# What's the value of a TBTF guaranty?
# Evidence from the G-SII designation for insurance companies

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**Abstract**

We document median abnormal stock returns of 12% (U.S. $17.2 billion) for international insurance firms designated as Global Systemically Important Insurers (G-SII). These gains are associated with a fall in default probabilities, an increase in expected asset risk and a loss to creditors. Over the same event window, identical measures for other large insurance firms show no significant changes, on average. Abnormal price responses for the G-SII show significant cross correlations with measures of firm risk and with country-level measures of regulatory quality. These results suggest that the market perceives a TBTF guaranty as unambiguously lowering risk for the largest and riskiest firms, but this drop in risk still comes with some cost in increased equity returns for protected firms, despite new, costly compliance measures and an increased emphasis on curtailing moral hazard effects.

**Key words:** Too big to fail (TBTF), Global systemically important financial institutions (G-SIFI); Global Systemically Important Insurers (G-SII), Insurance, Financial regulation
**JEL:** G22: Insurance Companies, G23: Non-bank Financial Institutions, G28: Government Policy and Regulation

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## 1. Motivation

Building on a history of protective policies in the banking industry, one major global policy response to the 2008 financial crisis was the extension of systemically important status to firms in the insurance industry, a sector of the economy that contributes the same amount to GDP as the banking sector.[1] Specifically, in July 2013 the Financial Stability Board designated nine global insurance firms in six countries as systemically important insurers (G-SII), a subset of systemically important financial institutions (G-SIFI). We examine the empirical question of whether this government protection, in the form of a too-big-to-fail (TBTF) guaranty, conveys a net gain or loss to the equity holders of these firms, estimating a median net gain from the guaranty of 12% in market capitalization across the G-SII.[2] We provide evidence that the equity gain is associated with a median fall in default probability across the G-SII of approximately one-third, a median increase in implied asset risk across the G-SII of approximately one-fifth, as well as a median 3.4% loss to bond holders.

Interest in "Too Big to Fail" (TBTF) first arose in the U.S. in 1984 when the U.S. Comptroller of the Currency testified before Congress that 11 U.S. banks were "too big to fail," and that the government would provide them total deposit insurance. O'Hara and Shaw (1990) measure the effects of being "on" or "off" the 1984 list of TBTF banks and

[1] The U.S. Bureau of Economic Analysis (BEA) estimates that in 2008 insurance carriers and related activities contributed 2.6% to gross output, compared to 2.7% for Federal Reserve banks, credit intermediation and related activities.

[2] For an analysis of the legal and regulatory framework and sources of concern for TBTF in the insurance industry, see Schwartz and Schwartz (2014).

note that the protected banks enjoy both costs and benefits. Direct costs arise from meeting regulatory requirements, and direct benefits stem from a lower probability of default which should lower borrowing costs, resulting in higher profits. The indirect benefits accrue from moral hazard: the implied government guaranty allows the bank to engage in riskier activities which should also lead to higher risk-adjusted expected returns.

O'Hara and Shaw show that on the day of the Comptroller's announcement, the stock prices of the 11 banks rose by an average of 1.3% (statistically significant), while the prices of their competitor banks fell by -0.16% (not statistically significant). The effects were positively correlated with bank size and solvency. Their results suggest that the stock market viewed the selection as TBTF as being positive for the designated banks. Since this initial analysis, the impact of TBTF policies on banks has been studied extensively.[3]

Events surrounding the 2008 crisis in international financial markets raised the issue of TBTF in a larger context. Domestically, the U.S. government took short-run actions to protect firms from the fallout of the crisis in mortgage markets.[4] While the focus of these efforts was on financial firms directly involved in mortgage markets, the government also supported firms in related areas, including the September 2008 bailout of AIG, an insurance company.[5] Ultimately, numerous countries, individually (e.g., the U.S. with Dodd-Frank in 2010) and collectively (through the Financial Stability Board, or FSB), considered and implemented policies to provide more formal and continuing support for the financial sector.[6]

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[3] Two recent papers that review the TBTF literature are Strahan (2013) and White (2014).
[4] The 2008 Emergency Economic Stabilization Act and the Troubled Asset Relief Program provided funds for the government to assist troubled firms. Details available at U.S. Department of the Treasury web site: www.treasury.gov.
[5] See: http://online.wsj.com/news/articles/SB122156561931242905
[6] The 'Dodd-Frank Wall Street Reform and Consumer Protection Act' was passed by Congress in 2010**.** A summary of the bill is available at: www.banking.senate.gov. The FSB was formed in 2009. See:

The FSB's initial efforts focused on global banks. In November 2011, the FSB declared 29 banks in 12 countries as Global Systemically Important Banks (G-SIBs). In effect, as in the actions taken by the U.S. in 1984, these banks were deemed TBTF because of their systemic importance. However, this designation came with new compliance costs and a focus on mitigating moral hazard incentives.[7] Abreu and Gulamhussen (2015), Bongini, Nieri, and Pelagatti (2015), and Kleinow, Nell, Rogler and Horsch (2014) conduct event studies for recent banking regulatory announcements, including the 2011 designation of G-SIBs. They find mixed and often insignificant reactions to the FSB regulatory announcements. However, interpreting their findings as a measure of the value of the TBTF guaranty is problematic. Based on past TBTF protective measures taken for banks, investors surely expected those governments to stand behind their largest banks again, and this expectation would already have been embedded in the large banks' stock prices.

In contrast, press reports indicate that the bailout of AIG in September 2008 is likely one of the first points at which investors began to consider the possibility that regulators might extend the TBTF umbrella to cover insurance firms.[8] This feature makes the context

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http://www.financialstabilityboard.org/. For a comprehensive discussion of content in Dodd-Frank related to insurance firms, see Schwartz and Schwartz (2014). For an empirical analysis of market reaction to the act, see Turk and Swicegood (2012) and Balasubramnian and Cyree (2014). For a general discussion of Dodd-Frank and international markets, see Acharya, Cooley, Richardson, Walter, and Scholes, Regulating Wall Street (2010).

[7] The FSB recommended that G-SIBs: (1) hold more capital than the Basel III level of 7.0%, (2) undergo intensive coordinated supervision, and (3) conduct explicit resolution planning, including the creation of cross-border "crisis management teams," as well as writing "living wills." See "Reducing the moral hazard posed by systemically important financial institutions," Financial Stability Board, October 20, 2010, http://www.financialstabilityboard.org/publications/r_101111a.pdf. As evidence of the effect of these regulations on operating costs, The Economist magazine reported observed compliance costs for two of the G-SIBs: in the first half of 2013 HSBC added 1,600 people to "ensure compliance with proliferating regulation," while Standard and Chartered added 2,000. See "A culture of fear," Economist, 11/2/2013.

[8] See "U.S. to Take Over AIG in $85 Billion Bailout; Central Banks Inject Cash as Credit Dries up," Wall Street Journal, 9/16/08 11:59 p.m. http://online.wsj.com/news/articles/SB122156561931242905. While Egginton et al., and Liebenberg (2010), Joines (2010), and Safia, et al, (2013) assess the AIG bailout, to our knowledge ours is the first paper to conduct an analysis of the entire sequence of G-SIFI announcements in the insurance industry. See Bongini et el. (2014) for a limited assessment.

for this paper closer to that of O'Hara and Shaw (1990) rather than more recent TBTF banking papers. In both this paper, and in O'Hara and Shaw, the events of interest revolve around the first time TBTF policies were announced for a particular industry. This suggests that in both cases it is less likely that expectations related to protection were already embedded in stock prices even before the affected firm/industry was perceived to need protection. Despite differences between the two industries, insurance firms are still subject to the three possible TBTF effects highlighted in O'Hara and Shaw (1990): additional compliance costs, lower funding costs, and increased moral hazard risks.[9]

To capture the entire decision sequence for the application of protection to insurance firms, our event study analysis begins with the AIG bailout announcement and extends through the July 18, 2013 announcement when the FSB named the nine insurance firms it identified as "global, systemically important insurers" (G-SII). We aggregate stock market abnormal returns for a total of eight announcements over the period; these announcements cover initial discussions of the method for selecting the G-SII, details on the new compliance requirements, and the final selection of the G-SII.

Due to AIG's uniqueness, we exclude AIG in our reported empirical results and focus on evaluating effects for the remaining eight G-SII.[10] We find that the median cumulative change in equity across all announcements is 12%, and results in a net increase in market capitalization of U.S. $17.2 billion. Over the same set of eight announcements the median G-SII probability of default falls by 35%, consistent with a TBTF guaranty; the

[9] The IAIS May 2012 document "Global Systemically Important Insurers: Proposed assessment methodology" discusses some of the differences between systemically important banks and insurers.

[10] We repeated the reported empirical tests with the full G-SII sample, including AIG. The results are substantively the same. The SUR results suggest average G-SII equity increases by 11.1% rather than 11.7% when the entire group is considered. For brevity, we do not report the full set of results here. See Internet Appendix, Table 5A.

median G-SII implied asset risk rises by 20%, consistent with the moral hazard effects of a TBTF guaranty; and the median fall in G-SII bond prices is 3%, a finding consistent with moral hazard risk-shifting effects outweighing the benefits of TBTF protection. Similar to the O'Hara and Shaw results, we find that the cross section of G-SII announcement abnormal equity returns are positively related to firm-specific measures of risk.

We apply the same analysis to a group of other large insurance firms (OLIF) located in the same countries as the G-SII group, and find strikingly different results. On average, across all announcements, the OLIF have no significant price responses for equity, default probabilities, options or bond prices. There are, however, some significant differences in the cross section of OLIF price responses suggesting that investors do expect the new regime to affect some of these firms as well. In particular, the abnormal bond price responses of the riskiest OLIF are consistent with exclusion from the TBTF umbrella.

In the U.S., the Financial Stability Oversight Council (FSOC) is the umbrella organization and first point of contact with the FSB for actions taken with respect to G-SIFIs. As a robustness check, we conduct an event study to confirm that U.S. regulatory policy announcements by FSOC during the FSB sample period do not affect returns for the two U.S.-based G-SII, MetLife and Prudential Financial. (Again, we exclude AIG from the analysis.) We also confirm that potentially confounding firm specific events for the G-SII sample have no effect on the results.

Finally, we conduct an across-country analysis, comparing the TBTF "premium," measured as the country-level difference between the G-SII and OLIF cumulative abnormal returns, with the quality of insurance regulations. We find the TBTF premium is largest in the countries with the weakest insurance regulations. This pattern is consistent

with arguments by Kane (2000) that the quality of local legal and political institutions can affect the efficacy of local regulations.

Our insurance industry estimates provide three sets of insights into the net value impact of the TBTF guaranty. First, our findings suggest that investors still perceive a net equity gain to firms that are brought under the TBTF umbrella, despite the substantial new compliance requirements in FSB G-SIFI policies. Further, these gains are larger for the riskier firms. Second, these results confirm that the TBTF effects are economically significant with a 12% gain in equity value, a 35% fall in default probability, a 20% increase in implied asset risk, and a 3% drop in bond returns. Third, because we measure abnormal returns across the sequence of announcements, from the first insurance firm bailout in 2008 through the FSB's identification of nine insurance firms as G-SII in 2013, we can better understand how and when investors incorporate the value effects of TBTF into stock prices. Our results are consistent with investor identification of the G-SII firms quite early in the process, with value effects embedded into their stock prices a year or more before the announcement that revealed the list of designated firms.

## 2. Background and hypotheses

The Financial Stability Board (FSB) assumed the roles and responsibilities of the Financial Stability Forum in April 2009.[11] According to the FSB website, "The FSB has been established to coordinate at the international level the work of national financial

[11] See FSB website, http://www.financialstabilityboard.org/index.htm.

authorities and international standard setting bodies and to develop and promote the implementation of effective regulatory, supervisory and other financial sector policies."

The FSB worked with the International Association of Insurance Supervisors (IAIS) to determine selection criteria and regulatory mandates for insurance firms. In consultation with the IAIS, the FSB justified extending the G-SIFI designation to insurance firms after a comprehensive analysis to identify the potential sources of systemic risk in the industry (IAIS, May 31, 2012, pg. 6):[12]

> *The focus of IAIS analysis is in relation to potential global systemically important insurers (G-SIIs). To this end, the IAIS has developed an assessment methodology to identify any insurers whose distress or disorderly failure, because of their size, complexity and interconnectedness, would cause significant disruption to the global financial system and economic activity. Any such insurers should be regarded as systemically important on a global basis.*

The IAIS May 2012 document identifies 5 categories of data that they would consider in selecting G-SII: size (with a weight of 5-10%), global activity (5-10%), interconnectedness (30-40%), non-traditional insurance and non-insurance activities (40-50%) and substitutability (5-10%).[13]

We begin our analysis with the announcement of the AIG bailout in September 2008. Subsequent announcements that we consider are identified in Table 1. These FSB-related announcements contain information that could change investor perceptions as to the probability that the FSB would extend the G-SIFI system to insurance firms, the types

[12] The FSB actions taken in 2013 included planned annual updates to the designated firms. Scheduled updates for 2014 were postponed to November, 2015, well outside our sample period, at which time Aegon was added and Assicurazioni Generali Spa was dropped from the formal G-SII list, effective in 2016. See: http://www.financialstabilityboard.org/2014/11/fsb-announces-update-of-list-of-global-systemically-important-insurers-g-siis/) and http://www.fsb.org/2015/11/fsb-publishes-the-2015-update-of-the-g-sii-list/ .

[13] This list clearly suggests that the IAIS is most concerned about interconnectedness and non-traditional insurance activities when identifying systemic risk with respect to insurance firms.See Dungey, Luciani, and Veredas (2014) for a discussion of the systemic risk of insurers and Banulescu and Dumitrescu (2015) for methodology as applied to G-SIFIs in 2007 and 2009.

of information the IAIS and FSB would then consider when selecting the G-SII firms, or the expected benefits or costs of the G-SII regulatory regime.

Our null hypothesis is that G-SII designation has no impact on the firms' equity value. The alternatives are that the benefits of the TBTF guaranty outweigh the costs and equity value increases, or that the compliance costs dominate and equity value drops.

## 3. Data description and summary statistics

Sample selection starts with the FSB's 2013 list of nine G-SII in six countries. We focus our analysis on the G-SII other than AIG because the bailout of AIG removed any uncertainty about government support for AIG. We then identify a set of other insurance firms, similar to the G-SII, for comparison. Since the nine firms designated G-SII are all categorized as life and/or full insurance firms, we limit our list of candidate firms to those classified as life or full insurance.[14] We also restrict the sample to firms from the same countries as the G-SII to control for country factors (e.g., regulatory or macroeconomic) that might affect performance even in the absence of the G-SII effect. [15]

[14] We use FTSE's Industrial Classification Benchmark to classify the insurance firms as Life, Full or Property and Casualty and use ORBIS to verify that firms do not engage in substantial reinsurance activity. Leaving aside health insurance, we note that insurance firms are typically categorized as life and full, property and casualty, or reinsurance firms. For a discussion of the IAIS analysis of systemic risk in these categories see the consultative document from the International Actuarial Association, "Actuarial Viewpoints on and Roles in Systemic Risk Regulation in Insurance Markets," May, 2013, http://www.actuaries.org/CTTEES_INSREG/Documents/IAASystemicRiskRegulationPaper_Final_May2013.pdf . Additionally, see Harrington (2011) who argues that property and casualty firms have less systemic risk than life and full insurance firms. The IAIS concludes that the bulk of reinsurance firm activity is unrelated to systemic risk. See IAIS July 19, 2012 documents: IAIS, "Reinsurance and Financial Stability," www.iaisweb.org/view/element_href.cfm?src=1/15854.pdf and Business Insurance, http://www.businessinsurance.com/article/20120719/NEWS04/120719879. See the IMF (April 2016) Global Financial Stability Report, IMF Survey, (Chp. 3) for a discussion of systemic risk for insures and its relationship to interest rate risk and asset price swings. For a synopsis and links to the report, see: http://www.imf.org/external/pubs/ft/survey/so/2016/pol040416a.htm

[15] Exhibit 3.6.1 in Nissim (2010) identifies country-level factors that could affect insurance firm performance.

Based on the classification of life/full and country restrictions, we then search for insurance companies with 2007 - 2014 financial statements in Bureau van Dijk's ORBIS data set, and with systemic risk data at NYU Stern's Volatility Laboratory (V-Lab).[16] The V-Lab data covers large firms as they tend to have the most systemic risk, which is consistent with the IAIS selection process. Further, numerous prior papers provide evidence that the financial performance of large and small insurance firms differs systematically.[17] These screens leave us with 22 other life insurance firms (OLIF) for comparison. A list of our sample firms is in the Appendix.

Table 2 lists and defines our measures of size, returns, and risk. We have three measures of size (total assets, gross premiums, and market capitalization), three measures of returns (investment yield, ROE, and ROA), and five measures of risk (solvency ratio from the balance sheet, leverage calculated from both balance sheet and market data, the market Beta, V-Lab's Systemic Risk (SRISK) measure, and CDS spreads). Higher values of the solvency measure indicate less risk, while higher values of the remaining risk measures indicate more risk.

Table 3 provides summary statistics for the 2012 values of these financial statement and risk variables, with tests of differences for the G-SII versus OLIF.[18] Here, and in all

[16] ORBIS data is based on financial data in firm annual reports. In cases when ORBIS has incomplete data, we verified and supplemented the ORBIS data using annual reports. (This was done for AIG, American National Insurance Co., China Life Insurance Co., China Pacific Insurance, Generali Deutschland Holding, Genworth Financial, Hartford Financial Services, Legal and General Group Plc, Metlife, Nuernberger Beiteiligungs, Primerica, Prudential Financial). The V-Lab risk data is collected by the Stern School at New York University. See Acharya et. al. (2010) and http://vlab.stern.nyu.edu/ .

[17] Examples include: Kellner and Mathewson (1983), Kroner and West (1995), and Karaca-Mandic, et al. (2011).

[18] The May 2012 IAIS method document says that the regulators would rely on 2010 financial statements to make their designation decisions. We present the 2012 data because those are the most recent data available to investors at the time of the 2013 designation announcement. If we conduct the same tests of differences in Table 3 on 2010 data, we find the same significant differences as with 2012 data. The two exceptions are that the solvency ratio is significantly higher for OLIF than G-SII, at the 10% level, in 2010, but not significantly

subsequent tables, values significant at the 5 or 1% levels are in bold type, while those significant at the 10% level are marked with an "*." The tests show that, with means or medians, prior to G-SII designation the G-SII as a group are larger than the OLIF (measured with assets, gross premiums, or market capitalization), have higher levels of market or systemic risk (measured with the market beta or SRISK), and have lower balance sheet solvency (with means and weakly with medians). There are no significant differences at the five percent or better level between the G-SII and OLIF with respect to returns.[19]

One possible interpretation of the results in Table 3 is that the FSB and IAIS simply selected the largest insurance firms as G-SII, or the firms with the highest systemic risk. However, Table 4 provides a ranking of the 30 largest insurance firms in the world as of 2012 with the G-SII in bold type and the OLIF in italics. The G-SII and OLIF are dispersed across this set. The systemic risk values for our sample firms confirm this pattern for systemic risk, as documented in Table 4A in the Internet Appendix. Additionally, as noted above, the IAIS document (May 2012) that lays out the method for selecting the G-SII indicates that a substantive analysis was done to choose the G-SII firms. We conclude that the nine G-SII choices are not based solely on publicly available measures of firm size or systemic risk.[20]

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different in 2012, and that OLIF CDS spreads are significantly higher in 2010, but not significantly different in 2012. See Table 3A in the Internet Appendix.

[19] We also collect data on government ownership: the percentage of shares held by the firm's home country federal government; non-federal home government shares (e.g., a state government in the U.S.), and non-home-government shares (e.g., Norway's sovereign wealth fund). These shareholdings do not significantly differ across the G-SII versus OLIF, though we note the high government ownership for Chinese firms in both groups.

[20] For example, Aviva's 2012 annual report provides details on global operations, derivatives use and intra-group assets and liabilities, but does not provide clean measures for variable annuities or premiums for export credits, two of the measures on the IAIS list. ORBIS' accounts provide only the relevant size measures. We note that the IAIS and FSB did not make the data they used in their assessments (five categories, 30 variables) publically available.

The information in Table 3 confirms that prior to G-SII designation the OLIF and G-SII are not "otherwise identical." Moreover, the anticipation and implementation of the new G-SII international regulatory regime could affect the OLIF performance during our sample period. To the extent that the new regulations lower system-wide risk, the OLIF could also benefit from lower borrowing costs. Or, as we have seen in the U.S. with the implementation of new Dodd Frank banking regulations, local regulators could extend the more rigorous international rules to a broader set of local firms, raising compliance costs for all.[21] For these reasons, the OLIF sub-set does not constitute a "randomized control group" of firms identical to the G-SII except for the "treatment," i.e., G-SII designation. On the one hand, the OLIF are the closest, most obvious match firms available – the largest insurance firms in the same line of business from the same countries. On the other hand, they are not perfectly matched and policies affecting the G-SII can indirectly have an impact on the comparison group. As a result of these issues, we provide the OLIF numbers as a benchmark for comparison, but are careful not to interpret the results as a formal "difference-in-differences" analysis.

We conduct four different event studies: on firm equity returns, expected implied asset risk, default probabilities, and bond returns. Summary statistics for these variables are at the bottom of Table 3. Firm equity returns are calculated from Datastream firm-specific return indices. The mean value for daily G-SII equity returns of 0.0005 (or, 0.05%) does not differ from the OLIF return. We calculate implied asset risk for all eight G-SII firms and 14 OLIF as the firm's implied equity volatility, from daily option price data in Datastream, multiplied by the ratio (Equity/(Debt + Equity)), from V-Lab's leverage time

[21] See, e.g., American Banker's Association, "Dodd Frank and Community Banks," 2012, http://www.aba.com/aba/documents/dfa/dfguide.pdf

series.[22] With both means and medians, the OLIF have a higher level of implied asset risk. The proxy for default probability is the one year horizon Probability of Default (PD) measure from the Credit Research Initiative (CRI) at National University of Singapore's Risk Management Institute, available for 8 G-SII and 16 OLIF.[23] The median G-SII value of 0.0041, which can be interpreted as a 0.41% chance of default over a one year horizon, is significantly different from the OLIF value of 0.0026, while the means do not differ. We have daily bond data, from Datastream, for seven of the G-SII and 13 of the OLIF. We use data for "plain vanilla" bonds outstanding as of the initial AIG bailout in our event window, that were issued on the firm's home country exchange and in the home currency with price series covering at least 2008-2013.[24] This allows us to focus on changes in value for bonds whose initial value was set prior to our event window. Thus, the future changes in value that we measure can cleanly capture changes in value from events in our window because these changes are measured relative to a baseline value set prior to any expectation of regulatory intervention on a scale that began with the AIG bailout. The value of these bonds is also unaffected by the impact of G-SII policies on special bond provisions such as call features. We use the "total return" series, but confirm that returns with the "clean price"

[22] See Correia, Kang, and Richardson (2013) for a description of this method and a comparison of it with other methods to calculate asset volatility. Datastream calculates implied volatilities from American equity options with the Cox-Rubenstein binomial model. See "Datastream: Options User Companion" February 2008. We use their continuous call series, which are calculated using one year options. The average correlation across our sample firms for the continuous call and put series is 0.96.

[23] The International Monetary Fund is a partner with CRI and uses these data in stress testing analysis. CRI uses a forward intensity model described in Duan, Sun and Wang (2012), Duan and van Laere (2012), Duan and Fulop (2013) and RMI staff (2015) that has six input variables: the country's stock index return and interest rate, and firm-specific proxies for volatility-adjusted leverage, liquidity, profitability, relative size, market misevaluation/future growth opportunities, and idiosyncratic volatility. Duan and Miao (forthcoming), Duan and Wang (2015), Kanno (2014) and Shin and Kim (2015) use these data. The CRI provides default probability estimates for multiple horizons. We present results for the one-year horizon and note that average correlations for abnormal changes calculated with the other horizon are above 0.95.

[24] We use only one bond per firm. Where a firm has more than one bond that meets our criteria, the correlation in bond prices is over 90%

series are highly positively correlated. The mean value for G-SII of 0.0003 (or, a 0.03% return on bond prices) does not significantly differ from the OLIF mean of 0.0005.

## 4. Empirical results

In this section, we begin by documenting sizable positive abnormal stock returns for the G-SII in our event window. We next examine changes in implied asset risk, default probabilities, and bond returns over the same period to examine the extent to which moral hazard, risk shifting, or regulatory costs may have affected the equity results. We also examine the relation between these abnormal returns and firm-specific measures of risk.

### *4.1 Event window abnormal stock returns*

We first examine whether equity investors in insurance firms benefited from the G-SII designation with an event study of abnormal stock returns for each of the eight FSB G-SII-related announcements, and compare the results with abnormal stock returns for the OLIF. The event window captures the first announcement that could reasonably be expected to affect expectations, the following relevant interim announcements, and the final date when the FSB revealed the protected firms. This setting has several advantages for an event study. It allows us to measure the impact of changes in market expectation from the initial event all the way through to the final announcement of the firms to be protected. We also have cleanly verifiable announcement dates allowing us to carefully measure the effects of changing expectations over our time frame. [25]

[25] It is common for regulatory event studies to examine reactions to multiple announcements. The earliest finance-related example we could find is a 1988 study of New York's 1985 changes in takeover statutes (Schumann 1985). More recently Bongini, et al. (2015) conduct an event study of three FSB announcements related to designating systemically important banks. Most of these studies find significant reactions to only a subset of the announcements. The earlier studies, like Schumann, tend to have samples that only include the firms ultimately affected by the proposed regulations, while later studies, like Bongini et al, tend to look at both the affected firms as well as a set of non-affected firms.

Nevertheless, the setting does have some drawbacks that we address in the empirical methodology. Because we have the same announcement dates for all insurance firms, i.e., event date clustering, we must take account of correlations across the sample firms when determining joint significance of the announcements. Typically, studies accomplish this by measuring abnormal returns with an equal or value weighted portfolio of sample firm returns.[26] The portfolio returns are regressed against a constant, the market return, and event day dummy variables set equal to one for the event window days, e.g. three dummies for the event window (-1, 0, +1). The cumulative abnormal announcement return (CAR) for any given announcement equals the sum of the 3 event day dummy coefficient estimates.

Our case is complicated by the fact that we have insurance firms from multiple countries. If we were to regress a portfolio of the insurance firm returns against a portfolio of country market returns, we would be restricting each firm's market beta to be equal across the six country market returns, introducing noise into the estimation. Instead, we measure joint significance in a SUR format, which controls for heteroskedasticity and contemporaneous correlation across the insurance firm error terms. The SUR has 30 equations, one for each insurance firm:

$$R_{GSII1} = \alpha_{GSII1} + \beta_{GSII1} R_{MKT:GSII1} + \sum_{e=1}^{24} \gamma_e D_e + \varepsilon$$

$$\vdots$$

$$R_{GSII8} = \alpha_{GSII8} + \beta_{GSII8} R_{MKT:GSII8} + \sum_{e=1}^{24} \gamma_e D_e + \varepsilon$$

$$R_{OLIF1} = \alpha_{OLIF1} + \beta_{OLIF1} R_{MKT:OLIF1} + \sum_{e=1}^{24} \delta_e D_e + \varepsilon$$

$$\vdots$$

[26] See Karpoff and Malatesta (1995) and Malatesta (1986) for a discussion of the econometric issues.

$$R_{OLIF22} = \alpha_{OLIF22} + \beta_{OLIF22} R_{MKT:OLIF22} + \sum_{e=1}^{24} \delta_e D_e + \varepsilon \qquad (1)$$

where the subscripts "GSII1" through "GSII8" ("OLIF1" through "OLIF22") refer to the eight G-SII (22 OLIF) firms. Each equation includes a constant (α), the insurance firm's home country market return ($R_{MKT}$), and the event day dummy variables (24 dummy variables, D, three for each of the eight announcements). We allow the intercepts and market betas to differ across firms, but restrict each event day dummy to be equal across the eight G-SII (equal across the 22 OLIF) allowing us to test whether, on average, each set of firms has a significant reaction to each announcement, and whether those reactions differ between the two sets of firms.[27]

Because the announcements span 5.5 years (we use data from January 1, 2008 – July 19, 2013), we first test, for each firm, whether its alpha and market betas vary over time. We fit a market model equation with the alpha and beta estimated separately for each of the six calendar years and then test for equality across the alphas and across the betas. If we reject equality, then we keep the separate year-based estimates in the SUR specification. If we do not reject, then we collapse the alpha or beta estimates into a single coefficient, as represented in equation (1) above. Equality of the alphas is rejected for two of the firms, while equality of the betas is rejected for 27 of the 30 firms.

Table 5 provides the CAR equity estimates from the SUR specification for the G-SII and OLIF samples. Figure 1, Panel A, provides a graph of the equity CARs cumulated across the eight announcements. The results in Table 5 show that the G-SII CARs are

[27] Bongini et al. (2015) use a similar methodology to estimate abnormal responses to the FSB announcements for banks. They show that results with this method closely parallel results with several non-parametric measures of abnormal returns. To account for time zone differences, we shift the time series data for the Asian firms one day so that the trading period that corresponds to the European FSB's announcements lines up in event-period-time.

related in a statistically significant and positive way to two announcements: we find a 5.0% increase for event #1, the AIG bailout, and a 5.3% increase for event #6, when the IAIS released a report on the identification method for G-SII. The sum of G-SII CARs for all eight G-SII-related announcements is 11.7%, significant at the 1% level. The OLIF have no significant CARs. The three significant G-SII CARs are significantly different from the OLIF CARs.

To examine the cross section of responses, we calculate firm-specific abnormal price changes with individually-estimated firm equations, where we use the same explanatory variables and specifications as in the SUR analyses. If we multiply each G-SII's abnormal return for each announcement times its outstanding market capitalization and then sum across all announcements and firms, we find a total net increase in market capitalization of $17.2 billion. [28] The median G-SII CAR is 12.0%. Seven of the OLIF have significantly positive equity CARs while 8 have significantly negative equity CARs, consistent with average effects near zero.[29]

To ensure that the results are not driven by confounding announcements within the event windows, we searched Factiva for *Wall Street Journal* articles on the 8 G-SII within the 8 announcement windows. Out of 64 windows (8 announcements for 8 firms), we found 5 possible confounding announcements (e.g., a merger or acquisition, earnings

[28] The G-SII equity gain of $17.2 billion we report corresponds to a -$7.1 billion loss for Allianz and a total +$24.3 billion gain for the other seven G-SII firms. The Allianz loss was likely driven by the fact that Allianz was in the process of selling its poorly performing bank, Dresdner Bank, to Commerzbank Bank during the event period. See:
https://www.allianz.com/en/invest)or_relations/announcements/ir_announcements/archive_2008/page10.html)

[29] The largest G-SII CAR equals 20.3% for Metlife, while the smallest CAR equals -11.1% for Allianz. Allianz is the only G-SII with a negative CAR, likely resulting from the aforementioned sale of Dresdner Bank. All of the G-SII summary equity CARs are significantly different from zero. The median OLIF CAR is 0.11%. The largest OLIF CAR equals 38.7% for CNO Financial, while the smallest equals -18.9% for Unipol. See Table 5&6A in the Internet Appendix for the firm specific summary abnormal returns.

announcement, senior management turnover). When we exclude these firms/windows from the estimations, the results do not change; this is due at least in part to the fact that the confounding announcements are in windows that show no abnormal returns in the Table 5 analysis (events #2, 3, and 8). See Table 5B in the Internet Appendix. Finally, to confirm that results are not affected by firms with government ownership, we conduct the SUR estimation without the four G-SII and three OLIF firms with home federal government ownership. The results do not change.[30]

*4.1. Abnormal changes in implied asset risk, default probabilities and bond returns*

The positive G-SII abnormal return, absolutely and relative to the OLIF, is consistent with equity investors believing the benefits of the G-SII designation outweigh the costs. To determine what is driving the positive equity returns, we provide a companion analysis by examining contemporaneous changes in three other areas: unlevered implied asset volatility, default probability, and bond prices. Ideally we would directly examine the cross section of these price responses in a multivariate regression. This would allow us to examine more closely the relative importance of changes in each measure for equity returns. However, we are prevented from doing so by our sample size, and so examine each aspect individually.

If the positive equity investor return is driven by an expectation that the G-SII firms will invest in riskier investments, asset risk will increase due to the moral hazard effects of TBTF insurance and we would expect to see an increase in implied asset risk in the event

[30] When we consider government ownership, the first G-SII CAR is still significant, but slightly smaller than that reported in Table 5, the sixth CAR is also significant and slightly larger, but the summary CAR, at 0.114, is almost the same. We also conduct the event studies that follow, for default probabilities, bond returns and implied asset risk on the subset of firms that do not have government ownership. The results of interest do not change. The only difference is that the summary measure for G-SII abnormal change in implied asset risk is now significant. These results are provided in the Internet Appendix, Table 5C.

window. Similarly, if asset risk increases, the probability of default should increase, unless the regulatory requirements from G-SII designation are sufficiently strong to offset the increased risk effects.

The effect on bond values is less obvious, and most easily framed in terms of expected value. Generically, expected bond value can be thought of as the sum of the expected values in two states of the world – "default" that results in some expected partial payment *E(PP)* and "no default" that results in full payment *(FP)*. Note that *FP* is a known amount so no expectation operator is required. Each state of the world has a probability associated with its payout ($\pi_{PP}$ and $\pi_{FP}$, respectively). Thus, total expected value at any point in time for debtholders can be expressed as the sum of the expected outcomes (*t* subscript omitted):

$$\begin{aligned} TEV(debt) &= \pi_{PP}\, E(PP) \;+\; \pi_{FP}\, FP \\ \textit{where:} \quad & \pi_{PP} \;+\; \pi_{FP} \;=\; 1 \\ \textit{and:} \quad & E(PP) < FP \end{aligned} \qquad (2)$$

If default occurs, the actual value for *E(PP)* will be set by a bankruptcy court. While bondholders' valuation of *E(PP)* likely varies over time, almost surely bondholders have a number less than full value (*FP)* in mind for *E(PP).* Our focus on bond value allows us to measure bondholders' valuation of this expected total value as it changes over our event window.

In the absence of regulatory protection, any increase in risk will increase the probability of default, increasing $\pi_{PP}$ and decreasing $\pi_{FP}$. Recall that the bonds we examine are "plan vanilla" bonds, so there is no change in promised cash flows or maturity dates for the bonds over the event window. The *FP* of a "plain vanilla" bond is not affected,

as this is stated in the bond contract. So, in this scenario, the value for *FP* is unaffected, but has a smaller probability of occurring; *E(PP)* is obviously smaller than *FP*, but now with a larger weight. Bond value must fall. This is the classic case of "risk shifting" from equity to debt through a change in asset risk.

However, the outcome can be quite different with regulatory protection. In the event that regulation does nothing to provide additional policies or support to manage the likelihood of default, we know that taking on more risk again increases the probability of default, so once again we have an increase in $\pi_{PP}$ and a decrease in $\pi_{FP}$. *FP* remains the same. Thus, unless *E(PP)* is expected to be higher with regulation than without, bond value must fall. Alternatively, if regulation does result in additional safeguards, the safeguards themselves could affect $\pi_{PP}$ and/or *E(PP)*, even with an increase in asset risk. The sum total effect on expected value will depend on the two outcomes from regulatory polices/actions: the extent to which the probability of default $\pi_{PP}$ has fallen/risen, and the extent to which additional regulatory safeguards increase or decrease the expected payouts *E(PP)* in a regulated resolution process. It seems most likely that regulatory protection will cause $\pi_{PP}$ will fall (causing the probability and expected value of a full payout to rise). However, the actual outcome for *PP* is less clear, and thus the net effect of changes in the expected value in either the "default" or "non-default" outcome is unclear. Given the complexities of regulatory resolution procedures, we have no priors on which effect will dominate, but view this as an empirical question which we address below.

We now turn to results in Tables 6 and 7. Table 6 reports results of event studies for the insurance firm implied asset risk, default probability (PD) estimates, and bond

returns.[31] Table 7 provides an analysis of the cross-sectional relationship between risk measures and implied asset risk, PD estimates, and bond returns.

*4.2.1 Implied Asset Risk Results*

The left hand side of Table 6 reports results from the implied asset risk SUR. Each equation is a regression of the first difference of the implied asset risk time series against year dummy variables and the 24 event day dummy variables. Figure 1, Panel B documents the changes in implied asset risk over the event period. The results in Table 6 show a positive and significant jump in implied asset risk for G-SII of 0.0022 in response to the AIG bailout. This increase is significantly larger than the OLIF change. Across all eight announcements, the abnormal change in implied asset risk is positive for the G-SII, with a p-value of 0.167, and essentially zero for the OLIF.[32] Six of the G-SII have a significantly positive summary abnormal reaction (with none significantly negative).

If we look at each firm's summary abnormal change in asset risk relative to the firm's average daily asset risk value, we find that the median expected increase in asset risk across the G-SII is 19.8%.[33] This pattern is consistent with a general, broad assessment that most of the G-SII firms will increase asset risk, consistent with a moral hazard reaction on the part of the G-SII. The OLIF summary abnormal returns are more mixed, with five significantly positive and four significantly negative, but with net effects being quite small for the group.

[31] As above, we restrict the event dummies to be equal across the G-SII and across the OLIF for each set of reported results in this section

[32] If we conduct a SUR with the option price implied volatility (without de-levering), we get similar results. See Table 6C in the Internet Appendix.

[33] If we do the same calculation for each firm's abnormal change in response to just the AIG announcement, the average expected increase in G-SII asset risk is 25%.

*4.2.2 Default Probabilities Results*

Each equation in the PD SUR is a regression of the first difference of the PD time series against year dummy variables and the 8 event month dummy variables. The middle section of Table 6 reports the abnormal changes in the probability of default estimates for each announcement and across all announcements. The point estimates in Table 6 suggest that G-SII default probabilities fell for all announcements, with the exception of announcement #3. Four of the drops for individual announcements and the summary over all announcements of -0.0043 were statistically significant for the G-SII. These event study numbers are represented visually in Figure 1, Panel C. The figure shows the clear downward trend in G-SII default probabilities. All changes for the OLIF are negative with one significant change for the sixth announcement. The sum effect is negative, but not statistically significant, though the OLIF and G-SII sum effects differ significantly from each other.

Across the eight G-SII firm-specific summary abnormal changes for default probability, two firms have significantly negative changes, none significantly positive.[34] The great majority of the OLIF show no change; one firm has a significant negative cumulative change, one significantly positive. As a proxy for the economic magnitude of the effect of the G-SII announcements, for each G-SII, we calculate the ratio of the summary abnormal change in default probability to the firm's average monthly 2008-13 default probability value. The median value of this ratio is -0.355, suggesting that the G-SII announcements are associated with a drop in G-SII default probabilities of

[34] The two G-SII firms with significant summary decreases in default probability are Ping An and Assic. Generali. Inferences from the SUR results do not change if we exclude Ping An.

approximately one-third, with most of this effect coming in the middle announcements as newly revealed details on the process clarified which firms would more likely fall under the new system's umbrella. These results are consistent with investors believing that regulatory policies, on average, will lead to lower default probabilities for G-SII and OLIF firms, though it is worth noting that the changes for the OLIF, while negative, are much smaller than those for the G-SII. This feature of the results is consistent with the G-SII firms having clearer protection in case of default. The OLIF result, taken alone, is consistent with investors' expectation that even non-regulated insurance firms may benefit from increased protection in case of a general meltdown in the financial sector. The median estimate for the OLIF equals -0.152.

*4.2.3 Bond Price Results*

Each firm's bond return equation in the SUR is a regression of the time series of daily bond returns, against an intercept, the daily return from a home country government bond index, and the 24 event day dummy variables. The intercept and government bond coefficients are separately estimated for each year if we reject equality of the year-based coefficient estimates.[35] As discussed above, we restrict our sample of bonds to those "plain

[35] We use the home country government bond index to compute abnormal returns because it is the most consistent measure across countries that is available for local long term bond returns. Of the 20 firms, 19 have significant government bond return coefficient estimates. Returns for the 10year government bond indices are highly correlated with the "all issues" index that we report in the table. We reject equality of the year intercepts (year-based government bond coefficient estimates) for 14 (12) of the 20 firms with data. See Table 6B in the Internet Appendix for event study results following the method recommended in Bessembinder et al. (2008). This procedure, which calculates daily abnormal returns independently for each firm and then tests for differences with a t-test or median rank sum test, suffers from event date clustering. The Bessembinder et al. approach results in larger abnormal return estimates and more significant test statistics. The general pattern, though, is the same as that reported for the SUR in Table 6, G-SII bond holders lose in the first event and overall. The first change is significantly greater than the OLIF change, the overall change is not.

vanilla" bonds that were outstanding prior to the AIG announcement, and that remained active during our event window.[36]

The far right columns of Table 6 show that both G-SII and OLIF bond prices fall by a statistically significant amount in response to the AIG bailout, with no significant difference between the two. No other announcement has significant abnormal bond returns, on average, for either set of firms, nor are cumulative returns significant for either group or between the two groups, though cumulative returns are negative for both. Figure 1, Panel D illustrates this pattern in bond prices for both groups. Across all of the announcements, five of seven G-SII have a significant negative abnormal bond return, while six of the 14 OLIF have a significantly negative abnormal bond return and one has a significant positive abnormal return. The median G-SII (OLIF) summary bond return equals -3.4% (-0.0076). Across the G-SII, our estimate of the total change in bond value in response to the AIG bailout equals $3.8 billion.[37]

In the context of the earlier discussion on possible bond responses to regulation, the documented drop in bond prices we find for announcement #1 is consistent with a broad concern that the financial crisis could affect insurance firms before regulatory safeguards were in effect to protect them, i.e., an increase in $\pi_{PP}$ and a fall in E($PP$) due to revised expectations of the health of the firms. Given the sudden and dramatic nature of the AIG bailout, this a reasonable interpretation. In contrast, this initial response, as well as the general downward trend in bond prices over the subsequent announcements, are also

[36] This results in bond data availability for seven of the eight G-SII (omitting AIG) and 14 of the OLIF.
[37] The $3.8b equals each firm's bond AR times total debt reported on the firm's 2007 annual report balance sheet. Total debt includes long term and short term debt, publicly traded and privately held (e.g. bank) debt, so this estimate represents an upper bound.

consistent with a regulatory scenario where both the probability of default ($\pi_{PP}$) and the expected payout *E(PP)* drop. Official discussions of regulatory "bail-in" provisions ( requiring bondholders to take a "haircut" in the event of default) were only preliminary at the beginning of our event window, but were formally proposed by the FSB in 2011, around announcement #4.[38] In addition, there may well have been a general expectation of losses that would occur with regulation, particularly given the focus in the media on the expected costs of regulation.

*4.3 Cross Section Results*

If the abnormal changes in G-SII stock returns, default probabilities, option and bond prices are driven by lower risk exposure from the TBTF guaranty, we should find that the abnormal responses of these prices are correlated with the cross section of firm risks. Among the G-SII, the TBTF guaranty should be of greatest benefit to the riskiest firms. If true, we should find that abnormal stock returns are positively correlated with firm-level measures of risk, while changes in default probability should be negatively correlated with risk. A positive correlation between the change in G-SII implied asset risk and firm risk is consistent with expectations that the moral hazard effects will be strongest for the riskiest firms. A positive correlation between bond returns and firm risk is consistent with the TBTF guaranty causing expected payoff value for bondholders to increase for the riskiest firms, while a negative correlation is consistent with market expectations that TBTF policies will cause investors to have lower expectations for expected payoffs for the riskiest firms.

[38] Active and detailed public discussion of a G-SIFI creditor "bail-in," did not occur until mid-2010. A 2011 FSB document, as well as a joint FDIC/Bank of England (2012) white paper, indicate G-SII resolution would entail first, wiping out equity holders, and then writing down and transforming debt into equity.

Again, we would prefer to measure the relation between firm risk and abnormal price responses with regressions where we place the abnormal price responses on the left hand side and measures of firm specific risk on the right hand side. The small sample size of 8 G-SII and 22 OLIF, however, renders that analysis impractical. Instead, we rely on Spearman rank correlations. Table 7 provides the Spearman rank correlations for the abnormal changes in stock prices, implied asset risk, default probability, and bond returns with firm measures of risk.[39] We report the correlations for the instances when the SUR results in Table 5 and 6 suggest significant reactions. Correlations are calculated for each announcement's firm specific abnormal return with the risk measure as of the prior year to the announcement.

Focusing first on the G-SII, the equity CARs are positively related to risk in announcement #1 (CDS spreads only) and #8 (Leverage, Beta and SRISK), consistent with the O'Hara and Shaw (1990) results. Implied asset risk is positively associated with one measure of risk for both announcements #1 and #8. The bond returns, for announcement #8 are significantly positive for two risk measures, consistent with Penas and Unal (2004) who find bondholders gain in bank mergers among medium sized banks where the combined assets push the bank above the TBTF threshold. These results show that equity returns, expected asset risk, and bond returns went up the most (or fell the least in the case of bond returns) for the riskiest G-SII.

There are almost no significant correlations for default probabilities. For announcement #6 there is a weakly negative correlation with CDS spreads. For announcement #7, there is a significant positive correlation with SRISK. The negative

[39] We focus here on the market-based measures of risk. We also examine solvency measures from the balance sheet, and results – while insignificant - are generally consistent with results from the market analysis.

correlation is consistent with the TBTF guaranty lowering default probabilities the most for the riskiest firms. We are unsure about the interpretation of the positive correlation for announcement #8, but note that while this announcement the initial set of G-SII firms, additional information may have been made available within the announcement or its interpretation that day that affected this correlation.

It is interesting to note that across the G-SII, and across all announcements, the correlation between the abnormal changes in implied asset risk and default probabilities equals -0.96; i.e., the firms expected the benefit the most from a drop in default probability are also the firms expected to increase asset risk the most. As an indication of whether these expectations were born out, we examine the correlation between the abnormal price effects and changes in total assets and leverage from 2012 through 2015.[40] The correlation between the G-SII summary abnormal changes in implied asset risk and changes in total asset (leverage) is 0.83 (-0.64). The comparable numbers for summary abnormal changes in default probability are 0.85 (-0.71). Thus, the firms expected to increase asset risk the most did add to their asset base the most and increase leverage the most.

For the OLIF, the probability of default dropped for the riskiest firms with announcement #6. This pattern is consistent with the new regulatory regime making all firms less risky. The abnormal bond returns exhibit strong negative correlations across several measures of risk and both announcements. All of the correlations are negative, opposite in sign from the G-SII bond return correlations. For OLIF, bond returns fall the most for the riskiest firms, while they rise the most for the riskiest G-SII. This pattern is

[40] Leverage is calculated as "external Borrowings/Total assets) as External Borrowings was the only measure of debt we could get across all firms. The reported results exclude AIG, but hold when AIG is included.

consistent with investors recognizing that the G-SII fall under and the OLIF fall outside of the TBTF umbrella.

## 5. Reactions in the U.S. to FSOC announcements

Technically, the FSB is an advisory body, so its recommendations for SIFI designation and control are not binding. In reality, since 1) all major relevant national regulatory bodies are FSB members, and 2) the FSB mandates that member countries implement its policy decisions, the FSB pronouncements are *de facto* binding. In the U.S., responsibility for designating SIFIs falls to the FSOC while implementing any resolution of financial distress for these firms is the responsibility of the Department of the Treasury, the Federal Reserve Board (FRB) and the FDIC.[41] We confirm that the FSOC announcements of G-SIFI implementation do not confound our FSB event study by examining whether FSOC announcements during the FSB event window affect results for U.S. firms. We focus on events concerning the designation of the two U.S. G-SII firms in our sample, Metropolitan Life and Prudential Financial. (Again, we exclude AIG because its bailout eliminated any uncertainty about its TBTF guaranty.) Table 9 provides the event dates and descriptions of 10 FSOC SIFI-related announcements from April 2012 to October 2014.[42] The first six of these announcements fall within the FSB-announcement window examined above.

We conduct an event study with the same format as for FSB announcements. Using daily returns from April 2011 through October 2014, we fit a SUR specification with one

[41] As with banks, the U.S. Dept. of the Treasury and the Federal Reserve Bank would be involved in G-SIFI resolutions for the G-SII but the actual resolution process, when needed, is supervised by the FDIC. We thank Charles Klingman at the FSOC and John O'Keefe and his colleagues at the FDIC for providing detailed information on this process. Wallison (2014) concludes "The FSOC just followed the FSB's lead." Harrington (2011) provides background on FSOC's creation through the Dodd-Frank Act.

[42] We extend the final date for this study beyond that of the FSB announcements to more fully capture the decisions regarding MetLife and Prudential.

equation for MetLife and one for Prudential. The equations have dummies for each calendar year and 30 event day dummies (3 event days for each of the 10 announcements). The stock return specification also includes returns for the Datastream total U.S. market index, while the bond return equation includes a return for U.S. government bonds. Both of these market returns are interacted with the year dummies. The default probability SUR use monthly data over 2008-14.

The results of the four SUR specifications, for stock returns, changes in default probability, changes in implied asset risk, and bond returns, are presented in Table 9. The most striking result in the table is the absence of almost any significant abnormal stock price changes. The lack of significant price reactions to the FSOC announcements is consistent with the interpretation that investors anticipated FSOC actions based on information provided in the FSB decisions and thus embedded their perceived TBTF value effects for U.S. firms early in the FSB process. The FSOC actions appear to have added little new information.

The single exception to this lack of reaction is the negative 5% abnormal stock return for both firms in response to announcement #7, which occurred outside the FSB-announcement window, when regulators rejected Prudential's appeal of its proposed U.S. SIFI designation. This negative reaction may corroborate the concerns expressed by the heads of both Prudential and MetLife that they did not need, nor would they benefit from, the SIFI designation, as evidenced by their active campaign against and their formal protest of their proposed SIFI designations.[43]

[43] See, e.g., http://www.insurancejournal.com/news/national/2014/06/03/330722.htm and http://blogs.wsj.com/moneybeat/2015/06/02/sifi-label-may-not-bite-metlife-as-hard-as-prudential/

Regardless of interpretation, it is important to note that the 5% value drop in response to the seventh FSOC announcement does not reverse the overall positive reaction to the eight FSB announcements, equal to 20% for MetLife and 14% for Prudential. Even after factoring in the local U.S. designation process, our results support a conclusion that the net value of the TBTF guaranty is positive for these two firms.

## 6. Cross country comparisons

The value of the TBTF guaranty may systematically vary across countries. Discussing banking regulation, Kane (2000, p. 40) argues that local systems for "transparency, deterrence and accountability" affect "private and government regulator's capacity for valuing banking institutions, for disciplining risk-taking and resolving insolvencies promptly and (above all) for being held accountable for how well they perform these tasks." The impact of strong or weak institutions could easily apply to insurance firms. Kane's argument suggests that the incremental benefit of FSB designation as G-SII may be smaller in strong institution countries since rigorous and effective regulatory oversight should reduce the probability of failure and, thus, the value of a TBTF guaranty. An alternative interpretation with similar predictions is that the relative value of the TBTF promise could be greater in the weak institution countries because the new regulatory regime adds transparency to a currently opaque system.

To examine these possibilities, we calculate a country-level TBTF "premium" as the difference between the (average if more than 1) G-SII and OLIF CARs. These country-level premiums equal: Germany (-14.5%), U.K. (7.9%), U.S. (14.6%), Italy (17.5%), China (19.8%), and France (30.3%). Figure 5 plots these premiums against the quality of the country's insurance regulations, measured with the IMF's assessment of how many of the

IAIS' insurance core principles the country is observing or largely observing.[44] The compliance values equal: China (68%), France (81%), Italy (81%), U.S. (89%), U.K. (93%), and Germany (100%). The correlation between the TBTF premiums and the regulatory quality measures is -0.76. The slope coefficient in Figure 5 of -1.035 suggests that a movement from France or Italy's level of compliance (81%) to the UK level (93%) would be associated with a drop in the TBTF premium of 12.4%. This 12.4% equals 0.97 of a standard deviation of the CARs. A lower incremental TBTF value in relatively strong institution countries is consistent with Kane's argument that strong institutions contribute to more effective regulatory oversight.

The results are similar if we use alternative, more common measures of institutional quality (the Rule of Law, Regulatory Quality, and Control of Corruption indices from the World Bank Worldwide Governance Indices, and the index of Economic Freedom from the Heritage Foundation). This result is not surprising since the average correlation between these indices and the IAIS compliance measure is 0.88. Moreover, the patterns are the same if we use the G-SII – OLIF premium calculated with the abnormal changes in default probability and implied asset risk (we have insufficient observations for the bond returns to conduct this analysis). These results are available in the Internet Appendix, Figure 5 Addendum and Figures 5A and 5B.

Clearly, given the small sample, these results are only indicative, but they do suggest that some country-level differences in the value of the TBTF guaranty exist, and these differences vary systematically with the rigor of country-level institutions.

[44] These values are taken from country reports conducted under the IMF's Financial Sector Assessment Program (FSAP), available on the IMF website. Compliance with each IAIS Insurance Core Principle is ranked as: Observed, Largely Observed, Partly Observed, and Not Observed. The six country reports that we use are dated: Italy and France (2013), China (2012), Germany and the U.K. (2011), and U.S. (2010).

## 7. Conclusions

The 2008 bailout of AIG was the first time a federal government bailed out a major global insurance company. Five years later, in 2013, the FSB extended the G-SIFI umbrella to cover nine insurance firms located in six countries. These two events, plus related interim announcements, provide a well-defined window that yields a relatively clean estimate of the net value of a TBTF guaranty.

We provide evidence that investors expected G-SII regulation to reduce the probability of default, thus providing a larger safety net to the financial system. But we also show that this comes at a cost: equity investors expect that the potential benefits of the TBTF guaranty to them will outweigh potential compliance costs for the designated firms, with median stock prices rising 12.0% across the eight announcements, corresponding to an economically significant net increase in G-SII market value of $17.2 billion. Median default probability falls 35.5%, implied asset risk rises 20.7%, and bond prices fall 6.2%. These results are consistent with the TBTF guaranty lowering the probability of default and increasing expected asset risk. The smaller bondholder losses (relative to equity holder gains) are consistent with the partially tempering effect of the TBTF guaranty on moral-hazard-induced loss in expected value.

Second, we find that other large non-designated insurance firms (OLIF) do not, on average, enjoy any net benefits or costs from the new regulatory regime. The cross section of price changes, however, suggests that the new regime does affect some individual firms in the OLIF, with default probabilities rising the most for the riskiest firms, bond prices falling the most for the riskiest firms, and implied asset risk falling the most for the riskiest

firms. All of these changes are consistent with the market recognizing that these firms fall outside of the TBTF umbrella.

Third, we find evidence that investors identified the likely candidates for G-SII designation very early in the process, with most of the net benefit embedded in stock prices a year before the final announcement of specific names. This pattern provides one explanation why our estimate of a median 12% net abnormal return, cumulating returns across eight announcements, is so much larger than the 1.3% estimate found by O'Hara and Shaw (1990), who had only the single announcement when individual TBTF banks were identified in 1984, to work with. The pattern also suggests that any attempt to measure the value of a TBTF guaranty must account for relevant ex ante expectations.

Finally, we provide evidence that the strength of local institutions affects the impact of regulations on firm performance. We show that country-level differences between G-SII and OLIF firm reactions to the FSB announcements are strongest in the relatively weak institution countries, consistent with a larger TBTF gain occurring in countries with lower regulatory standards (absent TBTF).

**References**


Abreu, J.F. and M. A. Gulamhussen, 2015, "The Stock Market Reaction to the Public Announcement of a Supranational List of Too-Big-to-Fail Banks during the Financial Crisis." *Journal of International Financial Markets, Institutions and Money*, July 2013, v. 25, 49-72.

Acharya, Viral V., Thomas F. Cooley, Matthew P. Richardson, Ingo Walter, and Myron Scholes, 2010, Regulating Wall Street: The Dodd-Frank Act and the new global architecture of finance, John Wiley & Sons, Inc.: New York.

Acharya, Viral V., Deniz Anginer, and A. Joseph Warburton, 2015, "The End of Market Discipline? Investor Expectations of Implicit Government Guarantees," SSRN Working Paper, http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1961656

Balasubramnian, Bhanu, and Ken B. Cyree, 2014, "Has market discipline on banks improved after the Dodd-Frank Act?," *Journal of Banking and Finance* v. 41, 155-166.

Banulescu, Georgiana-Denisa, and Elena-Ivona Dumitrescu, 2015, "Which are the SIFIs? A component expected shortfall approach to systemic risk," *Journal of Banking and Finance* v. 50, 575-588.

Bessembinder, Hendrik, Kathleen M. Kahle, William F. Maxwell, and Danielle Xu, 2008, "Measuring abnormal bond performance," *The Reviews of Financial Studies*, v. 22, n. 10, 4219-4258.

Bongini, Paoloa, Laura Nieri and Matteo Pelagatti, 2015, "The importance of being systemically important financial institutions," *Journal of Banking and Finance,* v. 50, 562-574.

Bongini, Paola, Laura Nieri and Andrea Piccini, 2014, "Curbing the moral hazard of a SIFI: mission impossible?" SSRN Working Paper: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2572660

Correia, Maria, Johnny Kang, and Scott Richardson, 2013, "Asset Volatility," SSRN working paper, http://ssrn.com/abstract=2361686

Demsetz, Rebecca S., and Philip E. Strahan, 1997, "Diversification, size, and risk at bank holding companies," *Journal of Money, Credit, and Banking*, August, v. 29, iss. 3, 300-313.

Duan, J.C. and A. Fulop, 2013, "Multiperiod corporate default prediction with the partially-conditioned forward intensity," National University of Singapore working paper.

Duan, J.C. and Weiman Miao, 2015, "Default Correlations and Large-Portfolio Credit Analysis," *Journal of Business and Economic Statistics*, forthcoming.

Duan, J.C., J. Sun and T. Wang, 2012a, "Multiperiod corporate default prediction – A forward intensity approach," *Journal of Econometrics*, 170, 191-209.

Duan, J.C., and E. Van Laere, 2012b, "A public good approach to credit ratings from concept to reality, *Journal of Banking & Finance*, 36, 3239-3247.

Duane, J.C. and W.T. Wang, 2015 forthcoming, "Default correlations and large-portfolio credit analysis," *Journal of Business & Economic Statistics*.

Dungey, Mardi, Matteo Luciani, and David Veredas, 2014, "Emergence of systemically important insurers," Research Report of the Centre for International Finance and Regulations, Working Paper No. WP038/2014.

Egginton, Jared F., and James I Hilliard, Andre P. Liebenberg, and Ivonne A. Liebenberg, 2010, "What effect did AIG's bailout, and the preceding events, have on its competitors?," *Risk Management and Insurance Review* Vol. 13, Issue 2, 225-249.

Federal Deposit Insurance Corporate and the Bank of England, 2012, "Resolving Globally Active, Systemically Important, Financial Institutions," White Paper (December 10).

Harrington, Scott E., 2011, "Insurance regulation and the Dodd-Frank Act," Policy Brief, Networks Financial Institute at Indiana State University, 2011-PB-01.

International Association of Insurance Supervisors, 2012 (May 31), "Global Systemically Important Insurers: Proposed Assessment Methodology," http://www.iaisweb.org/Supervisory-Material/Financial-Stability-Macroprudential-Policy-Surveillance-988

Joines, Adam, 2010, "Signals to the market: Too big to fail banks and the recent crisis," Working Paper, University of Notre Dame.

Kane, Edward J. 2000. "Designing financial safety nets to fit country circumstances." Working paper.

Kanno, M., 2014, "An assessment of systemic risk in the Japanese banking sector," *Global Credit Review*, 04 1-15.

Karaca-Mandic, Pinar, Jean M. Abraham, and Charles Phelps, 2011, "Dow do health insurance loading fees vary by group size?: Implications for Healthcare reform," *International Journal of Health Care Finance and Economics*, September, v. 11, iss. 3, 181-207.

Karpoff J.M., and P.H. Malatesta, 1995, "State takeover legislation and share values: the wealth effects of Pennsylvania's Act 36," *Journal of Corporate Finance* 1, 367-382.

Kellner, S. G., and Frank Mathewson, 1983, "Entry, size distribution, scale and scope economies in the life insurance industry," *Journal of Business*, January, v. 56, iss. 1, 25-44.

Kelly, Bryan, Hanno Lustig, and Stijn Van Nieuwerburgh, 2012, "Too-Systemic-to-fail: What option markets imply about sector-wide government guarantees," SSRN working paper, accessed at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1762312 .

Kleinow, Jacob, Tobias Nell, Silvia Rogler, and Andreas Horsch, 2014, "The Value of Being Systemically Important: Event Study on Regulatory Events for Banks," *Applied Financial Economics*, 24(22-24), 1585-1604.

Kroner, Kenneth F., and Douglas S. West, 1995, "The relationship between firm size and screening in an automobile insurance market," *Journal of Risk and Insurance*, March, 62(1), 12-29.

Malatesta P., 1986, "Measuring abnormal performance: The event parameter approach using joint generalized least squares," *Journal of Financial and Quantitative Analysis* 21, 27-38.

Nissim, Doron, 2010, "Analysis and valuation of insurance companies," Working Paper, CE/ASA Center for Excellence in Accounting and Security Analysis, Columbia Business School.

O'Hara, Maureen and Wayne Shaw, 1990, "Deposit insurance and wealth effects: The value of being 'Too big to fail'," *The Journal of Finance*, Vol. XLV, No 5, 1587-1600.

Pais, Amelia and Philip A. Stork, 2013, "Bank size and systemic risk," *European Financial Management*, June, v. 19 iss. 3, 429-51.

Penas, Maria F., and Haluk Unal, 2004, "Gains in bank mergers: Evidence from the bond markets," *Journal of Financial Economics* 74, 149-179.

RMI Staff, 2015, "NUS-RMI Credit Initiative Technical Report Version: 2015 Update 1," *Global Credit Review* vol. 5, 1-91.

Safia, M. Faisal, Hassan, M. Kabir, and Neal C. Maroney, 2013, "AIGs announcements, Fed's innovation, contagion and systemic risk in the financial industries," *Applied Financial Economics*, 23(16): 1337-1348.

Schumann, Laurence, 1985, "State regulation of takeovers and shareholder wealth: the case of New York's 1985 takeover statutes" *Rand Journal of Economics*, vol 19, no 4, 557-567.

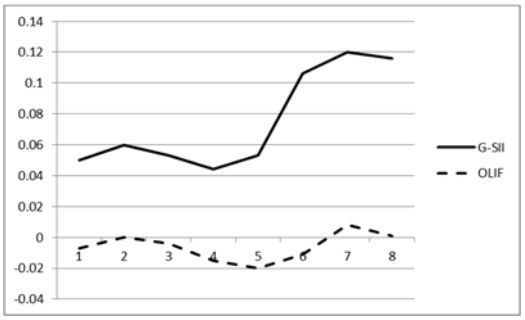
Schwartz, Daniel and Stephen L. Schwartz, 2014, "Regulating Systemic Risk in Insurance." *The University of Chicago Law Review*, forthcoming.

Shin D. and B. Kim, 2015, "Liquidity and credit risk before and after the global financial crisis: Evidence from the Korean corporate bond market," *Pacific Basin Finance Journal*, 33 38-61.

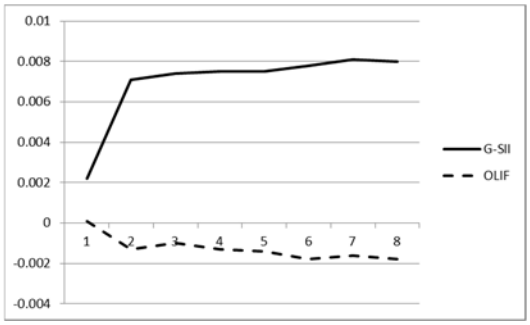
Strahan, Philip E., 2013, "Too Big to Fail: Causes, Consequences, and Policy Responses," *Annual Review of Financial Economics*, 5: 42-61.

Turk, George and Philip Swicegood, 2012, "Assessing the Market's Reaction to the Dodd-Frank Act," *Journal of Economic and Business Research* (October). 10(10): 569-578.
Wallison, Peter J., 2014, "The authority of the FSOC and the FSB to designate SIFIs: Implications for the regulation of insurers in the U.S. after the Prudential decision," Policy Brief of Networks Financial Institute at Indiana State University, 2014-PB-02.
White, Lawrence J, 2014, "The Basics of 'Too Big to Fail'," SSRN working paper: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2405433

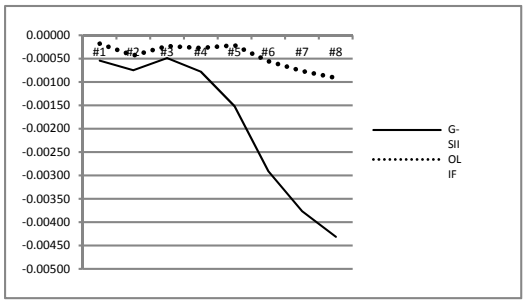
**Figure 1: Event study abnormal changes in stock returns, implied asset risk, default probabilities, and bond returns cumulated across the eight G-SII announcements**



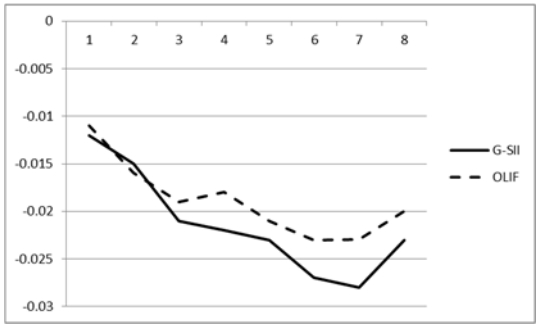

A. Stock returns




B. Implied asset risk



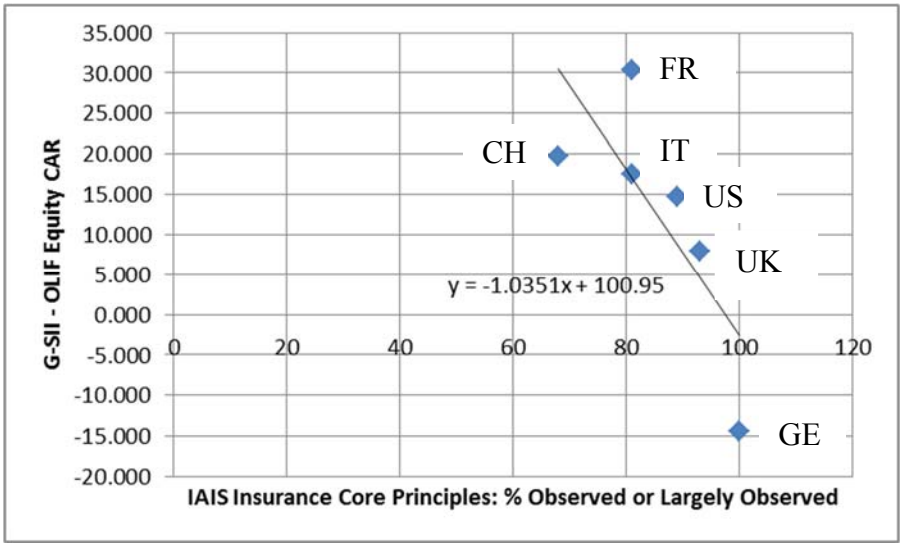

C. Default probability




D. Bond returns

NOTES for FIGURE 1: Figure 1 presents the event study average cumulated abnormal changes reported in Tables 5 and 6: event studies of Global Systemically Important Insurers (G-SII) related announcement abnormal returns. The announcement dates are in Table 1. The sample includes 8 firms from 6 countries designated G-SII by the FSB in July 2013, plus 22 full or life insurance companies from the same 6 countries that have available data on ORBIS and V-Lab, collectively referred to as Other Large Insurance Firms (OLIF). Panel A provides the summary abnormal returns for equity, Panel B for implied asset risk, Panel C for default probabilities and Panel D for bond returns.

**Figure 5: Cross country comparison of G-SII – OLIF abnormal equity return against the quality of insurance regulations**




NOTES for FIGURE 5: Figure plots the country-level difference between the average abnormal stock return for the Global Systemically Important Insurers (G-SII) for the eight FSB announcements and the average abnormal stock return for the Other Large Insurance Firms (OLIF) as reported in Table 5 against the percentage of IAIS insurance core principles ranked as Observed or Largely Observed in the IMF's FSAP country reports.

**Table 1: FSB-Related G-SII Announcements**

| Event Day 0 | Content of announcement |
|---|---|
| 1: September 17, 2008 | U.S. government announces AIG bailout (announced at 10:00 pm on the 16th). |
| 2: November 30, 2009 | *Financial Times* reports 6 insurance firms are on an FSB list of 30 financial institutions "for cross border supervision exercise." Firms are AXA, Allianz, and Aviva which make the final 2013 list, and Aegon, Zurich Financial Services, and Swiss Reinsurance which do not. |
| 3: November 12, 2010 | FSB says it will look at extending the regulatory framework to non-banking companies, including insurance firms. |
| 4: November 4, 2011 | FSB announces the initial list of 29 G-SIBs, saying it will begin work to define how to extend to other G-SIFIs. The FSB expects the IAIS to complete its work on a methodology for insurers by June 2012. |
| 5: January 10, 2012 | FSB says it will extend the "safety frameworks" to insurance firms. |
| 6: June 4, 2012 | IAIS releases a report on the identification methodology for G-SII (announced on Sunday June 3). |
| 7: December 3, 2012 | IAIS releases a paper on policies with respect to G-SII (announced on Sunday December 2). |
| 8: July 18, 2013 | The FSB announces the list of 9 G-SII, including AIG, while IAIS publishes revised policy measures. |

NOTES for TABLE 1: Table 1 includes relevant G-SII-related announcements from a Factiva search of the *Wall Street Journal* and *The Financial Times* from September 2008 through 2013 with search words: Financial Stability Board (FSB), International Association of Insurance Supervisors (IAIS), Global Systemically Important Financial Institutions (G-SIFI), and insurance.

**Table 2: Description of performance and ownership measures**

| Measures | Definition | Source |
|---|---|---|
| **Size** | | |
| Assets | Total assets in U.S.$ millions | ORBIS |
| Gross Premiums | Gross premiums in U.S.$ millions | ORBIS |
| Market Cap | Market capitalization in U.S.$ millions | V-Lab |
| **Returns** | | |
| Investment yield | 100*Net investment income/ (2-yr average of: liquid assets + other Investments) | ORBIS |
| ROE | 100*Pre-tax profit/Surplus | ORBIS |
| ROA | 100* Pre-tax profit/Total Assets | |
| **Risk** | | |
| Solvency ratio | 100*Surplus/Total assets | ORBIS |
| Leverage | Quasi market value of assets / market value of equity. Quasi market value of assets = (book value of assets – book value of equity + market value of equity) | V-Lab |
| Beta | Beta of the firm with respect to the MSCI World Index, using Rob Engle's Dynamic Conditional Beta model | V-Lab |
| SRISK | Firm's estimated loss of equity value for a full financial crisis of a 40% decline in a broad market index, using a 5.5% capital requirement for Europe and an 8% capital requirement everywhere else ( U.S.$ millions) | V-Lab |
| CDS | Credit default swap spreads | Datastream |
| **Event Study Variables** | | |
| Equity Returns | Daily returns from firm return indices (RI) | Datastream |
| Prob.Default | One-year horizon probability of default measure, available 8 G-SII and 16 OLIF | CRI at NUS |
| Implied Asset Risk | Daily option price implied volatility*(Equity/(Debt+Equity)), 8G-SII and 14 OLIF | Datastream, V-Lab |
| Bond Returns | Daily bond returns from total return series (fixed coupon, home exchange and home currency), 7 G-SII and 14 OLIF | Datastream |

NOTES for TABLE 2: Accounting and ownership data are from Bureau van Dijk's ORBIS data set and company annual reports. Financial risk data are from NYU Stern's Volatility Laboratory (V-Lab), except CDS spreads, collected from Datastream. Default probability data are from the Credit Research Initiative at National University of Singapore. All data are collected from 2007 through 2013.

**Table 3: Summary Statistics, 2012 U.S.$ millions**

| | G-SII N=8 | | | OLIF N=22 | | | Test of Difference G-SII - OLIF | |
|---|---|---|---|---|---|---|---|---|
| | **Mean** | **Median** | **St Dev** | **Mean** | **Median** | **St Dev** | **Mean** | **Median** |
| **Size** | | | | | | | | |
| Assets | 678,431 | 642,358 | 211,055 | 137,707 | 90,105 | 148,501 | **540,724** | **552,253** |
| Assets- 1 yr %change | 10.67 | 8.73 | 7.01 | 13.20 | 8.60 | 23.10 | -2.53 | 0.13 |
| Gross Premiums | 64,169 | 56,882 | 28,462 | 12,311 | 7,023 | 12,698 | **51,858** | **49,859** |
| Market Cap | 34,177 | 32,984 | 13,915 | 9,816 | 4,491 | 17,169 | **24,361** | **28,493** |
| **Returns** | | | | | | | | |
| Investment Yield | 3.7 | 3.93 | 0.87 | 4.07 | 4.01 | 1.33 | -0.37 | -0.08 |
| ROE | 7.8 | 9.1 | 16.9 | 11.81 | 12.7 | 7.3 | -4.01 | -3.6 |
| ROA | 0.5 | 0.54 | 0.7 | 1.26 | 0.83 | 1.14 | -0.76* | -0.29 |
| **Risk** | | | | | | | | |
| Solvency Ratio | 5.63 | 5.58 | 1.85 | 11.76 | 11.79 | 7.77 | **-6.13** | -6.21* |
| Leverage | 20.35 | 23.31 | 9.09 | 21.96 | 19.71 | 17.21 | -1.61 | 3.6 |
| Beta | 1.53 | 1.45 | 0.34 | 1.14 | 1.13 | 0.46 | **0.39** | **0.32** |
| SRISK | 21.1 | 20 | 16.2 | 2.6 | 0.9 | 10.3 | **18.5** | **19.1** |
| CDS | 197.6 | 190.9 | 68.5 | 260.4 | 233 | 141 | -62.8 | -42.1 |
| **Event Study Variables** | | | | | | | | |
| Equity Returns | 0.0005 | 0.000 | 0.0329 | 0.0006 | 0.000 | 0.0376 | -0.0001 | 0.000 |
| Probability of Default | 0.0065 | 0.0041 | 0.0091 | 0.0072 | 0.0026 | 0.0217 | -0.0007 | **0.0015** |
| Implied Asset Risk | 0.0296 | 0.0187 | 0.0352 | 0.0391 | 0.0203 | 0.0441 | **-0.0095** | **-0.0016** |
| Bond Returns | 0.0003 | 0.0002 | 0.0147 | 0.0005 | 0.0002 | 0.0150 | -0.0002 | 0.000 |

NOTES for TABLE 3: Table 3 reports summary statistics for insurance firms designated Global Systemically Important Insurers (G-SII) and other large insurance firms (OLIF). Sample includes 8 of 9 firms designated G-SII by the FSB in July 2013 (AIG is omitted), plus 22 full or life insurance companies from the same countries that have available data on ORBIS and V-Lab. See Table 2 for a definition of and source for all variables. Data cover the period 2012 for the accounting variables and 2008-13 for the event study variables. Mean test of difference is a t-test. Median test of difference is a Mann-Whitney test. Significant differences at the 5 and 1% levels are in bold type; significance at the 10% level is denoted with an "*

**Table 4: Ranking of global life insurance companies by 2012 total assets in ORBIS**
(**G-SII** in bold type, *OLIF* in italics)

| Size Ranking | Company name | Country | Total Assets 2012 |
|---|---|---|---|
| 1 | **AXA** | France | 991,270,462 |
| 2 | JAPAN POST INSURANCE CO LTD | Japan | 960,832,369 |
| 3 | **ALLIANZ SE** | Germany | 898,766,012 |
| 4 | NIPPON LIFE INSURANCE COMPANY | Japan | 585,933,225 |
| 5 | **GENERALI ASSICURAZIONI SPA** | Italy | 575,768,987 |
| 6 | ZENKYOREN & PREFECTURAL INSURANCE FEDERATIONS | Japan | 544,339,320 |
| 7 | *LEGAL & GENERAL GROUP PLC* | U.K. | 542,519,539 |
| 8 | **AMERICAN INTERNATIONAL GROUP INC** | U.S. | 529,424,000 |
| 9 | MANUFACTURERS LIFE INSURANCE CO. (THE) | Canada | 495,388,823 |
| 10 | STICHTING PENSIOENFONDS ABP | Netherlands | 494,931,991 |
| 11 | **AVIVA PLC** | U.K. | 484,288,184 |
| 12 | **PRUDENTIAL PLC** | U.K. | 474,646,605 |
| 13 | MANULIFE FINANCIAL CORP | Canada | 468,566,144 |
| 14 | AEGON NV | Netherlands | 465,641,312 |
| 15 | *CNP ASSURANCES* | France | 454,255,022 |
| 16 | **PING AN INSURANCE (GROUP) COMPANY OF CHINA LIMITED** | China | 450,732,148 |
| 17 | BERKSHIRE HATHAWAY INC | U.S. | 424,527,000 |
| 18 | ZURICH VERSICHERUNGS GESELLSCHAFT AG | Switzerland | 388,632,000 |
| 19 | DAI-ICHI LIFE INSURANCE COMPANY LIMITED (THE) | Japan | 379,122,808 |
| 20 | **METROPOLITAN LIFE INSURANCE COMPANY** | U.S. | 360,500,954 |
| 21 | CREDIT AGRICOLE ASSURANCES | France | 359,479,753 |
| 22 | MEIJI YASUDA LIFE INSURANCE COMPANY | Japan | 351,360,863 |
| 23 | MUNCHENER RUCKVERSICHERUNGS-GESELLSCHAFT AKTIENGESELLSCHAFT | Germany | 333,393,896 |
| 24 | PREDICA | France | 306,462,823 |
| 25 | *CHINA LIFE INSURANCE COMPANY LIMITED* | China | 301,768,467 |
| 26 | *HARTFORD FINANCIAL SERVICES GROUP INC* | U.S. | 298,513,000 |
| 27 | **PRUDENTIAL INSURANCE COMPANY OF AMERICA** | U.S. | 285,087,049 |
| 28 | LIFE INSURANCE CORPORATION OF INDIA | India | 284,538,720 |
| 29 | SUMITOMO LIFE INSURANCE COMPANY | Japan | 282,173,351 |
| 30 | POWER CORPORATION OF CANADA | Canada | 270,868,182 |

NOTES for TABLE 4: Firms ranked by 2012 Total Assets as reported in ORBIS, to reflect data available for 2013 G-SII announcement. Subsidiaries of Sumitomo and General and Legal Group PLC are large enough to be included, but are omitted to avoid double counting.

**Table 5: Event window abnormal stock returns to the 8 G-SII announcements estimated with a SUR specification**

| | G-SII N=8 | OLIF N=22 | G-SII – OLIF |
|---|---|---|---|
| **Announcement** | | | |
| #1 | **0.050** | -0.007 | **0.057** |
| | **(.000)** | (.539) | **(.000)** |
| #2 | 0.010 | 0.007 | 0.004 |
| | (.429) | (.556) | (.774) |
| #3 | -0.007 | -0.004 | -0.003 |
| | (.569) | (.667) | (.818) |
| #4 | -0.009 | -0.011 | 0.002 |
| | (.492) | (.290) | (.888) |
| #5 | 0.009 | -0.005 | 0.014 |
| | (.465) | (.632) | (.271) |
| #6 | **0.053** | 0.009 | **0.045** |
| | **(.000)** | (.381) | **(.001)** |
| #7 | 0.014 | 0.019* | -0.005 |
| | (.277) | (.054) | (.675) |
| #8 | -0.004 | -0.007 | 0.003 |
| | (.758) | (.468) | (.796) |
| Sum | **0.117** | 0.001 | **0.116** |
| | **(.001)** | (.979) | **(.002)** |

NOTES for TABLE 5: Table 5 reports results of an event study of Global Systemically Important Insurers, (G-SII) related announcement abnormal returns. The announcement dates are in Table 1. The sample includes 8 of 9 firms (excludes AIG) from 6 countries designated G-SII by the FSB in July 2013, plus 22 full or life insurance companies from the same 6 countries that have available data on ORBIS and V-Lab, collectively referred to as Other Large Insurance Firms (OLIF). The panel reports results from a SUR specification that includes one equation for each firm. Each firm's specification includes an intercept, its home country total market return, from Datastream Total Market Indices, and 24 event day dummies, with three dummies for each announcement corresponding to event days (-1, 0, +1). Each regression breaks apart the alpha and/or market beta into 5 separate year-based (2008 – 2013) estimates if Wald tests reject equality of the 5 year-based estimates. The event dummies are restricted to be equal across the G-SII firms and across the OLIF firms. The table provides the 3-day cumulative abnormal returns (CAR) for each of the 8 announcements, plus the summary CAR across all announcements, as well as a Chi-square test of equality of the G-SII vs. OLIF CARs. P-values are in parentheses. Differences significant at the 5 or 1% levels are in bold type. Differences significant at the 10% level are marked with a "*".

**Table 6: Abnormal changes around the 8 G-SII announcements for implied asset risk, default probability, and bond returns estimated with a SUR specification**

| | d(Implied Asset Risk) | | | D(Prob. Default) | | | d(Bond Returns) | | |
|---|---|---|---|---|---|---|---|---|---|
| | **G-SII** | **OLIF** | **G-SII-OLIF** | **G-SII** | **OLIF** | **G-SII-OLIF** | **G-SII** | **OLIF** | **G-SII – OLIF** |
| | **N=8** | **N=14** | | **N=8** | **N=18** | | **N=6** | **N=14** | |
| **Announcement** | | | | | | | | | |
| #1 | **0.0022** | 0.0001 | 0.0015* | **-0.00065** | -0.00006 | -0.00059* | **-0.012** | **-0.011** | -0.0008 |
| | **(.001)** | (.281) | (.075) | **(.042)** | (.785) | (.060) | **(.038)** | **(.048)** | (.913) |
| #2 | 0.0049 | -0.0014 | 0.0062 | -0.00018 | -0.00002 | -0.00016 | -0.003 | -0.005 | 0.002 |
| | (.370) | (.813) | (.377) | (.571) | (.922) | (.610) | (.655) | (.422) | (.779) |
| #3 | 0.0003 | 0.0003 | -0.0000 | 0.00022 | 0.00025 | -0.00003 | -0.006 | -0.003 | -0.003 |
| | (.635) | (.659) | (.975) | (.499) | (.258) | (.922) | (.348) | (.616) | (.715) |
| #4 | 0.0001 | -0.0003 | 0.0004 | -0.00024 | -0.00009 | -0.00015 | -0.001 | 0.001 | -0.0026 |
| | (.863) | (.715) | (.643) | (.450) | (.668) | (.636) | (.843) | (.804) | (.717) |
| #5 | -0.0000 | -0.0001 | 0.0001 | **-0.00071** | -0.00005 | **-0.00066** | -0.001 | -0.003 | 0.002 |
| | (.985) | (.929) | (.948) | **(.028)** | (.830) | **(.037)** | (.861) | (.659) | (.833) |
| #6 | 0.0003 | -0.0004 | 0.0007 | **-0.00131** | **-0.00046** | **-0.00085** | -0.004 | -0.002 | -0.003 |
| | (.658) | (.608) | (.435) | **(.000)** | **(.036)** | **(.007)** | (.444) | (.771) | (.694) |
| #7 | 0.0003 | 0.0002 | 0.0001 | **-0.00084** | -0.00028 | -0.00057* | -0.001 | 0.00005 | -0.001 |
| | (.694) | (.792) | (.946) | **(.009)** | (.212) | (.072) | (.808) | (.993) | (.837) |
| #8 | -0.0001 | -0.0002 | 0.00005 | -0.00050 | -0.00021 | -0.00028 | 0.005 | 0.003 | 0.003 |
| | (.847) | (.821) | (.957) | (.119) | (.326) | (.364) | (.356) | (.648) | (.697) |
| Sum | 0.0079 | -0.001 | 0.0089 | **-0.0042** | -0.00093 | **-0.0033** | -0.023 | -0.019 | -0.004 |
| | (.167) | (.869) | (.229) | **(.000)** | (.149) | **(.000)** | (.167) | (.245) | (.845) |

NOTES for TABLE 6: Table 6 reports results of three event studies of Global Systemically Important Insurers (G-SII) related announcement abnormal returns. The announcement dates are in Table 1. The sample includes 8 firms from 6 countries (excludes AIG) designated G-SII by the FSB in July 2013, plus 22 full or life insurance companies from the same 6 countries that have available data on ORBIS and V-Lab, collectively referred to as Other Large Insurance Firms (OLIF). Each panel reports results from a SUR specification that includes one equation for each firm where the event dummies are restricted to be equal across the G-SII firms and across the OLIF firms. In the left panel, which uses monthly data, first differences of 1-year horizon default probabilities are regressed against year dummy variables and 8 event month dummies. Default probabilities are available for 8 G-SII and 16 OLIF from the Credit Research Initiative at National University of Singapore's Risk Management Institute. In the middle panel, which uses daily data, first differences of firm implied asset risk are regressed against year dummy variables and 24 event day dummies, with three dummies for each announcement corresponding to event days (-1,0,,+1). Implied asset risk equals the firm's implied equity volatility, from option price data in Datastream,

multiplied by the ratio (Equity/Debt + Equity) from V-Lab's leverage time series. Options data are available from Datastream for 8 G-SII and 15 OLIF. In the far right panel, daily bond returns are regressed against year dummies, a federal-government bond index return, and 24 event day dummies, with three dummies for each **Table 6 Notes Continued:** announcement corresponding to event days (-1, 0, +1). Each regression breaks apart the intercept and/or government bond return beta into 5 separate year-based (2008 – 2013) estimates if Wald tests reject equality of the 5 year-based estimates. Bond data are available, from Datastream, for 7 G-SII and 13 OLIF. Each regression uses data over 2008 through 2013. For each SUR, the table provides the abnormal values for each of the 8 announcements, cumulated across the 3-day event window for the implied volatility and bond daily data, plus the summary abnormal value across all announcements, as well as a Chi-square test of equality of the G-SII vs. OLIF values. P-values are in parentheses. Coefficient estimates and test statistic differences significant at the 5 or 1% levels are in bold type. Coefficient estimates and test statistics differences significant at the 10% level are marked with a "*".

**Table 7: Spearman rank correlations between significant abnormal price responses to G-SII announcements (plus #8) and firm risk measures**

**Panel A: G-SII**

| | Equity CAR | | | Implied Asset Risk CAR | | Probability of Default CAR | | | | Bond Return CAR | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | #1 | #6 | #8 | #1 | #8 | #5 | #6 | #7 | #8 | #1 | #8 |
| **Leverage** | 0.310 | -0.024 | **0.833** | 0.310 | **0.659** | -0.357 | 0.119 | 0.262 | -0.119 | 0.143 | 0.378 |
| **Beta** | 0.238 | 0.524 | **0.667** | 0.238 | 0.431 | -0.452 | -0.190 | -0.095 | -0.143 | 0.393 | **0.847** |
| **SRISK** | 0.476 | -0.048 | **0.714** | 0.476 | 0.108 | -0.476 | 0.143 | **0.738** | 0.548 | 0.071 | 0.468 |
| **CDS Spreads** | **0.893** | 0.643 | 0.179 | **0.893** | -0.378 | -0.036 | -0.750* | -0.214 | -0.321 | 0.179 | **0.919** |

**Panel B: OLIF**

| | Equity CAR | Implied Asset Risk CAR | Probability of Default CAR | | Bond Return CAR | |
|---|---|---|---|---|---|---|
| | #8 | #8 | #6 | #8 | #1 | #8 |
| **Leverage** | 0.316 | 0.103 | -0.092 | -0.015 | **-0.678** | **-0.649** |
| **Beta** | 0.289 | 0.079 | **-0.534** | -0.104 | **-0.825** | -0.149 |
| **SRISK** | 0.241 | 0.257 | -0.261 | 0.073 | **-0.664** | **-0.481** |
| **CDS Spreads** | 0.297 | -0.317 | 0.357 | 0.119 | -0.017 | -0.092 |

NOTES for TABLE 7: Table 7 reports Spearman rank correlations for the performance variables in Table 2 with the cumulative abnormal returns (CARs), abnormal changes in CDS spreads, abnormal changes in implied asset risk and abnormal bond returns for three G-SII announcements (2007 accounting data for announcement #1, 2011 for #6, and 2012 for #8, see Table 1 for a description of the announcements). Correlations are reported for the 8 firms designated Global Systemically Important Insurers (G-SII) by the Financial Stability Board in 2013 (excludes AIG), and for the 22 other large insurance firms (OLIF). OLIF firms are from the same 6 countries as the G-SII, and also have data in ORBIS and V-Lab. Correlations significantly different from zero at the 5 or 1% level are in bold type, while correlations significant at the 10% level are marked with a "*".

**Table 8: FSOC SIFI-related announcements for the selection of systemically important financial institutions in the U.S.**

| Event Day 0 | Announcement |
|---|---|
| 1: 4-3-12 | FSOC finalizes process for selecting non-bank SIFI's |
| 2: 10-19-12 | Prudential moves to Stage 3 review |
| 3: 6-3-13 | FSOC votes to propose designating AIG, Prudential Financial, and Ge Capital SIFIs |
| 4: 7-3-13 | Prudential announces plan to appeal proposed SIFI designation (announced late 7-2-13) |
| 5: 7-10-13 | AIG and Ge Capital formally designated SIFI (announced late 7-9-14) |
| 6: 7-17-13 | MetLife moves to Stage 3 review in SIFI process. (announced late 7-16-14) |
| End of FSB window ➔ | |
| 7: 9-19-13 | Regulators reject Prudential's appeal and formally designates Prudential as a SIFI |
| 8: 8-20-14 | FSOC votes to close the "evidentiary record" and move to a vote on MetLife |
| 9: 9-4-14 | FSOC votes to propose designating MetLife a SIFI |
| 10: 10-3-14 | MetLife formally contests the proposed SIFI designation |

NOTES for TABLE 8: Table 8 reports day zero of event window (+1, 0, -1) for Financial Stability Oversight Council SIFI-related announcements. Day zero is the day the news was first reported in the Wall Street Journal.

**Table 9: Abnormal changes around the 10 FSOC SIFI-related announcements estimated with a SUR specification**

| | Stock Price Return | | d(Implied Asset Risk) | | d(Prob. Default) | | Bond Returns | |
|---|---|---|---|---|---|---|---|---|
| | **MetLife** | **Prudential** | **MetLife** | **Prudential** | **MetLife** | **Prudential** | **MetLife** | **Prudential** |
| #1 | -0.001 | 0.004 | 0.00049 | 0.00028 | 0.000 | -0.003 | -0.011 | 0.307 |
| | (.951) | (.822) | (.603) | (.685) | (.945) | (.782) | (.574) | (.530) |
| #2 | 0.007 | 0.018 | -0.00042 | 0.00056 | -0.002 | -0.002 | 0.002 | 0.000 |
| | (.717) | (.292) | (.650) | (.414) | (.690) | (.873) | (.911) | (.580) |
| #3 | 0.013 | 0.008 | -0.00021 | 0.00026 | 0.001 | 0.001 | 0.001 | 0.000 |
| | (.502) | (.647) | (.822) | (.706) | (.779) | (.951) | (.968) | (.578) |
| #4 | -0.007 | 0.006 | -0.00031 | -0.00012 | 0.003 | 0.001 | 0.000 | 0.000 |
| | (.696) | (.741) | (.684) | (.835) | (.552) | (.910) | (.997) | (.367) |
| #5 | -0.026 | -0.021 | -0.00066 | -0.00032 | -0.002 | -0.002 | -0.004 | 0.000 |
| | (.170) | (.235) | (.481) | (.638) | (.651) | (.874) | (.831) | (.343) |
| #6 | -0.002 | 0.005 | -0.00086 | -0.00040 | -0.001 | -0.001 | -0.020 | 0.000 |
| | (.924) | (.790) | (.354) | (.555) | (.905) | (.954) | (.316) | (.358) |
| #7 | **-0.057** | **-0.051** | -0.00014 | -0.00027 | 0.001 | 0.000 | 0.008 | 0.000 |
| | **(.003)** | **(.004)** | (.877) | (.690) | (.890) | (.994) | (.682) | (.329) |
| #8 | 0.052* | 0.044* | 0.00090 | -0.00020 | 0.000 | 0.000 | -0.006 | 0.000 |
| | (.055) | (.078) | (.496) | (.835) | (.980) | (.999) | (.839 | (.962) |
| #9 | -0.003 | -0.008 | -0.00013 | -0.00011 | 0.000 | 0.000 | -0.002 | 0.000 |
| | (.872) | (.662) | (.892) | (.867) | (.996) | (.998) | (.901) | (.357) |
| #10 | 0.002 | 0.000 | 0.00031 | -0.00072 | 0.000 | 0.000 | -0.002 | 0.000 |
| | (.905) | (.999) | (.744) | (.291) | (.998) | (.999) | (.902) | (.597) |
| Sum | -0.023 | 0.005 | -0.00135 | -0.00034 | 0.000 | -0.005 | -0.032 | -0.0001 |
| | (.694) | (.921) | (.606) | (.861) | (.999) | (.882) | (.571) | (.316) |

NOTES for TABLE 9: Table 9 reports results of an event study of U.S. Systemically Important Financial Institution, or SIFI, related announcement abnormal returns for MetLife and Prudential Financial. The announcement dates are in Table 1. The data span April 2011 through October 2014 (2008 – 2014 for the default probability specifications with monthly data). The panel reports results from four SUR specifications that include one equation for each firm. In the Stock Price Return specification, each firm's equation includes an intercept, the U.S. total market return, from Datastream U.S. Total Market Index, and 30 event day dummies, with three dummies for each announcement corresponding to event days (-1, 0, +1). Each regression breaks apart the alpha and/or market beta into 4 separate year-based (2011 – 2014) In the d(Prob.Default) specification, first differences of monthly default probabilities are regressed against 4 year dummy variables and 10 event month dummies. In the d(Implied Asset Risk) specification, first differences of daily implied asset risk, defined in Table 6, are regressed against 4 year dummy variables and 30 event day dummies, with three dummies for each announcement corresponding to event days (-1,0,+1). In the Bond Return panel, daily bond returns are regressed against 4 year dummies, the U.S. federal-government bond index return interacted with the 4 year dummies, and 30 event day dummies, with three dummies for each announcement corresponding to event days (-1, 0, +1). For each SUR, the table provides the 3-day cumulative abnormal values for each of the 10 announcements (one month abnormal value for the d(Prob.Default) specification), plus the summary abnormal value across all announcements. P-values in parentheses. Coefficient estimates significant with a Wald test at the 5 or 1% levels are in bold type. Coefficient estimates significant at the 10% level are marked with a "*".

## Appendix: G-SII and OLIF samples

| G-SII | Country |
|---|---|
| Ping An Insurance | China |
| Axa SA | France |
| Allianz SE | Germany |
| Assicurazioni Generali Spa | Italy |
| Aviva Plc | U.K. |
| Prudential Plc | U.K. |
| American International Group | U.S. |
| Metlife | U.S. |
| Prudential Financial | U.S. |

| OLIF | Country |
|---|---|
| China Life Insurance Co | China |
| China Pacific Insurance | China |
| CNP Assurances | France |
| Generali Deutschland Holding | Germany |
| Nuernberger Beteiligungs | Germany |
| Societa Cattolica Di Assicurazioni | Italy |
| Unipol Gruppo Finanziario Spa | Italy |
| Legal & General Group Plc | U.K. |
| Standard Life Plc | U.K. |
| Aflac | U.S. |
| American National Insurance Co | U.S. |
| Assurant Inc | U.S. |
| CNA Financial Corp | U.S. |
| CNO Financial Group, Inc | U.S. |
| Genworth Financial | U.S. |
| Hartford Financial Services | U.S. |
| Kemper Corp | U.S. |
| Lincoln National Corp | U.S. |
| Primerica, Inc | U.S. |
| Protective Life Corp | U.S. |
| Torchmark Corp | U.S. |
| Unum Group | U.S. |

NOTES for Appendix: G-SII sample includes nine insurance firms designated Global Systemically Important Insurers (G-SII) by the Financial Stability Board in 2013. Other Large Insurance Firm (OLIF) sample includes 22 full and life insurance firms in the same 6 countries as the G-SII firms who have financial statements in ORBIS, stock price information on Datastream, and systemic risk information from V-LAB.