes or financial institution infrastructure, global (cross-jurisdictional) activity, and complexity; and (4) total assets and total assets squared.<sup>7</sup>

**Credit risk.** For each bank holding company, we constructed several indicators of credit risk, including indicators of capital adequacy, asset quality, earnings, maturity mismatch, and volatility.<sup>8</sup>

- **Capital adequacy.** Capital absorbs losses, promotes public confidence, helps restrict excessive asset growth, and provides protection to creditors. We constructed two alternative sets of indicators of capital adequacy: (1) equity capital and subordinated debt as percentages of assets as of the beginning of the quarter, and (2) equity capital and subordinated debt as percentages of risk-weighted assets as of the beginning of the quarter.
- **Asset quality.** Asset quality reflects the quantity of existing and potential credit risk associated with a bank holding company's loan and investment portfolios and other assets, as well as off-balance sheet transactions. It also reflects the ability of management to identify and manage credit risk. We used the Texas ratio—nonperforming assets as a percentage of tangible common equity plus loan loss reserves—as of the beginning of the quarter as an

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<sup>7</sup>A bank holding company's total assets may change from one quarter to the next. Similarly, a bank holding company may have less than \$50 billion in assets in some quarters and more than \$50 billion in assets in others. An alternative measure of a bank holding company's size or systemic importance is whether or not it participated in the Federal Reserve's Comprehensive Capital Analysis and Review (CCAR). However, the measure of size based on CCAR participation is highly correlated with the measure of size based on whether or not a bank holding company had \$50 billion or more in assets, so these two measures of size are not substantively different.

<sup>8</sup>Credit risk increases with higher values of our asset quality, maturity mismatch, and volatility measures and with lower values of our capital adequacy and earnings measures.



indicator of asset quality, where nonperforming assets include assets in nonaccrual status, other real estate owned, restructured loans, and restructured loans in compliance and tangible common equity is total capital minus perpetual preferred stock minus goodwill and other intangibles. The Texas ratio can indicate a bank holding company's likelihood of failure by comparing its troubled loans to its capital. The higher the ratio, the more likely the institution is to fail because more of its capital could be eroded by realized losses on these troubled loans.

- **Earnings.** Earnings are the initial safeguard against the risks of engaging in the banking business and represent the first line of defense against capital depletion that can result from declining asset values. We used net income as a percentage of assets as of the beginning of the quarter as an indicator of earnings.
- **Maturity mismatch.** Maturity mismatch reflects a bank holding company's ability to obtain funds at a reasonable price within a reasonable time period to meet obligations as they come due. We used the difference between volatile liabilities—liabilities that may quickly or unexpectedly come due—and liquid assets—assets that can easily be converted to cash to cover liabilities—as a percentage of total liabilities as of the beginning of each quarter as an indicator of maturity mismatch. Volatile liabilities include federal funds purchased and repurchase agreements, trading liabilities, other borrowed funds, foreign deposits, and jumbo deposits less derivatives with negative fair value. Liquid assets include cash, securities, federal funds sold and reverse repurchase agreements, and trading assets less pledged securities.<sup>9</sup>
- **Volatility.** Volatility reflects how much the value of a bank holding company fluctuates over a given amount of time and the possibility that the value will fall below a given threshold for default. We constructed five alternative indicators of volatility: (1) the standard deviation of equity prices over the quarter, (2) option implied volatility for the quarter, (3) the standard deviation of equity returns over the quarter, (4) the standard deviation of excess equity returns over the

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<sup>9</sup>Several components of volatile liabilities, such as federal funds purchased, repurchase agreements, and demand deposits, have relatively short maturities and may not be rolled over by the creditor when they mature. Maturity mismatch measures the bank holding company's capacity to cover these liabilities if the creditor chooses to not roll them over.

quarter, and (5) the standard deviation of earnings over the past 16 quarters as alternative indicators of volatility.

**Other factors.** We also collected data on several other factors that may influence bond yield spreads, including bonds' coupon rates, times to maturity, and liquidity, and bank holding companies' operating expenses. We used three alternative indicators of a bond's liquidity: (1) issue size, (2) total volume traded during a quarter, and (3) average bid-ask spread over a quarter.<sup>10</sup> Finally, we used a bank holding company's noninterest expenses as a percentage of total assets as an indicator of its operating expenses.<sup>11</sup> Table 4 shows summary statistics for bank holding companies with senior unsecured bonds outstanding in 2008 and 2013 and for senior unsecured bonds outstanding in 2008 and 2013.

**Table 4: Summary Statistics for Bank Holding Companies and Bonds Analyzed, 2008 and 2013**

	Mean	Standard deviation	Minimum	Maximum
<i>Bank holding companies with senior unsecured bonds outstanding, 2008</i>				
Total assets (dollars in billions)	403.974	640.816	7.685	2134.499
Operating expense/assets (%)	1.067	0.801	0.576	4.451
Equity capital/assets (%)	10.602	5.226	5.916	31.332
Equity capital/risk-weighted assets (%)	14.340	9.326	7.688	52.366
Subordinated debt/assets (%)	3.308	1.353	0	6.010
Subordinated debt/risk-weighted assets (%)	4.157	1.412	0	6.364
Earnings/assets (%)	0.110	0.440	-1.032	1.349
Maturity mismatch (%)	17.869	18.000	-53.133	34.162
Texas ratio (%)	16.287	10.946	0.011	40.211
Equity price volatility (%)	88.156	31.924	48.106	180.773

<sup>10</sup>The bid-ask spread is the difference between the best buying price and the best selling price. We expressed the bid-ask spread as a percentage of the midpoint between the bid price and the ask price.

<sup>11</sup>Some studies suggest that there may be economies of scale or scope in banking. For example, see Joseph P. Hughes and Loretta J. Mester, "Who Said Large Banks Don't Experience Scale Economies? Evidence From a Risk-Return-Driven Cost Function," *Journal of Financial Intermediation* 22 (2013), pp. 559-585. We include noninterest expense as a percentage of total assets to control for a channel through which economies of scale may affect bond funding costs. Other channels through which economies of scale or scope may affect bond funding costs are profitability, which is captured in our earnings variable, and riskiness, which is captured in our volatility variable.

**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

	<b>Mean</b>	<b>Standard deviation</b>	<b>Minimum</b>	<b>Maximum</b>
Option implied volatility (%)	66.246	14.459	43.573	97.816
Equity return volatility (%)	5.079	0.899	3.508	6.962
Excess equity return volatility (%)	3.723	0.969	2.231	5.817
Earnings volatility (%)	6.108	4.353	0.460	23.510
GSIB designation (indicator)	0.273	—	0	1
Assets \$50 billion or more (indicator)	0.818	—	0	1
<i>Senior unsecured bonds outstanding, 2008</i>				
Average bond yield spread calculated using prices from executed trades, executable quotes, and composites of executable and indicative quotes (bps)	456.407	305.194	15.066	1479.019
Average bond yield spread calculated using prices from executed trades (bps)	474.809	342.013	15.066	1479.019
Bond issue size (dollars in millions)	1004.746	1028.839	0.143	5500.000
Total trade volume (dollars in millions)	160456.800	225838.100	0	1663766.000
Average bid-ask spread, all pricing sources (%)	1.535	1.621	0.0156	14.224
Time to maturity (quarters)	17.177	19.706	0	119.000
Coupon (%)	5.461	1.219	2.000	12.500
<i>Bank holding companies with senior unsecured bonds outstanding, 2013</i>				
Total assets (dollars in billions)	413.488	672.505	4.563	2412.823
Operating expense/assets (%)	0.986	0.598	0.613	3.899
Equity capital/assets (%)	10.993	2.375	7.207	19.144
Equity capital/risk-weighted assets (%)	16.206	4.358	10.676	31.576
Subordinated debt/assets (%)	1.602	0.996	0	4.137
Subordinated debt/risk-weighted assets (%)	2.402	1.205	0	5.171
Earnings/assets (%)	0.280	0.150	0.040	0.766
Maturity mismatch (%)	-1.044	20.512	-53.133	47.001
Texas ratio (%)	17.523	12.061	0.812	38.690
Equity price volatility (%)	20.629	3.280	12.952	28.572
Option implied volatility (%)	23.996	3.656	15.788	30.250
Equity return volatility (%)	1.311	0.202	0.828	1.758
Excess equity return volatility (%)	1.003	0.200	0.630	1.478
Earnings volatility (%)	3.936	4.771	0.355	23.510
GSIB designation (indicator)	0.267	—	0	1
Assets \$50 billion or more (indicator)	0.700	—	0	1
<i>Senior unsecured bonds outstanding, 2013</i>				

**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

	<b>Mean</b>	<b>Standard deviation</b>	<b>Minimum</b>	<b>Maximum</b>
Average bond yield spread calculated using prices from executed trades, executable quotes, and composites of executable and indicative quotes (bps)	140.684	69.252	15.066	500.750
Average bond yield spread calculated using prices from executed trades (bps)	132.952	71.563	15.066	796.406
Bond issue size (dollars in millions)	1042.622	1107.804	0.350	5500.000
Total trade volume (dollars in millions)	161367.900	293879.200	0	33334868.000
Average bid-ask spread, all pricing sources (%)	0.537	0.474	0.003	2.819
Time to maturity (quarters)	24.548	24.729	0	126.000
Coupon (%)	4.320	1.712	0.800	10.000

Source: GAO analysis of Bloomberg and Financial Stability Board data. | GAO-14-621

We estimated a variety of models for each year from 2006 to 2013 to address uncertainty about how to appropriately control for bond liquidity, bank holding company credit risk, and the size or systemic importance of a bank holding company and also to allow the relationship between bank holding company size and bond funding costs to vary over time. In our baseline specifications, we measured bond funding costs using average yield spreads on senior unsecured bonds based on executed trades, executable quotes, and composites derived from executable and indicative quotes; size using total assets; capital adequacy using equity capital and subordinated debt as percentages of total assets; and bond liquidity using issue size and total volume. We estimated the parameters for each year and for each of our five volatility variables, as well as for each year without controlling for volatility. We also estimated the parameters of the following variations of the baseline specifications for senior unsecured bonds:

- **Bid-ask specification.** We measured bond liquidity using issue size, total volume, and average bid-ask spread.
- **Trade Reporting and Compliance Engine specification.** We measured bond funding costs using average yield spreads based only on actual trades reported in the Trade Reporting and Compliance Engine database.
- **Risk-weighted assets specification.** We measured capital adequacy using equity capital and subordinated debt as percentages of risk-weighted assets.
- **GSIB specification.** We measured size using the indicator for whether or not a bank holding company was designated a GSIB in November 2013.

Appendix I. Methodology for Analysis of Funding Cost Differences between Large and Small Bank Holding Companies

- **Systemically important financial institution (SIFI) specification.** We measured size using the indicator for whether or not a bank holding company had \$50 billion or more in assets.
- **Total assets and total assets squared specification.** We measured size using both total assets and the square of total assets.

Altogether, we estimated the parameters of 42 separate specifications for each year from 2006 to 2013. For all specifications, we included indicators for each quarter to control for the influence on yield spreads of economic conditions, the regulatory environment, and other factors that vary over time but not across bank holding companies. We also adjusted the standard errors of our parameter estimates to allow for the possibility that they are not identically distributed and to allow for arbitrary correlation between observations on bonds issued by the same bank holding company. Table 5 shows the estimates of the parameters for our baseline regressions for 2008 and 2013.

**Table 5: Parameter Estimates for Baseline Regressions, 2008 and 2013**

Dependent variable = average bond yield spreads calculated using prices from executed trades, executable quotes, and composites of executable and indicative quotes (basis points)						
2008	Volatility variable					
	Equity price volatility	Option implied volatility	Equity return volatility	Excess equity return volatility	Earnings volatility	No volatility variable
Time to maturity	-1.269* (0.614)	-1.187* (0.641)	-1.255* (0.606)	-1.255* (0.611)	-1.232** (0.570)	-1.267** (0.590)
Coupon	30.982 (20.589)	29.042 (21.853)	30.547 (20.257)	30.517 (20.379)	29.479 (19.355)	29.876 (20.006)
Operating expenses	-92.810** (37.956)	-202.517*** (60.420)	-89.526** (36.812)	-70.820* (35.180)	-138.984** (55.786)	-111.772*** (34.104)
Issue size	0.000 (0.023)	0.004 (0.024)	0.000 (0.023)	0.003 (0.023)	0.002 (0.022)	-0.000 (0.022)
Total trade volume	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Total assets	0.124 (0.144)	0.064 (0.139)	0.124 (0.129)	0.130 (0.104)	0.055 (0.133)	0.063 (0.129)
Equity capital	19.526** (6.944)	23.180** (10.197)	18.946** (7.655)	17.337** (6.725)	18.710** (8.084)	19.686*** (6.863)
Equity capital x total assets	0.013 (0.023)	-0.022 (0.026)	0.012 (0.024)	0.017 (0.018)	0.021 (0.020)	0.020 (0.021)

**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

<b>Dependent variable = average bond yield spreads calculated using prices from executed trades, executable quotes, and composites of executable and indicative quotes (basis points)</b>						
Subordinated debt	7.918 (31.859)	14.153 (29.805)	6.180 (31.162)	0.322 (26.788)	10.856 (29.995)	11.004 (32.695)
Subordinated debt x total assets	-0.099 (0.065)	-0.025 (0.046)	-0.090 (0.065)	-0.092* (0.053)	-0.108 (0.064)	-0.103 (0.065)
Earnings	-167.831* (96.274)	-108.627 (97.037)	-143.709 (99.636)	-146.072 (84.756)	-177.705 (108.083)	-163.593* (93.830)
Earnings x total assets	0.068 (0.138)	0.169 (0.138)	0.045 (0.130)	0.060 (0.106)	-0.000 (0.130)	0.013 (0.125)
Maturity mismatch	-5.968** (2.466)	-8.608*** (2.105)	-5.385** (2.422)	-4.915** (2.181)	-7.370*** (2.349)	-6.829** (2.535)
Maturity mismatch x total assets	0.003 (0.002)	0.007*** (0.002)	0.003 (0.002)	0.002 (0.002)	-0.001 (0.003)	0.003 (0.002)
Texas ratio	6.512* (3.526)	0.258 (1.979)	6.320* (3.453)	4.985 (3.813)	7.060* (3.514)	7.531* (3.615)
Texas ratio x total assets	-0.002 (0.002)	-0.000 (0.001)	-0.002 (0.002)	-0.002 (0.002)	-0.002 (0.002)	-0.003 (0.002)
Equity price volatility	0.586 (0.396)					
Equity price volatility x total assets	-0.000 (0.000)					
Option implied volatility		1.696 (1.463)				
Option implied volatility x total assets		0.000 (0.001)				
Equity return volatility			34.178* (17.628)			
Equity return volatility x total assets			-0.005 (0.010)			
Excess equity return volatility				48.818** (18.522)		
Excess equity return volatility x total assets				-0.017* (0.009)		
Earnings volatility					7.787 (10.992)	
Earnings volatility x total assets					0.014 (0.011)	

**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

**Dependent variable = average bond yield spreads calculated using prices from executed trades, executable quotes, and composites of executable and indicative quotes (basis points)**

Number of observations	478	428	478	478	478	478
Adjusted R-squared	0.628	0.606	0.631	0.638	0.624	0.622
Akaike Information Criteria	5917	5254	5913	5904	5922	5927
Schwartz Information Criteria	6000	5323	5997	5988	6005	6010
Number of bank holding companies	21	18	21	21	21	21

Hypothesis test that the coefficients on total assets and the total assets-credit risk interaction terms are jointly equal to zero:

F-statistic	3.579	3.792	2.972	4.486	2.983	4.207
Probability of observing F-statistic if hypothesis is true	0.012	0.012	0.026	0.004	0.026	0.007

**2013** **Volatility variable**

	Equity price volatility	Option implied volatility	Equity return volatility	Excess equity return volatility	Earnings volatility	No volatility variable
Time to maturity	0.788*** (0.093)	0.775*** (0.087)	0.794*** (0.095)	0.798*** (0.095)	0.857*** (0.120)	0.878*** (0.128)
Coupon	9.497*** (2.079)	8.455*** (1.742)	9.453*** (2.047)	9.197*** (1.926)	8.396*** (2.459)	10.085*** (2.511)
Operating expenses	5.749 (8.154)	0.972 (6.588)	6.741 (8.190)	7.736 (8.433)	-10.274** (4.296)	-13.639** (5.668)
Issue size	-0.013*** (0.004)	-0.010** (0.004)	-0.013*** (0.004)	-0.013*** (0.004)	-0.013*** (0.004)	-0.016*** (0.004)
Total trade volume	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Total assets	0.013 (0.032)	0.017 (0.022)	0.010 (0.034)	0.013 (0.033)	0.269*** (0.077)	-0.037 (0.048)
Equity capital	6.763* (3.856)	7.444** (3.428)	6.072 (3.923)	3.375 (3.965)	5.487 (3.716)	0.470 (4.559)
Equity capital x total assets	-0.005 (0.005)	-0.009* (0.005)	-0.004 (0.005)	-0.002 (0.005)	-0.011 (0.007)	0.012** (0.005)
Subordinated debt	-29.137** (13.149)	-29.108*** (9.968)	-29.921** (13.257)	-31.370** (13.438)	-19.769 (16.353)	-25.283* (14.168)
Subordinated debt x total assets	0.052** (0.019)	0.057*** (0.017)	0.054** (0.020)	0.057** (0.021)	0.065* (0.033)	0.030 (0.023)
Earnings	-69.186 (49.502)	-44.545 (44.445)	-71.544 (49.088)	-74.556 (47.102)	-32.870* (17.759)	-48.299** (21.803)

**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

<b>Dependent variable = average bond yield spreads calculated using prices from executed trades, executable quotes, and composites of executable and indicative quotes (basis points)</b>						
Earnings x total assets	0.027 (0.041)	0.044 (0.028)	0.026 (0.042)	0.018 (0.038)	-0.070*** (0.022)	-0.048 (0.034)
Maturity mismatch	0.522 (0.695)	1.136* (0.593)	0.559 (0.714)	0.555 (0.706)	1.062 (0.779)	2.244*** (0.531)
Maturity mismatch x total assets	-0.001* (0.001)	-0.001*** (0.000)	-0.001* (0.001)	-0.001 (0.001)	-0.002* (0.001)	-0.003*** (0.001)
Texas ratio	3.207*** (1.114)	2.961*** (0.933)	3.270*** (1.108)	2.826** (1.055)	4.106*** (1.463)	3.447** (1.464)
Texas ratio x total assets	-0.003*** (0.001)	-0.003*** (0.001)	-0.003*** (0.001)	-0.004*** (0.001)	-0.008*** (0.002)	-0.006*** (0.001)
Equity price volatility	5.959*** (1.434)					
Equity price volatility x total assets	0.000 (0.001)					
Option implied volatility		9.397*** (1.818)				
Option implied volatility x total assets		0.000 (0.001)				
Equity return volatility			98.615*** (25.234)			
Equity return volatility x total assets			-0.001 (0.014)			
Excess equity return volatility				124.829*** (32.956)		
Excess equity return volatility x total assets				-0.020 (0.017)		
Earnings volatility					12.388*** (3.559)	
Earnings volatility x total assets					-0.029*** (0.007)	
Number of observations	1446	1446	1446	1446	1535	1535
Adjusted R-squared	0.521	0.563	0.519	0.519	0.521	0.469
Akaike Information Criteria	15083	14951	15090	15090	16221	16378
Schwartz Information Criteria	15199	15067	15206	15206	16338	16484
Number of bank holding companies	30	30	30	30	31	31



**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

**Dependent variable = average bond yield spreads calculated using prices from executed trades, executable quotes, and composites of executable and indicative quotes (basis points)**

Hypothesis test that the coefficients on total assets and the total assets-credit risk interaction terms are jointly equal to zero:

F-statistic	3.027	3.907	3.009	4.477	7.309	5.258
Probability of observing F-statistic if hypothesis is true	0.016	0.004	0.017	0.002	<0.001	0.001

Source: GAO analysis of Bloomberg and Financial Stability Board data. | GAO-14-621

Notes: We estimated econometric models of the relationship between bank holding company size and funding costs using data for U.S. bank holding companies and their outstanding senior unsecured bonds for the first quarter of 2006 through the fourth quarter of 2013. The models used bond yield spreads to measure funding costs and controlled for credit risk factors such as capital adequacy, asset quality, earnings, maturity mismatch, and volatility, as well as bond liquidity and other characteristics of bonds and bank holding companies that can affect funding costs. We estimated multiple models for each year from 2006 through 2013 to assess the sensitivity of our results to alternative measures of capital adequacy, volatility, bond liquidity, and size or systemic importance. This table shows estimates of the parameters of models for 2008 and 2013 that used average bond yield spreads calculated using prices from executed trades, executable quotes, and composites of executable and indicative quotes to measure bond funding costs; total assets to measure bank holding company size; issue size and total trade volume to measure bond liquidity; equity capital and subordinated debt as percents of assets to measure capital adequacy; and each of equity price volatility, option implied volatility, equity return volatility, excess equity return volatility, and earnings volatility to measure volatility, as well as a model with no volatility measure. Other explanatory variables include coupon, time to maturity, Texas ratio, maturity mismatch, and operating expenses. Standard errors clustered by bank holding company are in parentheses. \*=statistically significant at the 10 percent level. \*\*=statistically significant at the 5 percent level. \*\*\*=statistically significant at the 1 percent level.

Our econometric models allow the size of a bank holding company to influence its bond yield spreads both directly and indirectly through the relationships between yield spreads and each indicator of credit risk, i.e., through the interaction term. To summarize the overall relationship between yield spreads and size reflected in each specification, we predicted yield spreads on senior unsecured bonds for bank holding companies of different sizes and credit risk levels using our estimates of the parameters for each specification for each year. Specifically, for each year, we predicted bond yield spreads for bank holding companies with \$10 billion, \$50 billion, \$100 billion, \$250 billion, \$500 billion, and \$1 trillion in assets assuming that all bank holding companies had the average level of credit risk each year, a low level of credit risk each year, a high level of credit risk each year, and the average level of credit risk for

**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

2008.<sup>12</sup> Table 6 shows all of the differences between predicted bond yield spreads for bank holding companies with \$50 billion, \$100 billion, \$250 billion, \$500 billion, and \$1 trillion in assets and predicted bond yield spreads for bank holding companies with \$10 billion in assets for our baseline regressions for 2008 and 2013 assuming bank holding companies have the average level of credit risk each year.

**Table 6: Baseline Comparisons of Bond Yield Spreads for Bank Holding Companies of Different Sizes by Year, 2008 and 2013 (basis points)**

<b>Comparison</b>	<b>Comparison from baseline model with volatility variable:</b>					
	Equity price volatility	Option implied volatility	Equity return volatility	Excess equity return volatility	Earnings volatility	No volatility variable
<b>2008, credit risk equal to average for 2008</b>						
\$50 billion vs. \$10 billion in assets	-3.860*** (1.175)	-1.867** (0.770)	-4.124*** (1.186)	-3.590*** (1.181)	-4.353*** (1.235)	-4.011*** (1.256)
\$100 billion vs. \$10 billion in assets	-8.686*** (2.644)	-4.201** (1.734)	-9.278*** (2.669)	-8.078*** (2.658)	-9.794*** (2.779)	-9.026*** (2.827)
\$250 billion vs. \$10 billion in assets	-23.161*** (7.050)	-11.204** (4.623)	-24.742*** (7.118)	-21.541*** (7.088)	-26.119*** (7.410)	-24.069*** (7.537)
\$500 billion vs. \$10 billion in assets	-47.288*** (14.394)	-22.874** (9.439)	-50.515*** (14.532)	-43.980*** (14.471)	-53.326*** (15.128)	-49.140*** (15.389)
\$1 trillion vs. \$10 billion in assets	-95.541*** (29.081)	-46.215** (19.070)	-102.061*** (29.360)	-88.858*** (29.237)	-107.739*** (30.565)	-99.284*** (31.092)

<sup>12</sup>For predictions at average levels of credit risk, we set variables equal to the unweighted average for the sample used to estimate the regression for each year. For predictions at low levels of credit risk, we set variables measuring asset quality, maturity mismatch, and volatility equal to their 25<sup>th</sup> percentiles for each year and we set variables measuring capital adequacy and earnings equal to their 75<sup>th</sup> percentiles for each year. For predictions as high levels of credit risk, we set variables measuring asset quality, maturity mismatch, and volatility equal to their 75<sup>th</sup> percentiles for each year and we set variables measuring capital adequacy and earnings equal to their 25<sup>th</sup> percentiles for each year.

**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

<b>2013, credit risk equal to average for 2013</b>		<b>Comparison from baseline model with volatility variable:</b>					
<b>Comparison</b>	Equity price volatility	Option implied volatility	Equity return volatility	Excess equity return volatility	Earnings volatility	No volatility variable	
\$50 billion vs. \$10 billion in assets	1.152** (0.446)	1.011*** (0.365)	1.239** (0.463)	1.388*** (0.498)	0.930 (0.861)	2.365*** (0.727)	
\$100 billion vs. \$10 billion in assets	2.591** (1.004)	2.276*** (0.820)	2.787** (1.042)	3.123*** (1.120)	2.093 (1.936)	5.322*** (1.635)	
\$250 billion vs. \$10 billion in assets	6.910** (2.676)	6.068*** (2.187)	7.432** (2.778)	8.329*** (2.985)	5.582 (5.164)	14.19*** (4.359)	
\$500 billion vs. \$10 billion in assets	14.107** (5.464)	12.389*** (4.465)	15.174** (5.673)	17.006*** (6.095)	11.397 (10.542)	28.977*** (8.900)	
\$1 trillion vs. \$10 billion in assets	28.502** (11.039)	25.031*** (9.022)	30.658** (11.461)	34.358*** (12.315)	23.027 (21.30)	58.546*** (17.982)	

<b>2013, credit risk equal to average for 2008</b>		<b>Comparison from baseline model with volatility variable:</b>					
<b>Comparison</b>	Equity price volatility	Option implied volatility	Equity return volatility	Excess equity return volatility	Earnings volatility	No volatility variable	
\$50 billion vs. \$10 billion in assets	1.976 (3.253)	2.541 (2.414)	1.465 (2.899)	-0.639 (2.598)	-0.087 (1.704)	-1.971 (1.750)	
\$100 billion vs. \$10 billion in assets	4.447 (7.319)	5.717 (5.431)	3.296 (6.523)	-1.437 (5.846)	-0.195 (3.835)	-4.435 (3.937)	
\$250 billion vs. \$10 billion in assets	11.859 (19.517)	15.245 (14.483)	8.789 (17.395)	-3.833 (15.589)	-0.519 (10.226)	-11.828 (10.499)	
\$500 billion vs. \$10 billion in assets	24.212 (39.848)	31.126 (29.570)	17.943 (35.514)	-7.826 (31.828)	-1.060 (20.879)	-24.148 (21.436)	
\$1 trillion vs. \$10 billion in assets	48.918 (80.509)	62.888 (59.743)	36.253 (71.754)	-15.812 (64.305)	-2.142 (42.183)	-48.789 (43.309)	

Source: GAO analysis of Bloomberg and Financial Stability Board data. | GAO-14-621

Notes: We estimated econometric models of the relationship between bank holding company size and funding costs using data for U.S. bank holding companies and their outstanding senior unsecured bonds for the first quarter of 2006 through the fourth quarter of 2013. The models used bond yield spreads to measure funding costs and controlled for credit risk factors such as capital adequacy, asset quality, earnings, maturity mismatch, and volatility, as well as bond liquidity and other characteristics of bonds and bank holding companies that can affect funding costs. We estimated multiple models for each year from 2006 through 2013 to assess the sensitivity of estimated funding cost differences to alternative measures of capital adequacy, volatility, bond liquidity, and size or systemic importance and then used the models to compare bond funding costs for bank holding companies of different sizes but the same levels of credit risk, bond liquidity, and other characteristics. This table shows bond funding cost comparisons from models for 2008 and 2013 that used average bond yield spreads calculated using prices from executed trades, executable quotes, and composites of executable and indicative quotes to measure bond funding costs; total assets to measure bank holding company size; issue size and total trade volume to measure bond liquidity; equity capital and subordinated debt as percents of assets to measure capital adequacy; and each of equity price volatility, option implied volatility, equity return volatility, excess equity return

**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

volatility, and earnings volatility to measure volatility, as well as a model with no volatility measure. Other explanatory variables include coupon, time to maturity, Texas ratio, maturity mismatch, and operating expenses. \*=statistically significant at the 10 percent level. \*\*=statistically significant at the 5 percent level. \*\*\*=statistically significant at the 1 percent level.

Table 7 shows the difference in predicted bond yield spreads for bank holding companies with \$1 trillion and \$10 billion in assets for all specifications for 2008 and 2013 assuming bank holding companies have the average level of credit risk each year. Table 7 also shows the difference in predicted bond yield spreads for bank holding companies with \$1 trillion and \$10 billion in assets for all specifications for 2013 assuming bank holding companies have the average level of credit risk in 2008.

**Table 7: Comparisons of Bond Yield Spreads for Bank Holding Companies with \$1 trillion versus \$10 billion in Assets, All 42 Models, 2008 and 2013 (basis points)**

2008, credit risk equal to average for 2008	Comparison from model with volatility variable:					
	Equity price volatility	Option implied volatility	Equity return volatility	Excess equity return volatility	Earnings volatility	No volatility variable
Baseline model <sup>a</sup>	-95.54*** (29.08)	-46.22** (19.07)	-102.06*** (29.36)	-88.86*** (29.24)	-107.74*** (30.57)	-99.28*** (31.09)
Add bid-ask spreads to bond liquidity measures	-98.52*** (32.98)	-21.30 (15.94)	-104.08*** (31.57)	-88.60** (32.09)	-106.98** (37.49)	-104.99** (37.40)
Measure size using GSIB designation	-148.78** (60.01)	-115.16*** (35.69)	-157.00** (60.78)	-143.10** (58.73)	-145.12** (55.21)	-148.98** (57.39)
Measure size using total assets and total assets squared	-382.78*** (119.13)	-629.74*** (82.69)	-422.24*** (101.56)	-270.29** (113.61)	-228.54* (127.27)	-291.43** (120.81)
Measure capital adequacy using equity capital and subordinated debt as percents of risk-weighted assets	-86.43** (30.87)	-44.90 (32.54)	-96.96*** (31.12)	-77.63** (29.26)	-96.79*** (32.30)	-92.96** (34.10)
Measure size using an indicator of whether a bank holding company has assets of \$50 billion or more	-432.86*** (90.04)	-397.28** (146.06)	-420.42*** (67.65)	-357.57*** (30.33)	-515.38*** (133.82)	-357.49*** (73.88)

**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

Measure bond yield spreads using prices from executed trades only	-79.73** (31.77)	-16.75 (20.62)	-89.17** (32.85)	-73.39** (32.98)	-93.21** (34.18)	-85.16** (35.49)
<b>2013, credit risk equal to average for 2013</b>						
	<b>Comparison from model with volatility variable:</b>					
	Equity price volatility	Option implied volatility	Equity return volatility	Excess equity return volatility	Earnings volatility	No volatility variable
Baseline model <sup>a</sup>	28.50** (11.04)	25.03*** (9.02)	30.66** (11.46)	34.36*** (12.31)	23.03 (21.30)	58.55*** (17.98)
Add bid-ask spreads to bond liquidity measures	32.80*** (10.95)	29.63*** (8.431)	34.86*** (11.35)	38.49*** (12.41)	25.87 (21.28)	62.60*** (17.88)
Measure size using GSIB designation	3.07 (11.43)	-11.18 (11.32)	7.49 (11.10)	28.13*** (9.52)	36.07** (14.40)	28.97 (20.42)
Measure size using total assets and total assets squared	-51.80** (23.50)	-41.43** (18.95)	-52.43** (23.06)	-36.89 (22.97)	-19.01 (52.29)	3.73 (43.74)
Measure capital adequacy using equity capital and subordinated debt as percents of risk-weighted assets	23.17** (10.53)	20.33** (7.790)	24.33** (11.00)	28.05** (11.91)	0.264 (15.62)	45.88** (17.03)
Measure size using an indicator of whether a bank holding company has assets of \$50 billion or more	-183.08** (81.39)	-195.76*** (59.77)	-190.95** (80.21)	-160.67* (85.47)	-188.38*** (66.17)	-163.51 (100.2)
Measure bond yield spreads using prices from executed trades only	17.32 (14.24)	13.21 (12.66)	20.06 (14.78)	24.87 (15.86)	13.39 (25.28)	49.02*** (17.37)

**Appendix I. Methodology for Analysis of  
Funding Cost Differences between Large and  
Small Bank Holding Companies**

**2013, credit risk  
equal to average  
for 2008**

**Comparison from model with volatility variable:**

	Equity price volatility	Option implied volatility	Equity return volatility	Excess equity return volatility	Earnings volatility	No volatility variable
Baseline model <sup>a</sup>	48.92 (80.51)	62.89 (59.74)	36.25 (71.75)	-15.81 (64.31)	-2.14 (42.18)	-48.79 (43.31)
Add bid-ask spreads to bond liquidity measures	64.91 (76.62)	86.12 (54.27)	51.00 (66.88)	3.65 (62.80)	-0.28 (42.16)	-43.14 (44.27)
Measure size using GSIB designation	-290.72 (210.512)	-264.12** (103.19)	-266.26 (197.211)	-118.16 (184.807)	-41.328 (55.122)	28.798 (54.296)
Measure size using total assets and total assets squared	-455.05 (279.97)	-327.16** (141.48)	-494.45* (253.52)	-473.93* (242.11)	-241.81 (195.99)	-160.75 (153.44)
Measure capital adequacy using equity capital and subordinated debt as percents of risk- weighted assets	-54.12 (68.63)	-7.73 (71.92)	-67.52 (58.98)	-102.48** (47.92)	-45.56 (35.37)	-105.58*** (37.02)
Measure size using an indicator of whether a bank holding company has assets of \$50 billion or more	-194.56 (144.1)	-606.39* (307.14)	-373.43* (195.44)	-355.84*** (107.35)	-246.16* (143.55)	-154.46 (144.58)
Measure bond yield spreads using prices from executed trades only	38.47 (87.83)	35.45 (61.70)	36.14 (75.85)	-1.00 (64.28)	12.43 (35.46)	-50.39 (41.98)

Source: GAO analysis of Bloomberg and Financial Stability Board data. | GAO-14-621

Notes: We estimated econometric models of the relationship between bank holding company size and funding costs using data for U.S. bank holding companies and their outstanding senior unsecured bonds for the first quarter of 2006 through the fourth quarter of 2013. The models used bond yield spreads to measure funding costs and controlled for credit risk factors such as capital adequacy, asset quality, earnings, maturity mismatch, and volatility, as well as bond liquidity and other characteristics of bonds and bank holding companies that can affect funding costs. We estimated multiple models for each year from 2006 through 2013 to assess the sensitivity of estimated funding cost differences to alternative measures of capital adequacy, volatility, bond liquidity, and size or systemic importance and then used the models to compare bond funding costs for bank holding companies of different sizes but the same levels of credit risk, bond liquidity, and other characteristics. This table shows bond funding cost comparisons from models for 2008 and 2013 for bank holding companies with the average level of credit risk for those years, and from models for 2013 for bank holding companies with the average level of credit risk for 2008.

\*=statistically significant at the 10 percent level. \*\*=statistically significant at the 5 percent level.

\*\*\*=statistically significant at the 1 percent level.

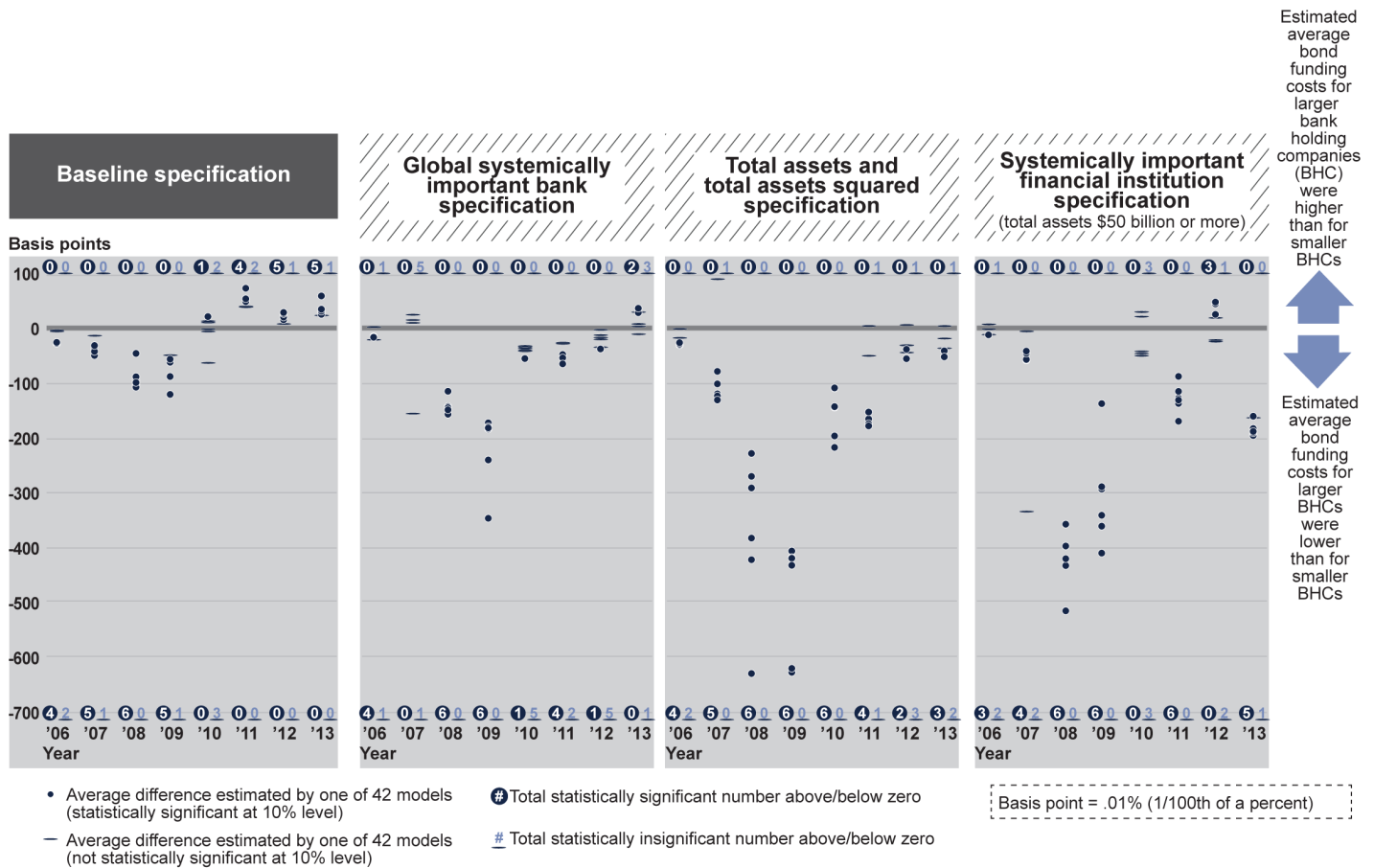
<sup>a</sup>The baseline model used average bond yield spreads calculated using prices from executed trades, executable quotes, and composites of executable and indicative quotes to measure bond funding

**Appendix I. Methodology for Analysis of Funding Cost Differences between Large and Small Bank Holding Companies**

costs; total assets to measure bank holding company size; issue size and total trade volume to measure bond liquidity; equity capital and subordinated debt as percents of assets to measure capital adequacy; and each of equity price volatility, option implied volatility, equity return volatility, excess equity return volatility, and earnings volatility to measure volatility, as well as a model with no volatility measure. Other explanatory variables include coupon, time to maturity, Texas ratio, maturity mismatch, and operating expenses.

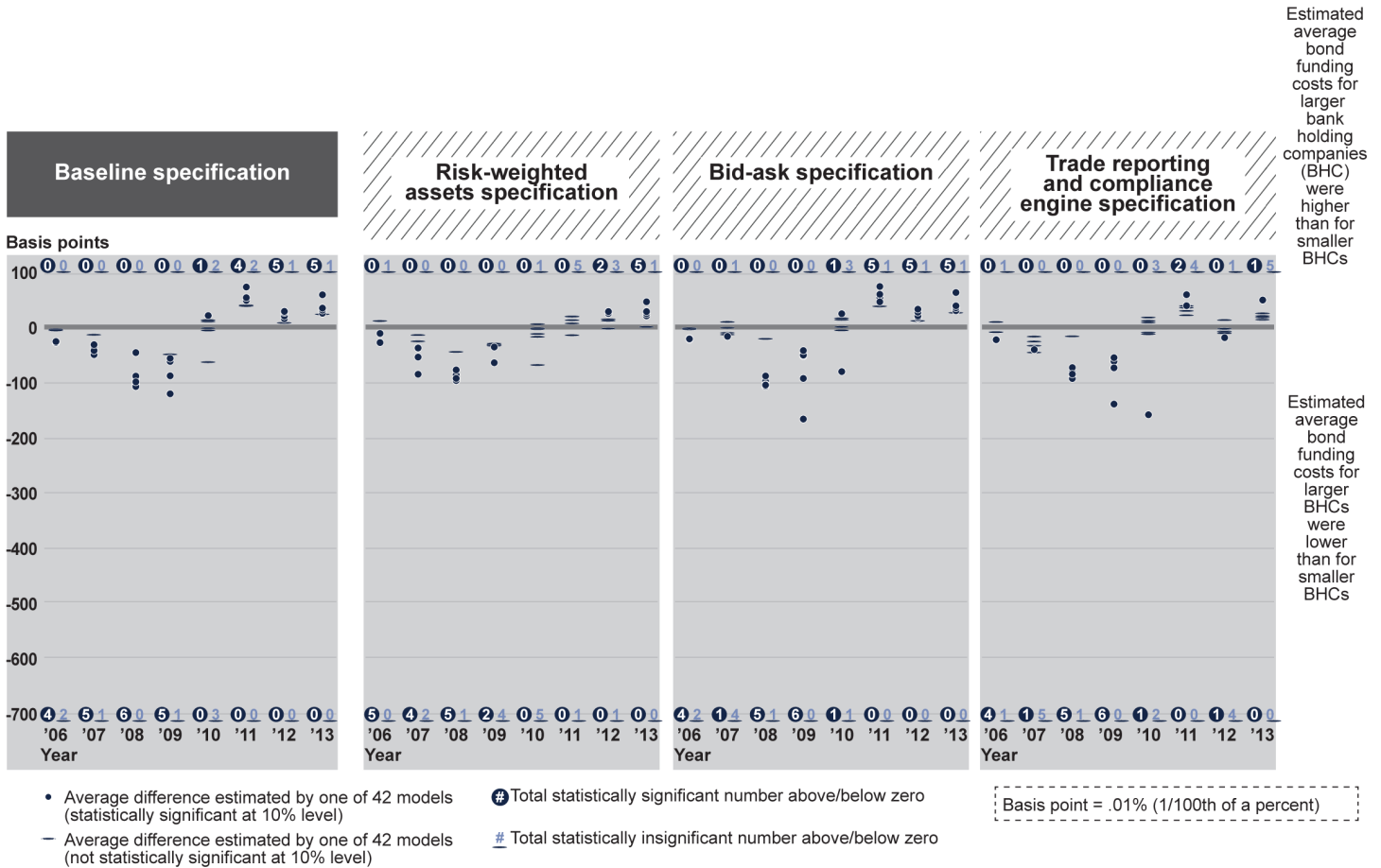
Figure 4 shows estimated bond funding costs for bank holding companies with \$1 trillion in assets versus those with \$10 billion in assets by model and year, assuming that all bank holding companies have the average level of credit risk in each year.

**Figure 4: Difference in Estimated Bond Funding Costs for Average Credit Risk Bank Holding Companies with \$1 Trillion versus \$10 Billion in Assets by Model Specification, by Year, 2006-2013**



Source: GAO analysis of data from Bloomberg and the Financial Stability Board. | GAO-14-621

**Appendix I. Methodology for Analysis of Funding Cost Differences between Large and Small Bank Holding Companies**



Source: GAO analysis of data from Bloomberg and the Financial Stability Board. | GAO-14-621

Notes: We estimated econometric models of the relationship between bank holding company size and funding costs using data for U.S. bank holding companies and their outstanding senior unsecured bonds for the first quarter of 2006 through the fourth quarter of 2013. The models used bond yield spreads to measure funding costs and controlled for credit risk factors such as capital adequacy, asset quality, earnings, maturity mismatch, and volatility, as well as bond liquidity and other characteristics of bonds and bank holding companies that can affect funding costs. We estimated 42 models for each year from 2006 through 2013 to assess the sensitivity of estimated differences in funding costs to alternative measures of capital adequacy, volatility, bond liquidity, and size or systemic importance. We used the models to compare bond funding costs for bank holding companies of different sizes but the same levels of credit risk, bond liquidity, and other characteristics. This figure compares bond funding costs for bank holding companies with \$1 trillion and \$10 billion in assets, for each model and for each year, with average levels of credit risk. Each circle and dash shows the comparison for a different model, where circles and dashes below zero suggest bank holding companies with \$1 trillion in assets have lower bond funding costs than bank holding companies with \$10 billion in assets, and vice versa.



# Appendix II: Comments from the Department of the Treasury



UNDER SECRETARY

DEPARTMENT OF THE TREASURY  
WASHINGTON, D.C.

July 21, 2014

Lawrance Evans, Jr.  
Director  
Financial Markets and Community Investment  
Government Accountability Office  
441 G Street, NW  
Washington, DC 20548

Dear Mr. Evans:

I am writing regarding the Government Accountability Office's (GAO) draft report GAO-14-621 (the Draft Report), *Large Bank Holding Companies: Expectations of Government Support*.

Five years ago, the U.S. economy was reeling from the devastating financial crisis that helped trigger the worst recession since the Great Depression. To prevent our economy from melting down, the American taxpayer was forced to provide extraordinary assistance to financial companies. While the President and Treasury Secretary acted decisively to put out the financial fires, they were also determined to ensure that such a crisis never happens again. The Administration's efforts produced the most comprehensive overhaul of our financial system since the Great Depression—the Dodd-Frank Wall Street Reform and Consumer Protection Act. The Act's reforms impose more stringent requirements on large firms through heightened capital and liquidity standards, put in place living wills and resolution authority, and prohibit taxpayer bailouts. The law makes clear that shareholders, creditors, and executives—not taxpayers—will be responsible if a large financial company fails.

The Draft Report reflects an impressive amount of empirical work using more recent data than existing research and represents a meaningful contribution to the literature. We appreciate the complexity of the task you and your team undertook, as well as the limitations of available data for comparing funding costs across institutions of different size.

The Draft Report asks readers to interpret its findings with caution, and we recognize the issue merits continued monitoring and further study. Nevertheless, the results of GAO's analysis are noteworthy: While large bank holding companies had clear funding cost advantages during the 2007-2009 financial crisis, these advantages had declined or reversed by 2013. Specifically, GAO ran 42 models for 2013, 26 of which produced statistically significant results. Of these 26 models, 18 showed that larger bank holding companies had higher funding costs than their smaller counterparts in 2013. In other words, more than two-thirds of these models found a funding cost disadvantage for large institutions. The remaining eight models showed a funding cost advantage, but one that had declined since the financial crisis. We believe these results

reflect increased market recognition of what should now be evident—Dodd-Frank ended “too big to fail” as a matter of law.

We thank all those involved for their professionalism and diligence throughout the study process. Treasury is continuing its efforts to fully implement the Dodd-Frank reforms to reduce the likelihood and the impact of the failure of a large, interconnected financial company. We also recognize that we must remain vigilant on this issue. We look forward to working with you on additional matters related to strengthening the financial system.

Sincerely,



Mary J. Miller

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# Appendix III: GAO Contact and Staff Acknowledgments

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## GAO Contact

Lawrance L. Evans, Jr., (202) 512-4802, or [EvansL@gao.gov](mailto:EvansL@gao.gov)

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In addition to the contact named above, Karen Tremba (Assistant Director), John Fisher (Analyst in Charge), Bethany Benitez, Michael Hoffman, Risto Laboski, Courtney LaFountain, Rob Letzler, Marc Molino, Jason Wildhagen, and Jennifer Schwartz made significant contributions to this report. Other assistance was provided by Abigail Brown, Rudy Chatlos, Stephanie Cheng, and José R. Peña.

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