The value and price of a "too-big-to-fail" guarantee: evidence from the insurance industry

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Abstract

This paper analyzes the impact of the evolution of the regulation dealing with systemically important insurance groups, using an event study methodology. The results show that investors were able to detect which companies were to be designated well ahead of the publication of the list. Most importantly, after an initial positive reaction, consistent with the expectation of a ‘‘too-big-to-fail’’ implicit subsidy, the disclosure on how the capital charges for systemic insurers would be calculated led to sizeable negative abnormal returns for the entities concerned. Leverage plays a key role in driving investors’ reaction; more leveraged entities experience higher abnormal returns when the expectation of a TBTF guarantee arises and lower ones when information on the size of the capital charges is revealed.

1. Introduction and motivation

In 2008, the biggest bailout in history prevented the failure of a large insurance company, AIG. This was coupled, in Europe, with substantial amounts of public money being used to rescue and recapitalize financial conglomerates with sizeable insurance activities. Despite AIG paying back bailout funds in the following years, concluding repayments in 2012, this has raised the question of whether insurance companies can become an important source of systemic risk and, if so, which entities should be regulated and how. Since 2012, international regulators have proposed a new framework aimed at identifying and regulating Global Systemically Important Insurers (G-SIIs). This framework foresees stricter oversight of accounts and practices, the requirement for the designated companies to prepare a plan allowing an orderly resolution of the entity in case of severe distress and, above all, envisages an additional capital requirement to which G-SIIs will be subjected, the Basic Capital Requirement (BCR).

This paper seeks to assess how financial markets have reacted to the introduction of this regulation between the end of 2011 and the end of 2015. In particular, I try to gauge to what extent insurance companies designed as systemically important, or those who may be so in the future, enjoy a "too-big-to-fail" (TBTF) premium and/or whether the imposition of additional capital requirements has been perceived as burden. In order to distinguish with precision which entities are liable to fall under the new measures I explore the different layers of regulation recently proposed for domestically and internationally active insurance groups. Following what is being done for other components of the financial industry (especially banks) I use a time-tested event study methodology.

The results show that this regulation does matter to investors, as the key steps of the regulation were accompanied by statistically significant abnormal returns for the equity of the entities affected. Investors were able to identify which companies would be designed as G-SII a year and a half before the official designation, and the positive reaction to the extension of the framework for systemically important banks to insurance companies can be thought as the perception of a valuable "too-big-too-fail" implicit guarantee, in line with what was found in similar studies on the banking sector. However, when details emerged, after the formal designation, on what arguably is the most important policy measure, the Basic Capital Requirement, G-SIIs experienced negative abnormal returns, which can be seen as a gauge of the price of the TBTF guarantee. This interpretation is corroborated by the fact that both the first–positive-effect and the second-negative-effect are stronger for more leveraged entities.

The overall impact of the regulation so far is not very large, slightly below what found for banks. Considering the group of G-SIIs, the cumulated abnormal return of the events, when they are statistically significant, is 0.58%. The -0.18% return differential with respect to a group of large multinational insurers which are not designated as systematic indicates that, so far, the price of the TBTF guarantee is perceived as slightly higher than its value. These findings, along with the results of the responsiveness of abnormal results to company characteristics, can hopefully inform the debate on the regulation and provide support for the next stages.

In Section 2 I briefly describe the cases of public bailouts of insurance companies during the 2007/8 financial crisis and sketch the new regulatory framework for global insurers that is being developed. Section 3 illustrates the differences between the banking and insurance business, the merits and limitations of capital-based regulation applied to insurance intermediaries and the evidence available so far on the TBTF premium in insurance. Section 4 summarises the methodology utilised. The results are shown in Section 5 and discussed in Section 6. Section 7 concludes.

2. The insurance sector, the financial crisis and the new regulation

The insurance sector was not spared by the global financial crisis and some groups had to be bailed out by governments or central banks. Towards the end of 2008, as a consequence of the rapidly escalating losses on its CDS portfolio, AIG, one of the largest insurers in the world, had to be bailed out by the US government. In September 2008 the Federal Reserve recapitalized AIG for USD 85 billion, in exchange for 79.9% of AIG equity; one year later, escalating uncertainty over the future of the company forced the Fed to pledge another USD 37.8 billion. This amounted to the largest bailout in history. On top of that, AIG was forced to sell part of its insurance business. More specifically, the amount disbursed to support AIG reached USD 184.6 billion in April 2009. In return, AIG paid interest plus dividends on the received funding and US Treasury obtained a 92% ownership share in the company. As of December 14, 2012, the government assistance for AIG concluded. All Federal Reserve loans were repaid and the Treasury sold all of the common equity obtained through the support (Webel, 2013).

During the subprime crisis, other large US insurance companies, in addition to AIG, received public bailout funds through the TARP scheme, many others applied for it and others benefited from capital relief because of ad hoc regulatory changes. Many of them came under distress as the large losses in their investment portfolio, coupled with long-term guarantees to policyholders, quickly eroded their capital base. Others, writing financial guarantees to other firms, were unable to pay the claims related to the defaults of mortgage-backed securities. Finally, several life insurers qualified for public bailout because of their status as bank holding companies.[1]

In Europe, public support was given to the insurance subsidiaries of banks (such as RBS in the UK and Fortis in Belgium) and, to three large Dutch financial conglomerates: ING, Aegon and SNS Reaal. Within the framework of a Europe-wide financial plan, €30 billion were made available to prevent a liquidity shortfall; €14 billion were actually used.

Regulators have started responding to the problems that surfaced in 2007/8 within a wider framework for the regulation of insurance activity at the global level. The measures aim to target two issues: 1) how to regulate large and complex groups operating under different jurisdictions and 2) how to mitigate the contribution of the insurance sector to financial systemic risk. The focus of this paper is on the latter set of measures.

In order to respond to the growing complexity of the global insurance business[2] the body in charge of coordinating insurance regulation internationally, the International Association of Insurance Supervisors (IAIS) has drafted a framework of globally accepted principles framing the supervisory activity, called Insurance Core Principles (ICPs). This is a set of principles and standards intended to help local supervisors design and implement a more effective supervision. These principles, which are not mandatory, are to be applied to any insurance company, on both a legal entity and group-wide level, in an attempt to cover all aspects of the regulatory activity, from the powers of the supervisor, to the set-up of the risk management framework and to the prevention of fraud and money laundering.[3]

The ICPs have then been extended to create the Common Framework for the Supervision of International Insurers (ComFrame), a set of requirements specifically focused on the group-wide supervision of internationally active insurance groups (IAIGs): an IAIG is an entity which writes premiums in at least three jurisdictions, with at least 10% of them outside the home market, and which has total assets of at least USD 50 billion or gross written premiums of at least USD 10 billion, based on a three-year average. No distinction is made either between primary insurers and reinsurers or among pure life or P&C insurers and composite entities. The IAIS has so far refrained from publishing a list of the IAIGs, the number of which should be around 50 worldwide, according to press estimates. A crucial feature of the ComFrame is the provision of an additional capital charge to be applied to large international insurance groups; the details on how this capital charge will operate are to be disclosed in late 2016.

In addition to the ComFrame, new regulation is being drafted in order to minimise the contribution of the insurance industry to systemic risk. The starting point is of course to assess which parts of the insurance business may be a source of systemic risk. A discussion of what in the insurance business constitutes a source of systemic risk is clearly beyond the scope of this paper, and in-depth analysis of the issue can be found in several recent overviews.[4]

In May 2011 the IAIS presented its thinking on the matter, and sketched the possible regulatory responses (IAIS, 2011). First of all, the IAIS states that traditional insurance activity is not a

[1] Schwarcz & Schwarcz (2014).

[2] See Schoenmaker, Osterloo, & Winkels (2008) for a description on how the globalisation of the insurance industry is changing the structure of large multinational groups, leading to the centralisation of some activities. Cummins & Venard (2007) provide some fitting examples of the tension between the existence of a global structure and the need to comply to strict national regulation and market practice.

[3] See IAIS (2011) for a detailed list of the areas of application.

[4] See, among many others, Eling and Pankoke (2014), Cummings and Weiss (2013) and Geneva Association (2010).

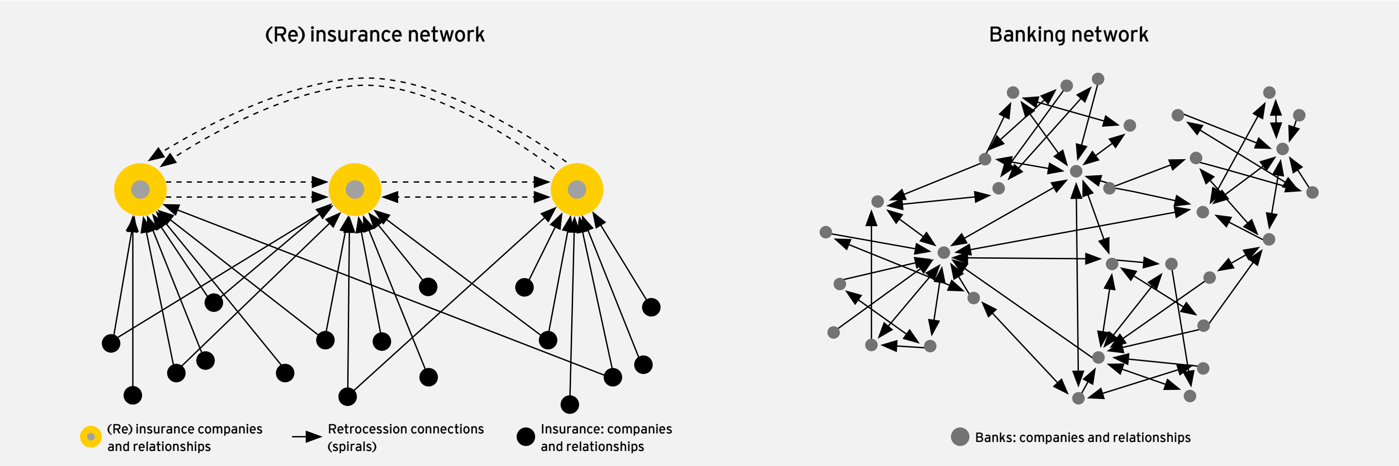
(Re) insurance network
Banking network
(Re) insurance companies and relationships
Retrocession connections (spirals)
Insurance: companies and relationships
Banks: companies and relationships

Figure 1: Insurance and banking networks compared
Source: Radice (2010)

source of systemic risk, as it entails underwriting risks that are (i) idiosyncratic (ii) not correlated with each other (iii) not influenced by the business cycle.

However, as shown by the AIG case, insurance groups can contribute to systemic risk via non-traditional activities, which have rapidly increased in size and scope. In life insurance, the existence of financial guarantees on capital and, above all, minimum guaranteed returns attached to many products complicate the risk profile with respect to standard, pure risk, products. The collapse in asset prices or yields may leave some insurers unable to pay the guaranteed returns, leading potentially to insolvency; the exposure of life insurers to the same asset classes can lead rapidly to contagion. Other problems could come from non-insurance activities such as trade in derivatives, used to hedge assets returns. In non-life insurance, systemic risk is restricted to very specific lines of business, such as the supply of credit protection in the form of credit insurance, credit guarantees and derivatives (especially CDS).

The IAIS argues that, given the overall small size of non-traditional insurance, the potential contribution to systemic risk by the industry should be limited. However, other considerations, related to the size of the entities and their geographical reach must be taken into account. Insurers are large institutional investors, holding large positions in fixed income securities; therefore a main source of risk is linked to large drops in bond prices, not to mention defaults.

While systemic risk can arise due to the linkages between insurers and banks, the connections within the industry are much less a case for concern. As shown in Figure 1, there are profound differences in the way insurance companies and banks are interconnected. The banking networks allow for the possibility of distress in an entity to spread quickly to the rest of the industry, as shown by the freeze in the European interbank market in 2009 and 2011.

In insurance, on the other hand, the structure is normally highly hierarchical. There are almost no linkages among primary insurers; therefore, there is not a network comparable to the interbank market. Risks in the insurance sector are redistributed by reinsurance companies; they receive risks from insurers and may share part of it with other reinsurers via retrocessions.

The insurer-reinsurer relationship can have non-negligible implications for systemic risk, according to IAIS.[5] The reinsurance market appears to be highly concentrated, and this leads to a strong interconnection between reinsurers and primary insurers ceding business to them. In principle the failure of a reinsurer

[5] For a completely opposite view see Kessler (2013).

may create problems as several contracts may be cancelled, leaving insurers without protection for tail risks, since contracts are very specific and difficult to be rewritten quickly.

Based on the considerations outlined above, IAIS has set up a framework to designate which insurance groups are systemically important (IAIS, 2011), and devised specific policy measures for them (IAIS, 2012a). The designation was based on a set of indicators related to:

- Size: the importance of an entity increases with the amount of services provided; however a large size is also a "prerequisite for effective risk pooling and diversification".
- Global activity: the extent of international activity is a proxy of the negative externalities that distress may generate.
- Interconnectedness: interlinkages with other institutions may give rise to systemic risk.
- Non-traditional and non-insurance (NTNI) activities: activities such as investing substantially in the bond market or entering into derivative contracts are thought to be the biggest potential sources of systemic risk
- Substitutability: the difficulty of replacing the services provided by an institution in distress increases its systemic importance.

This indicators-based methodology was complemented by soft information on specific features of the companies and their products, gathered through interviews with national supervisors.

On July 18, 2013 nine insurance groups were designed as systemically important (Global Systemically Important Insurers, G-SIIs). There are five European companies, Allianz (Germany), AXA (France), Assicurazioni Generali (Italy), Aviva and Prudential (UK), three from the US, AIG, MetLife and Prudential Financial, and a Chinese one, Ping An. In November 2014 the designation for these groups was confirmed, with no additions to the list. It changed in October 2015, with Generali being replaced by the Dutch insurer Aegon.

Together with the first list, a set of policy measures for G-SIIs was decided. It includes the following:[6]

- Systemically important insurers will be subjected to a more intensive and coordinated supervision, on top of the other requirements determined by national (and supranational, in case of EU insurers) authorities. Moreover, plans to restrict non-traditional and non-insurance businesses and separate them from the mainstream activities may be envisaged.
- Increased resolvability of groups or parts of them, in order to improve the supervisor's ability to resolve an entity in distress, minimising the impact on the rest of the financial system and the taxpayer's exposure to the risk of loss. G-SIIs are required to present a plan detailing how to handle the restructuring in case of failure.
- Higher Loss Absorbency (HLA): a higher level of capitalization will be required given the risk G-SIIs pose to the global financial system. The initial step is constituted by a Basic Capital Requirement (BCR). The BCR is to be calculated using a factor-based approach using risk weights related to different areas of activities, and applied on a group-wide basis.[7] This will be replaced at some point by a global Insurance Capital Standard (ICS), which will be applied to all IAIGs.

The resolution plans were submitted to the regulator during summer 2014 and, after a discussion begun in October 2013, in November 2014 the model to calculate the BCR was presented. The details on the HLA were published in October 2015. From 2019, G-SIIs will be required to hold a level of capital no lower than the BCR. Figure 2 summarizes the different layers of regulations and the types of companies affected by each of them.

The new regulatory framework creates three groups of insurers:

1. Those that are too small or focused on just one market to be subjected to the ComFrame
2. The IAIGs that will have to adopt the ComFrame
3. A subset of the IAIGs, determined on an annual basis, deemed to be systemically important, to which the G-SII regulation will apply

[6] For a quick presentation of the measures see IAIS (2014b).

[7] The details on how it is to be computed can be found in IAIS (2014a).

<table>
<tr><th>Type of Entity:</th><th>Legal Entity</th><th>Group</th><th>IAIGs</th><th>G-SIIs</th></tr>
<tr><td></td><td colspan="4">Supervisory requirements and actions</td></tr>
<tr><td>1st Tier: Insurance Core Principles</td><td>ICPs applied to legal entities only</td><td colspan="3">ICPs applied to legal entities and groups</td></tr>
<tr><td>2nd Tier: ComFrame</td><td></td><td></td><td colspan="2">ComFrame</td></tr>
<tr><td>3rd Tier: G-SIIs Package</td><td></td><td></td><td></td><td>G-SIIs package</td></tr>
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Figure 2: The regulatory framework
Source: Adapted from IAIS (2013a)

It follows that insurers belonging to group 1 will never be subjected to the G-SII regulation, whereas those in group 2 may be. In the empirical exercise I will exploit this fact to assess the impact of the evolution of the regulation on the equity prices of different groups of companies.

The process of identifying the systemically important insurers has so far spanned over four years. These are the most salient events, which will be considered in the empirical analysis.

1. November 15, 2011: The IAIS publishes a document on the relationship between insurance activity and systemic risk (IAIS, 2011) and sets a list of which activities undertaken by insurance groups can be a source of systemic risk. It contains also the first, tentative, list of policy measures to be taken in order to mitigate the contribution of the insurance industry to systemic risk.
2. January 10, 2012: The Financial Stability Board (FSB), the international body in charge of regulating the whole financial system, announces that the supervisory framework for systemically important financial institution will be extended to global systemically important insurance companies and other types of financial institutions.[8] No details are provided on how or when this would be done and how to define systemically important insurers.
3. May 31, 2012: IAIS releases its proposed assessment methodology for the identification of G-SIIs.

According to the Financial Times (Masters & Gray, 2012)

> *"Some 48 insurance groups in 13 countries are being targeted by global regulators for possible designation as "systemically important", a label that could lead to higher capital requirements and limits on business lines."*

4. July 18, 2013: The list of G-SIIs is published, together with the revised list of policy measures.
5. December 16, 2013: The IAIS publishes, for public consultation, the proposed methodology for the calculation of the Basic Capital Requirement to be applied to GSII.
6. October 5, 2015. The details of the Higher Loss Absorbency Requirement for Global Systemically Important Insurers are published.[9] The IAIS paper stipulates how the extra capital requirement needed on top of the BCR is to be calculated.
7. November 3, 2015.The G-SII list is updated, with Assicurazioni Generali being replaced by Aegon.

[8] See http://www.financialstabilityboard.org/2012/01/meeting-of-the-financial-stability-board-in-basel-on-10-january/

[9] See IAIS, 2015.

3. The role of capital and the "too-big-to-fail" premium

Investors' assessment on the measure is likely to be driven to a large extent by the result of the trade-off between the expectation of a "too-big-to-fail" premium enjoyed by systemically important insurers and its cost, in terms of higher administrative charges and above all, higher and costlier capital requirements.

The G-SIIs' regulation is based on a blueprint taken from banking prudential regulation, in which capital buffers clearly play a key role. However, this can be different, given the specificities of the two industries. While banks and (life) insurers share the role of channelling savers' funds into investment and of large investors in financial markets, major differences emerge in several respects (Thimann, 2015). For the purpose of this analysis the most important ones are about the role of debt and capital, and therefore leverage.

Insurers, being pre-funded, do not need to issue much debt and, crucially, do not do that to finance core activities.[10] Financial assets are acquired using the insurance premiums already earned, and not issuing additional liabilities. Therefore, while a higher capital charge will slow down asset accumulation and leverage in banking, the same will not happen in insurance, as the size of the asset size is mostly determined by the amount of premiums written.

As explained in Plantin & Rochet (2007), Chapter 4, in the traditional insurance business, capital serves as a buffer. If the proceeds from the sale of assets (which can take a long period and be conducted smoothly given the high liquidity of most assets) are not enough to cover all the claims, capital is used to pay the remaining claims, and only if it is depleted do the claimholders suffer losses. It works somehow in the same way as the deductible in a non-life insurance contract. Therefore, for insurers "raising capital […] means that there are (even) more assets available to cover the liability stream […], but such additional capital will be consumed, if at all, at the end of the process and has no crisis prevention or stabilisation function" (Thimann, 2015, page 376).

Additionally, bail-in is built in in most of the traditional life contracts as a participation to the gains (or losses) of the financial portfolios where their premiums are invested. This works as an additional buffer on top of capital. Unit-linked contracts with no guarantees on the amount invested would be, by definition, bailed in by policyholders.[11]

In non-life insurance, the policyholder's claim to be compensated is guaranteed by the law regardless of the return from the investment of provisions. Policyholders are protected by the imposition of very prudent provisioning criteria, strong constraints on the asset classes in which provisions can be invested and/or by the requirement to hold extra capital over and above the technical provisions. As such, in these lines of business, a bail-in is ruled out.

Therefore, as far as the bulk of the business is concerned, the specificity of insurance may call into question the usefulness of capital surcharges as a systemic risk mitigating tool; as a consequence, it may be argued that any new regulation that increases surcharges may be perceived simply as an additional cost and investors may react negatively to news of their introduction.

Another crucial issue is whether insurers can be considered "too-big-too-fail", thus raising the expectations of a public bailout in case of distress. As pointed out by Schwarcz & Schwarcz (2014), most of the US insurers that received government support as a consequence of the 2007/8 crisis were not "too-big-to-fail" in terms of size, but experienced distress due to the strong exposure to the mortgage-backed securities (both as liabilities for the companies writing credit insurance and as assets for life insurers) and the strong interconnections with other parts of the financial markets. The same applies for Europe, where it was mostly the banking and asset allocation arms of financial conglomerates that led to the distress which triggered the bailout.

Thus, it may be argued that the bailout was caused mostly by the activity undertaken by some insurers rather than by their size or core business. However, given the evidence on AIG and the large

[10] Normally debt is issued for M&A operations or to acquire fixed assets.

[11] However, the existence of guarantees on the premiums invested and of minimum return of course changes the conclusion. In this case an adequate level of capital works as a buffer against adverse changes in the price and yields of financial assets. Recently, Berdin & Gründl (2015) developed a stylised model of a German life insurance company and showed that, in a scenario of prolonged low interest rate, quite a large number of companies with an insufficient level of capitalization would run the risk of going bust as the yield on investment remains below the guaranteed returns for a prolonged period.

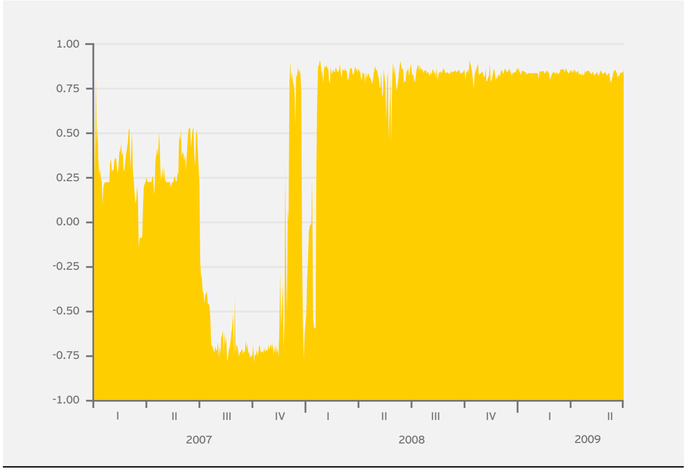

Figure 3: Dynamic Conditional Correlation* between CDS prices: ING and Aegon
*Computed using the Dynamic Conditional Correlation approach presented in Engle (2002).

Dutch conglomerates presented in Section 2, one could argue that, in case of other crises, large insurers could benefit from public bailout given:

- The role they play in providing long-term savings to a large number of people and the fact that the failure of a life insurer could lead to loss of confidence in the industry as a whole.
- The weight of their investment in some asset classes (for example, government and sovereign bonds); distress could trigger a fire sale of assets leading to potentially destabilising effects on prices. However, the extent of the sales may be limited by the ALM strategy aimed at reducing the maturity mismatch.
- The possibility that large losses in policyholder wealth due to the financial distress of an insurer and/or the plunge in its equity price may propagate to other parts of the financial markets, undermining the confidence in the whole system. Figure 3 plots the dynamic correlation between the prices of CDS of ING and Aegon's debt. The unfolding of the subprime crisis in the final months of 2007 led to a spike in the correlation between the perceived default risks.

According to the regulator, two main arguments supported the intervention (IAIS, 2011):

- Large losses in the investment portfolios of the insurance business led to a drop in solvency ratio; the ensuing chaos in financial markets exposed the banking arms to severe liquidly problems, preventing the access to market to restore the capital buffers of the insurance business.
- In a conglomerate, the loss of confidence in the banking or insurance sector may have propagated to the other sectors, and then to the rest of the financial system.

All this suggest that the existence and size of the TBTF premium is something that has ultimately to be assessed empirically.

The impact of the new regulation on systemically important financial institutions (SIFIs) on the banking sector is the subject of a few recent papers.[12] Less has been written so far concerning insurance.

The consequences of the AIG crisis and subsequent bailout on stock prices are studied by Safa, Hassan, & Maroney (2013). They analyze the impact of the most important events related to the insurer's near bankruptcy, assessing the extent of the contagion to other parts of the US financial industry. They find that the announcement of the first bailout had a positive effect on insurers' equity price; in the day following the announcement average prices were 4% higher than what was projected by a factor model. However, immediately after the second bailout, stocks were 7% down with respect to the same benchmark. Equity prices of banks, brokers and savings and loans institutions show the same pattern. According to the authors, this indicates that, initially, the bailout was welcomed by the market, but the later realisation that the crisis was persisting and a new capital injection was needed depressed the valuations. Moreover, the authors try to test whether the Federal Reserve perceived AIG

[12] For example, Bongini, Nieri, & Pelagatti (2015) study whether the release of information concerning the methodology to identify SIFI, the list of designated banks and the new capital requirements had different impacts on the affected banks from that on non-designated banks. All in all, they find that the market reaction to the announcement was not very strong, slightly negative but very diverse according to the banks' characteristics (level of capitalization, retail versus investment banks, etc.). Mixed but very weakly negative results are found by Kleinow et al. (2014): interestingly, they find that the announcements of the banks designed as systemic leave their stock prices unchanged, and interpret this find as a sign that investors were able to predict the outcome of the designation process. Moenninghoff et al. (2015) find that, overall, the new regulation has a negative impact on the banks affected, which is however mitigated by the positive effect of the official designation. They also find that such a positive reaction may be linked to the expectation of a "too-big-to-fail" guarantee, which is exactly what the new regulation is meant to avoid. Schäfer, Schnabel, & Weder di Mauro, 2015 use event studies to analyze the impact of other reforms enacted after the subprime crisis in the US and Europe finding that overall, they reduce bailout expectations at the expense of lower equity returns.

as too big to fail. They estimate a factor model for financial intermediaries' stock prices and introduce dummies for the period after the disclosure of large losses by AIG and before the first bailout ("crisis period") and for that including the two bailouts ("post-crisis period"). If AIG was perceived as too big to fail, stock returns would have discounted an intervention by the Fed and the dummy for the crisis period would have been positive. Conversely, the dummy for the post-crisis period would be negative. The estimated coefficients, albeit having the expected sign, are not significant and this leads the authors to conclude against the "too-big-to-fail" hypothesis.

Dewenter & Riddick (2016) study the impact of several events on equity prices of eight of the nine insurers that have been named as systemic and a "control" sample of another 22 entities with similar characteristics. They consider the first AIG bailout and a few steps of the evolution of the G-SII regulation. They find that, adding the reactions to these events, designated firms enjoyed, on average, a "too-big-to-fail" premium of roughly 10% with respect to the other entities considered. Moreover, they find that in the G-SII sample, positive abnormal returns in several events are positively correlated with companies' leverage and standard measures of systemic risk constructed using equity prices. This reinforces the authors' view of the existence of a TBTF guarantee. Their analysis reaches three main conclusions:

> *"[…] first, […] equity investors conclude that the potential benefits of the TBTF guaranty outweigh potential compliance costs for the designated firms, with stock prices rising an average 11.7% across the eight announcements, corresponding to an economically significant net increase in G-SII market value of $17.2 billion. The equity gains are not associated with a perceived fall in default probability, but are associated with an increase in implied asset risk of approximately 15%, and with a 2.5% abnormal loss to bondholders. These results are consistent with investor expectations that protected firms will increase asset risk in response to the moral hazard created by protection against default, and with investor expectations that bondholders will bear more risk and higher losses if the firm does fail, even with the G-SII protection. Second, we find that other large non-designated insurance firms do not, on average, enjoy any net benefits or costs from the new regulatory regime[…] consistent with the market recognizing that these firms fall outside of the TBTF umbrella. Third, we find 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"*

(Dewenter and Riddick, 2016 p. 32).

Using a slightly different methodology in terms of estimation, choice of events, and considering both a much larger sample of securities and a different, regulation-based, criterion to select the "control" group, I reach somewhat different conclusions.

In the remainder of the paper I will seek to provide an empirical test of the following hypotheses:

1. The G-SII regulation is not considered important and therefore the new pieces of information have a neutral impact on stock returns.
2. The new regulation does have an impact, the sign of which derives from the balance of two effects:
    a. The new regulation, and especially the stricter capital requirements, may make insurers safer, reducing their cost of equity and propping up returns. At the same time, being designated as systemic implies the expectation of some sort of public guarantee: in this sense "systemic" can be read as "too-big-to-fail" and implies an indirect subsidy which boosts returns upon designation announcements.
    b. The higher costs and burden entailed by the new regulation offset the perceived TBTF benefits, leading to negative response of stock prices to any announcement.

4. Methodology

The methodology used for this event study closely follows the standard one described in Campbell, Lo, & MacKinlay (1997) and MacKinlay (1997) and surveyed more recently in Kothari & Warner (2007). For each company and announcement I estimate a simple market model using 88 observations ending three days before the event date; the sample length corresponds to four months of transactions and seeks to strike a balance between the need to have enough information to get sound parameter estimates and to minimise the probability of the estimates being contaminated by other events, an issue that is particularly relevant given the large volatility stock markets experienced in 2011-2012.

As a regressor I use the national market index for the country where the company is listed, following the results of Campbell, Cowan, & Salotti (2010). While such a choice might be questionable in an analysis of the banking sector, given the weight credit institutions have on the stock markets in some countries, the issue is much less relevant for insurers, the capitalization of which is much smaller. My preferred measure of abnormal returns is computed over the event day (or first trading day after that if the event happens during the weekend or on a bank holiday) and the next, in order to account for differences in the time zones and lagged perception of the implications of the regulatory actions.

I use the daily returns of all the insurers' stocks included in the Datastream World Insurance index that were continuously traded between June 2011 and November 2015. I exclude brokers and analyze separately the impact on the six largest reinsurance companies in the world as a robustness check, as their prudential supervision related to systemic risk is not tackled by the measures under analysis.[13] With this, I have a list with 121 securities, which can be found in Appendix A.

Then I consider different subsamples of insurers and test whether, on average, the event produced statistically significant abnormal returns and then if they were different across subgroups, using some parametric and non-parametric tests.

Since I consider the same set of events for all the securities, the assumption of absence of cross-section correlation (needed to aggregate abnormal returns) is not met. Therefore, in order to test whether the Cumulative Average Abnormal Returns (CAAR) of each subgroup is different from zero I employ the parametric test introduced by Boehmer, Musumeci & Poulsen (1991) and modified by Kolari & Pynnönen (2010), which adjusts the variance of the standardised CAAR taking into account both serial correlation and cross-section correlation across securities' abnormal returns; this latter issue can also be potentially a serious problem in case of concurrent events affecting a subset of insurers, such as, for example, a development in the Eurozone debt crisis.

I cross-check the results with those of a non-parametric test, the Generalised Sign Test explained in Cowan (1992). The whole procedure is explained in Appendix B. To test whether the difference between two groups is significantly different from zero I employ a simple t-test and a (non-parametric) Wilcoxon rank sum test.

Additionally, I check for the existence of other events that may have influenced insurers' stock prices on the dates analyzed, using event study papers related to the period under analysis[14] and the Financial Times website. I do not find any significant event that can confound the results.

As a robustness check, I consider the results obtained from two alternative models. Firstly, I consider a larger window, covering two days before and after the event, to account for possible leaks and a slower reaction to the news. Then I re-estimate the market models using for each security a global stock market index (the Morgan Stanley Global Index), as done in other recent multi-country event studies.[15]

In order to test the significance of the average stock price response to the regulatory announcements, I split the sample in two ways. First of all, I take the full sample of insurance companies and form a subset of entities which meet the IAIG criteria. Data on total assets are taken from Worldscope, and I look into company statements to determine the geographical scope of the activity. I was able to identify 38 entities meeting the IAIG criteria of size and geographical diversification: adding to them the six global reinsurers the final number is not too far away from the "around 50 insurers" affected by the regulation declared by IAIS. The remaining companies are grouped into the "Other" category. Then, within the IAIG sample, I consider the nine insurers designated as G-SII in 2013 and those not designated. For the latest event I modify the group in accordance with the

[13] The decision on the list of global systemically important reinsurers and the policy measures was scheduled for July 2014 but has been delayed.

[14] Altavilla, Giannone, & Lenza (2014), Stracca (2013), Gagnon, Raskin, Remache, & Sack (2011).

[15] For example Schäfer, Schnabel, & Weder di Mauro (2015). Securities prices are converted into US dollars in order to avoid spurious volatility due to exchange rate fluctuations.

2015 revision of the list. As an alternative, I just focus on the IAIGs and group them according to the region where they are headquartered, creating three groups: EU-based, US-based and those located in the rest of the world.

Subsequently, I consider just the sample of IAIGs, and focus on the performance of the individual securities trying to assess which characteristics explain the size of the abnormal returns in selected events. Given the very small number (38) of data points I focus on just size, a proxy for the weight of non-insurance activity and a measure of leverage. As emphasized by Bongini, Nieri, & Pelagatti (2015) concerning banks, it is likely that less capitalized entities would benefit more from being perceived as "too-big-to-fail" and suffer more from the obligation to raise capital levels.

5. The results

Table 1 details the results of the tests on cumulative returns, comparing the IAIGs that were designated as systemically important, the other IAIGs, and the other companies. The CAAR is reported in the fourth column, followed by the values of respectively the Kolari and Pynnönen (KP) test and the Generalised Sign Test (GST).

The seventh column has the differences between the CAAR for the G-SIIs group and the others, and then the p-values of the t-test on the difference and that of the Wilcoxon rank sum test.

The disclosure of the activities that the IAIS thinks are sources of systemic risks (Event 1) in November 2011 followed the publication (In July 2011) of the criteria used to define an IAIG. Therefore, investors were, in principle, already able to identify the type of companies liable to be targeted by the new regulation. Large, international insurers show negative and statistically significant abnormal returns on average, while companies too small and local do not record any significant abnormal return. At this stage, investors do not seem to be able to pick which companies would have been identified: the average CAAR of the G-SII group is lower than that of the group of the non-designed ones, but the difference is not significantly different from zero.

A clear distinction between the subgroups also appears in the reaction to the following event, the FSB announcement of the extension to insurers of the regulation for systemically important institutions. Here, an explicit connection is made for the first time to the regulation coming into force for banks and that for insurance that begins to be planned. Investors appear now to be able to distinguish among IAIGs, and the group of G-SII enjoys a large and significant positive return (2.94%), which translates into a 1.08% extra-return over the other IAIGs and 2.62% over non-IAIGs.

The FSB statement lacks any detail on how the specific regulation for insurance was to be framed, and therefore the results can be rationalised as the expectation of some form of guarantee linked to the systemically important status or the possibility to be designated as such. In line with some evidence for the banking sector and the findings of Dewenter & Riddick (2016), this can be interpreted as the value of the implicit 'too-big-too-fail'' guarantee, conditional on the information available on the event date.

The presentation of the methodology to be employed to identify a G-SII (Event 3) does not appear to be related to any significant difference in the average returns, even though the CAAR for the SIIs group is negative and statistically significant. This can be interpreted as investors having already guessed which companies would have been designated and adjusting their valuation accordingly. This view seems to be confirmed by the fact that the formal designation itself (Event 4) is not met by statistically significant abnormal returns.

On the contrary, when details emerge on the most important policy measure, the Basic Capital Requirement for G-SIIs (Event 5), a clear distinction shows up. The insurers that are subjected from the beginning to the new capital requirements experience a statistically significant -0.8% CAAR and the other insurers (non-IAIGs) have a statistically significant -0.6%, but the other IAIGs (non-G-SIIs) show no significant abnormal returns. The difference between designated and non-designated IAIGs amounted to a statistically significant -1.26%. These results, being related to an estimate of the capital burden designated insurers will incur, can be interpreted as the perceived cost of the "too-big-to-fail" guarantee.

The negative performance of the insurers that do not meet the IAIG criteria may be rationalised as the realisation by investors that these entities would not be covered by the regulation mitigating systemic risk, but may still suffer from a systemic event for which they may not be ready.[16] In other words, the results of Event 5 show that being outside the "club" of IAIGs has some costs, but being inside it and having to face systemic risk related charges is not a free lunch either and entails a significant stock market penalisation.

Finally, the addition of new, more detailed information on how the HLA is calculated (Event 6) does not seem to affect the three groups in a significant way.

Table 2 presents the results of the analysis for the IAIGs only, which are grouped according to the location of their headquarters: European Union (EU), United States (US) and rest of the world (ROW). This splitting is meant to capture the impact of the differences in the regulatory regimes with which the new framework will coexist. It must be noted, however, that the response of the ROW group is never significantly different from zero as long as the parametric tests are considered; the large heterogeneity in the regulatory frameworks is probably responsible for the large variability of the abnormal returns.

The methodology proposed by the IAIG to identify systemically important insurers (Event 3) is viewed by investors as more damaging for European concerns than for US ones, whereas the difference with those in the rest of the world is not significantly different from zero. When the single most important measure is tackled - the discussion of the details of the calculation of the BCR (Event 5) - it is the US group that records a negative differential with respect to the EU-based insurers.

The publication of the HLA calculation details has a negative impact on large US-based insurers, but the difference with respect to entities based elsewhere is not statistically significant.

In order to assess the robustness of the results, especially as far as the ability of investors to pick which companies would have been affected by the new measures is concerned, it may be useful to compare the behaviour of primary insurers versus that of reinsurers. To this end, I add to the sample the six reinsurers that match the IAIGs criteria.[17] Table 3 presents the result of the split between IAIGs, other insurers and large reinsurers.

Concerning the first event, the absence of any statistically significant CAAR for the insurance group and the difference with respect to IAIGs' abnormal returns confirm the view that the information provided by the IAIS paper was enough to enable investors to determine which companies were liable to be affected by the new regulation. The same applies for Event 2; moreover, the slightly negative CAAR for reinsurers is an indication that investors ruled out any form of TBTF premium benefitting reinsurers. The positive CAAR posted in Event 3 may be interpreted as an indication of investors reacting to the realisation that reinsurers were (temporarily) "off the hook" as far as systemic risk regulation was concerned.

The results of the robustness tests are reported in Appendix C. The results obtained using a single global index in the market model are in line with that of the baseline model as far as the size and significance of the events are concerned. On the other hand, moving from a two-day to a much larger five-day window gives more volatile results, as expected.

[16] As an additional robustness check I split the small insurers sample according to HQ location, finding no significant differences.

[17] They are QBE (Australia), Swiss Re (Switzerland), SCOR (France), Munich Re and Hannover Re (Germany). Berkshire Hathaway was excluded as, while listed as a reinsurer, it is in fact a large conglomerate.

Event	Date	Description		CARR	KP§	GST§	Diff. Vs. SII	p-val.	Wilcoxon§
1.	November 15, 2011	The IAIS publishes a document on the relationship between insurance activity and systemic risk, and sets a list of which activities undertaken by insurance groups can be a source of Systemic Risk.	SII	-1.31	0.02**	0.06**			
			Non-SII	-1.08	0.08*	0.00***	-0.23	0.35	0.46
			Other	0.36	0.14	0.43	-1.67	0.01***	0.02***
2.	January 10, 2012	The FSB announces that the supervisory framework for systemically important financial institutions will be extended to global systemically important insurance companies and other types of financial institutions.	SII	2.94	0.13	0.00***			
			Non-SII	1.86	0.28	0.00***	1.08	0.11	0.08*
			Other	0.32	0.22	0.01***	2.62	0.00***	0.00***
3.	May 31, 2012	IAIS releases its proposed assessment methodology for the identification of G-SIIs.	SII	-0.23	0.03**	0.04**			
			Non-SII	-0.24	0.36	0.45	0.01	0.5	0.42
			Other	0.05	0.01***	0.01***	-0.28	0.34	0.11
4.	July 18, 2013	The list of G-SIIs is published, together with the list of policy measures.	SII	-0.2	0.26	0.3			
			Non-SII	0.19	0.24	0.11	-0.39	0.18	0.33
			Other	-0.15	0.45	0.39	-0.05	0.41	0.47
5.	December 16, 2013	IAIS releases the public consultation document on the calculation of the basic capital requirements to be imposed on G-SIIs.	SII	-0.82	0.00***	0.01***			
			Non-SII	0.44	0.2	0.31	-1.26	0.00***	0.04**
			Other	-0.61	0.00***	0.00***	-0.21	0.21	0.22
6.	October 3, 2015	The details of the HLA are published.	SII	-0.13	0.21	0.17			
			Non-SII	0.26	0.41	0.25	-0.74	0.14	0.18
			Other	-0.23	0.28	0.17	0.1	0.46	0.47
§p-values. Significant at ***1% **5% *10%									

Table 1: Cumulative average abnormal returns, G-SIIs, other IAIGs and other insurers

Event	Date	Description		CARR	KP§	GST§	Diff. Vs. SII	p-val.	Wilcoxon§
1.	November 15, 2011	The IAIS publishes a document on the relationship between insurance activity and systemic risk, and sets a list of which activities undertaken by insurance groups can be a source of Systemic Risk.	EU	-1.07	0.08	0.00***			
			US	-1.33	0.03	0.02**	0.26	0.34	0.15
			ROW	-1.08	0.48	0.07*	0.01	0.5	0.37
2.	January 10, 2012	The FSB announces that the supervisory framework for systemically important financial institutions will be extended to global systemically important insurance companies and other types of financial institutions.	EU	2.2	0.09	0.44			
			US	2.49	0.37	0.15	-0.29	0.49	0.2
			ROW	1.37	0.44	0.00***	0.83	0.15	0.28
3.	May 31, 2012	IAIS releases its proposed assessment methodology for the identification of G-SIIs.	EU	-1.57	0.16	0.00***			
			US	0.86	0.23	0.19	-2.42	0.03***	0.12
			ROW	0.14	0.38	0.36	-1.7	0.09*	0.28
4.	July 18, 2013	The list of G-SIIs is published, together with the list of policy measures.	EU	0.29	0.33	0.03**			
			US	0.28	0.19	0.15	0.01	0.5	0.28
			ROW	-0.29	0.39	0.34	0.58	0.19	0.26
5.	December 16, 2013	IAIS releases the public consultation document on the calculation of the basic capital requirements to be imposed on G-SIIs.	EU	0.3	0.35	0.03**			
			US	-0.62	0.11	0.01***	0.92	0.01***	0.01***
			ROW	0.43	0.46	0.5	-0.13	0.5	0.34
6.	October 3, 2015	The details of the HLA are published.	EU	0.13	0.45	0.41			
			US	-0.16	0.05**	0.02**	0.29	0.46	0.28
			ROW	0.07	0.13	0.2	0.06	0.41	0.28
§p-values. Significant at ***1% **5% *10%									

Table 2: Abnormal returns, IAIGs split by geography

Event	Date	Description		CARR	KP§	GST§	Diff. Vs. SII	p-val.	Wilcoxon§
1.	November 15, 2011	The IAIS publishes a document on the relationship between insurance activity and systemic risk, and sets a list of which activities undertaken by insurance groups can be a source of Systemic Risk.	IAIGs	-1.13	0.07*	0.00***			
			Other	0.36	0.14	0.43	-1.49	0.00***	0.00***
			Reins	0.76	0.24	0.10*	-1.89	0.05**	0.12*
2.	January 10, 2012	The FSB announces that the supervisory framework for systemically important financial institutions will be extended to global systemically important insurance companies and other types of financial institutions.	IAIGs	2.11	0.27	0.00***			
			Other	0.32	0.22	0.01***	1.79	0.00***	0.00***
			Reins	-0.6	0.00***	0.08*	2.71	0.07*	0.04**
3.	May 31, 2012	IAIS releases its proposed assessment methodology for the identification of G-SIIs.	IAIGs	-0.23	0.22	0.2			
			Other	0.05	0.01***	0.01***	-0.28	0.26	0.18
			Reins	0.61	0.18	0.00***	-0.84	0.15	0.28
4.	July 18, 2013	The list of G-SIIs is published, together with the list of policy measures.	IAIGs	0.1	0.37	0.14			
			Other	-0.15	0.45	0.39	0.25	0.25	0.12
			Reins	0.82	0.11	0.01***	-0.72	0.24	0.26
5.	December 16, 2013	IAIS releases the public consultation document on the calculation of the basic capital requirements to be imposed on G-SIIs.	IAIGs	0.15	0.47	0.19			
			Other	-0.61	0.00***	0.00***	0.76	0.00***	0.01***
			Reins	-0.06	0.25	0.36	0.21	0.12	0.36
6.	October 3, 2015	The details of the BCR are published.	IAIGs	0.21	0.4	0.33			
			Other	-0.23	0.28	0.17	0.44	0.13	0.09*
			Reins	-0.53	0.14	0.33*	0.74	0.13	0.21
§p-values. Significant at ***1% **5% *10%									

Table 3: Abnormal returns, insurers and reinsurers

Summing up, some of the regulatory announcements had a non-negligible impact on insurers' stock prices. The first official documents by the IAIS mentioning systemic risk depressed the valuation of IAIGs, but then, when the FSB suggested that insurance and banks could somehow be "lumped" together as far as systemic risk regulation was concerned, IAIGs experienced positive abnormal returns. Additionally, investors appear to be able to distinguish the insurers most likely to be designated, well ahead of the formal designation. The information provided by the IAIS in its methodological paper seems to have been enough to enable investors to pick those which would have been designated, despite the fact that investors have a much narrower information set than the regulators.

Finally, I utilise the information on the change in the SII list that occurred in November 2015 (Event 7) to get an overall assessment of how financial markets value the "systemic" status. Using a SUR model, I regress the returns of Generali and Aegon stocks on their home market index, the STOXX index for financial services (to control for industry specific shocks) and three time dummies for the day when the new list was announced, and the day before and after. I use a sample spanning 85 days before the event and three after it.[18] It turns out that the only significant time dummy is the one for Generali on the event day: the coefficient is 1.07 with a t-statistic of 1.93, indicating a positive, but not very statistically significant positive effect of being removed from the SII list. The fact that the Aegon equity price does not seem to be affected by the event may indicate that firm characteristics matter for the assessment of the implications of the new regulation.

In order to investigate this issue I then consider the sample of the IAIGs, i.e., all the companies that at some point may be affected by the regulation and regress the CAAR for the most significant events (1, 2, and 5) on size, gearing and the importance of non-insurance activity. Moreover for Event 5, I also use a dummy for the entities headquartered in the US, in order to gauge how investors assess the compatibility with the global framework being developed and the existing national regulation. This is relevant in light of the expected developments in prudential regulation: the Solvency II regime, coming into force for all EU-based companies in 2016 foresees a risk-based capital weighting scheme, whereas US companies will stick to the risk weighting scheme.

Dep. Var: CAR	Event 1	Event 2	Event 5
Constant	-10.42 [-2.46]*	-11.74 [-2.46]*	0.14 [0.04]
Total asset (log)	0.57 [2.11]*	0.59 [2.19]*	0.1 [0.51]
Debt/capital	-0.04 [-1.38]	0.07 [2.52]*	-0.03 [-2.41]*
Non policyholder liabilities	-1.06 [-1.16]	1.59 [0.79]	-1.51 [-1.44]
Headquartered in the US	-	-	-1.4 [-2.98]**
Observations:	38	38	38
R-squared:	0.11	0.28	0.32
F-statistic:	1.47	4.37	3.93
Prob(F-stat):	0.24	0.01	0.01
Significant at ***1% **5% *10%			

Table 4: Determinants of abnormal returns in selected events

Consider first the results for Events 1 and 2 reported in Table 3 (first and second columns). They show that size is positively related to CAAR for both events and that Event 2 extra returns have a positive correlation with company's gearing.

If the positive abnormal returns are interpreted as an expectation of a TBTF guarantee, this accrues, as expected, to larger entities and those that, being more leveraged, would be more in need of a public bailout. The relative size of non-policyholders' liability is not statistically significant. Consider then the third column, which shows the same model (plus the dummy for US insurers) applied to Event 5. It appears that size is no longer correlated with the response. Interestingly, in Event 5, the relationship with gearing remains significant but switches sign: more leveraged firms may need extra efforts to raise capital to meet the BCR and this seems to be priced in their stocks. On top of that, companies based in the US have a stronger penalty, possibly suggesting a more difficult compatibility between the BCR and the local solvency regime.

[18] The sample includes Event 6, so I dummy it out.

6. Discussion

Some of the steps in the development of the regulation did cause significant abnormal returns in insurers' equity prices. In order to calculate the total impact I add across events the abnormal returns, considering just the case when they are statistically significant at least at the 10% level for both the Kolari-Pynnönen and the Generalised Sign Test. Considering the group of G-SIIs, I take Events 1, 2, 3 and 5: the cumulated abnormal return is 0.58%. The difference with respect to non-designated IAIGs is statistically significant only in Events 2 and 5: summing them I get -0.18%. Finally, the difference over non-IAIGs, considering Events 1 and 2, is 0.95%.

The first conclusion that can be drawn is that the perceived value of the TBTF guarantee related to being designated (or initially perceived by investors as) systemically important is relatively small, less than 0.6%. However, the difference with respect to IAIGs not having this status is slightly negative. This contrasts sharply with the nearly 12% (10.3% considering only the statistically significant responses) TBTF premium estimated by Dewenter & Riddick (2016), who consider a different set of events and put together the reaction to the first AIG bailout and only some of the steps of the G-SII regulation process. Some of the differences may be due to the choice of the events: in particular their analysis stops at the designation of the G-SIIs, while mine includes the publication of the details of the Basic Capital Requirement. More important, however, is the fact that their "control" group put together IAIGs which can be at some point designated as systemic with large, but just domestically focused entities which will never be designated.

It is, however, important to notice the quite large difference with respect to the group of smaller companies which do not meet the IAIG criteria, suggesting that, possibly, some form of implicit guarantee could come from the ComFrame regulation.

However, the process of regulating the sources of systemic risk in insurance is at a relatively early stage compared with that of the banking sector and therefore the sum of the impacts may not, at present, be very informative. What matters more is the effect of the additional information provided by the events.

Considering the G-SIIs group, only the - rather vague - statement by the FSB on the extension of the framework for G-SIFI to insurance was met by positive abnormal returns. The following steps, i.e. the releases of the details on how to identify SIIs (Event 3) and, crucially, how to calculate the BCR (Event 5), were accompanied by negative abnormal results. This is likely to indicate a pessimistic revision of the investors' assessment of the impact of the new regulation on insurers' profitability. However, the extra information provided by the details on the HLA calculation and the revision of the SII list was not considered relevant by financial market.

The revision in expectations also appears in the results of the regressions of the CAAR for Events 2 and 5 on companies' size and, crucially, gearing. When the FSB declared that the systemic risk framework would also encompass insurers, the benefit in terms of extra returns was larger for bigger and more leveraged insurers, consistent with the TBTF premium hypothesis. However, once the details of the measures, and in particular the calculation of the BCR were known, size no longer mattered[19] and more geared insurers experienced larger negative abnormal returns, consistent with the view that the new measures represented a higher cost for firms as they will have to recapitalize. Bongini, Nieri & Pelagatti (2015) find a similar result for banks.

7. Conclusion

This paper has sought to assess whether and to what extent the financial market priced the different phases of the evolution of the macroprudential frame work for insurance companies. The new regulation matters to investors, as some of the key steps were accompanied by statistically significant abnormal returns and investors seem to have understood which entities would have been designated as systemically important well ahead of the publication of the list. The size of the abnormal returns and their evolution over time, suggest that investors' opinions on the regulation have turned to moderately pessimistic once the details on the capital standards were enounced. Overall, the impact is not very strong, in line with what was found recently by similar studies on banks. Gearing is an important driver of the results. Its correlation with the cumulative results was positive upon the announcement of the extension of the SIFI status to insurers

[19] This is consistent with the view that size is an imperfect indicator of systemic risk for banks and insurance, as shown by the low correlation between asset prices based measures of systemic risk and the size of the individual entities. See for example, Adrian & Brunnermeier, 2016.

before turning negative when investors were able to estimate the cost of being systemically important in terms of capital requirement. This is again consistent with an evolution of market perception from an initial expectation of a TBTF premium to a more pessimistic assessment of the costs and burdens related to the new regulation, especially for US-based entities.

	Name	Jurisdiction	Assets 2010 YE (USD '000)
Designated as G-SII in 2013 and 2014	AVIVA	UNITED KINGDOM	591820229
	ALLIANZ	GERMANY	881697289
	AXA	FRANCE	1037518855
	ASSICURAZIONI GENERALI	ITALY	597900960
	PING AN INSURANCE	CHINA	169752469
	PRUDENTIAL	UNITED KINGDOM	419755352
	AMERICAN INERNATIONAL GROUP	UNITED STATES	683443000
	METLIFE	UNITED STATES	730906000
	PRUDENTIAL FINANCIAL	UNITED STATES	539854000
Non Designated	AGEAS (EX-FORTIS)	BELGIUM	142342814
	MANULIFE FINANCIAL	CANADA	406783811
	POWER FINANCIAL	CANADA	138358244
	SUN LIFE FINANCIAL	CANADA	203583257
	MAPFRE	SPAIN	64569551
	CNP ASSURANCES	FRANCE	451545437
	AEGON (designated in 2015)	NETHERLANDS	472167398
	TOKIO MARINE HOLDINGS	JAPAN	188605816
	MS&AD INSURANCE GP.HDG.	JAPAN	82463115
	SONY FINANCIAL HOLDINGS	JAPAN	65482398
	SAMSUNG FIRE & MAR.IN.	KOREA (SOUTH)	23830851
	LEGAL & GENERAL	UNITED KINGDOM	524189226
	STOREBRAND	NORWAY	69243952
	VIENNA INSURANCE GROUP	AUSTRIA	55359872
	OLD MUTUAL	UNITED KINGDOM	313392987
	RSA INSURANCE GROUP	UNITED KINGDOM	33035621
	BALOISE-HOLDING AG	SWITZERLAND	63711969
	SWISS LIFE HOLDING	SWITZERLAND	143526673
	ZURICH INSURANCE GROUP	SWITZERLAND	324302899
	STANDARD LIFE	UNITED KINGDOM	239761143
	SHIN KONG FINL.HLDG.	TAIWAN	64623125
	ACE	SWITZERLAND	82586000
	AFLAC	UNITED STATES	101039000
	CHUBB	UNITED STATES	50151000
	GENWORTH FINANCIAL	UNITED STATES	111295000
	TRAVELERS	UNITED STATES	104688000
	EULER HERMES GROUP	FRANCE	7404483
	HISCOX	BERMUDA	5733282
	XL GROUP	BERMUDA	44879826

Appendix A: Internationally Active Insurance Groups (IAIGs)
Note: China refers to mainland China jurisdiction

Name	Jurisdiction	Assets 2010 YE (USD '000)
ARCH CAP. GP.	BERMUDA	15770792
CINCINNATI FINL.	UNITED STATES	15095000
AMP	AUSTRALIA	82476410
CHALLENGER	AUSTRALIA	17090611
INSURANCE AUS. GROUP	AUSTRALIA	18735042
ADMIRAL GROUP	UNITED KINGDOM	2279765
AMLIN	UNITED KINGDOM	9237019
BEAZLEY	IRELAND	4946640
PORTO SEGURO ON	BRAZIL	8055497
SUL AMERICA UNT	BRAZIL	6509969
E-L FINANCIAL	CANADA	13554996
FAIRFAX FINL.HDG.	CANADA	30314468
INDL.ALL.IN. & FINL.SVS.	CANADA	32792659
INTACT FINANCIAL	CANADA	11811103
CATLIN GROUP	BERMUDA	11806000
CHESNARA	UNITED KINGDOM	7438861
NUERNBERGER BETS.	GERMANY	31840050
WURTTEMBERGISCHE LEB.	GERMANY	41505319
ALM BRAND	DENMARK	9200129
TOPDANMARK	DENMARK	11039415
TRYG	DENMARK	9511345
GRUPO CATALANA OCCIDENTE	SPAIN	11686722
APRIL	FRANCE	1895465
CATTOLICA ASSICURAZIONI	ITALY	25941756
MEDIOLANUM	ITALY	46911913
UNIPOL GRUPPO FINANZIARI	ITALY	73506545
VITTORIA ASSICURAZIONI	ITALY	3547104
MAX INDIA	INDIA	2908440
RELIANCE CAPITAL	INDIA	5716623
T & D HOLDINGS	JAPAN	139563228
JARDINE LLOYD THOMPSON	UNITED KINGDOM	1984725
CHINA TAIPING IN.HDG.	HONG KONG	19630869
CHINA LIFE INSURANCE 'H'	CHINA	206608264
PICC PROPERTY & CLTY.'H'	CHINA	29341125
SAMSUNG FIRE & MAR.IN.	KOREA (SOUTH)	23830851
HYUNDAI MARINE & FIRE IN.	KOREA (SOUTH)	10186551
DONGBU INSURANCE	KOREA (SOUTH)	13263737

Appendix A: Other Insurers

Note: China refers to mainland China jurisdiction

LANCASHIRE HOLDINGS	UNITED KINGDOM	2576600
STOREBRAND	NORWAY	69243952
NOVAE GROUP	UNITED KINGDOM	2325611
UNIQA INSU GR AG	AUSTRIA	39775884
SCB LIFE ASSURANCE	THAILAND	2013043
DISCOVERY	SOUTH AFRICA	1796183
LIBERTY HOLDINGS	SOUTH AFRICA	31916917
MMI HOLDINGS	SOUTH AFRICA	NA
SANLAM	SOUTH AFRICA	48291979
SANTAM	SOUTH AFRICA	2185363
HELVETIA HOLDING N	SWITZERLAND	36315515
SCHWZ.NATIONAL-VERSICH.- GESELL.	SWITZERLAND	7519112
VAUDOISE 'B'	SWITZERLAND	10979703
ST.JAMES'S PLACE	UNITED KINGDOM	41212786
ANADOLU HAYAT EMEKLILIK	TURKEY	3631081
CHINA LIFE INSURANCE	TAIWAN	20430356
FUBON FINL.HLDG.	TAIWAN	108426390
SHIN KONG FINL.HLDG.	TAIWAN	64623125
AMERICAN FINL.GP.OHIO	UNITED STATES	32454000
ASSURED GUARANTY	BERMUDA	19247554
ASSURANT	UNITED STATES	26320588
ARTHUR J GALLAGHER	UNITED STATES	3350800
AXIS CAPITAL HDG.	BERMUDA	16373125
BROWN & BROWN	UNITED STATES	2400814
CNA FINANCIAL	UNITED STATES	54690000
CNO FINANCIAL GROUP	UNITED STATES	31060200
HCC INSURANCE HDG.	UNITED STATES	9064082
HARTFORD FINL.SVS.GP.	UNITED STATES	314621000
LINCOLN NATIONAL	UNITED STATES	193824000
MARKEL	UNITED STATES	10762326
MARSH & MCLENNAN	UNITED STATES	14105000
OLD REPUBLIC INTL.	UNITED STATES	15837400
PROGRESSIVE OHIO	UNITED STATES	21150300
PROTECTIVE LIFE	UNITED STATES	47562786
PARTNERRE	BERMUDA	23349411
EVEREST RE GP.	BERMUDA	18258870
RENAISSANCERE HDG.	BERMUDA	8138278
TORCHMARK	UNITED STATES	16159762
UNUM GROUP	UNITED STATES	57307700

Appendix A: Other Insurers (continued)

Note: China refers to mainland China jurisdiction

W R BERKLEY	UNITED STATES	17463055
WILLIS GROUP HOLDINGS	UNITED KINGDOM	15840000
WHITE MOUNTAINS IN.GP.	BERMUDA	14034400
ALLEGHANY	UNITED STATES	6354552

Appendix A: Other Insurers (continued)

Note: China refers to mainland China jurisdiction

Appendix B: Methodology

First consider an 88-day estimation window $[T_0, T_1]$, ending three days before the event and estimate the following model

$$r_{it} = \alpha + \beta r_{Mt} + u_{it} \quad \text{(A1)}$$

The abnormal returns are computed in the event window (T_2, T_3) as

$$ar_{it} = r_{it} - \hat{\alpha} + \hat{\beta} r_{Mt} \quad \text{(A2)}$$

Then they are cumulated over the event window of days ranging from T_2 and T_3 , encompassing the event day, as

$$CAR_i(T_2, T_3) = \sum_{t=T_2}^{T_3} ar_{it} \text{(A3)}$$

The BMP test considers first the cumulative returns standardized for an estimate of their standard deviation

$$SCAR_i(T_2, T_3) = CAR_i(T_2, T_3)/S_{CAR_i(T_2,T_3)} \quad \text{(A4)}$$

Here the standard deviation is corrected for the serial dependence that arises in successive prediction errors based on the same parameter estimates as follows

$$S_{CAR_i(T_2,T_3)} = \sqrt{\left(\frac{1}{(T_1-T_0)} \sum_{t=T_0}^{T_1} ar_{it}^2\right)\left\{(T_3 - T_2) * \left[1 + \frac{(T_3-T_2)}{(T_1-T_0)} + \frac{\left(\sum_{t=T_2}^{T_3} r_{Mt} - (T_3-T_2)\overline{r_M}\right)^2}{\sum_{t=T_0}^{T_1} (r_{Mt} - \overline{r_M})^2}\right]\right\}} \text{ (A5)}$$

where $\overline{r_M}$ is the mean of the market return over the estimation sample.

Then the statistic on the cross-section of the N companies belonging to a group is derived as

$$Z = \frac{\sum_{n=1}^{N} SCAR_n(T_2, T_3)}{\sqrt{N} S_{SCAR}} \text{(A6)}$$

where

$$S_{SCAR} \sqrt{\left[\frac{1}{N-1} \sum_{n=1}^{N} \left(SCAR_n(T_2, T_3) - \frac{1}{N} \sum_{n=1}^{N} SCAR_n(T_2, T_3)\right)^2\right]} \quad \text{(A7)}$$

Z is asymptotically distributed as a standard normal.

However, the BMP test assumes that individual securities are uncorrelated in the cross-section, which may not be the case when the event date is the same for all companies. Kolari & Pynnönen (2010) devise a modification of the BMP statistics in order to account for cross-section correlation. The statistic they propose is the following

$$Z_{BMP-KP} = Z_{BMP} \sqrt{\frac{1-\bar{p}}{1+(1+N)\bar{p}}} \qquad \text{(A8]}$$

where $\hat{p}$ is the average cross-sectional correlation coefficient of the residuals of the estimated equation (i.e. the abnormal returns in the estimation period). This statistic is again asymptotically normally distributed under the null hypothesis of no effect.

In the generalised sign (GS) test the null hypothesis is that, within a group, the share of returns having a positive sign in the event window is equal to the fraction expected to have that sign, based on the estimation window. For example, considering positive returns

$$\hat{p} = \frac{1}{N} \sum_{n=1}^{N} \frac{1}{((T_1 - T_0))} \sum_{t=T_0}^{T_1} S_{nt}\,, \quad S_{nt} = \begin{cases} 1 \; if \; u_{nt} > 0 \\ 0 \; otherwise \end{cases} \qquad \text{(A8)}$$

The test statistic is based on the normal approximation of a binominal distribution with parameter $\hat{p}$ and reads

$$Z = \frac{N_0 - N\hat{p}}{\sqrt{[N\hat{p}(1-\hat{p})]}} \quad \text{(A9)}$$

where N_0 is the number of securities in the group having on average positive residuals in the estimation windows.

In order to test for negative signs, substitute negative for positive in the definition of S_{nt} and N_0.

	Event	1	2	3	4	5	6
SII	CAAR	-1.24	3.29	0.81	0.41	-0.9	0.14
	BMP-KP	0.12	0.07*	0.10*	0.26	0.03**	0.37
	GST	0.16	0.00**	0.36	0.11	0.02**	0.32
Non SII	CAAR	-1.02	1.67	0.8	0.18	0.35	0.88
	BMP-KP	0.07*	0.29	0.48	0.17	0.24	0.16
	GST	0.04**	0.00***	0.03**	0.07*	0.12	0.06**
Other	CAAR	-0.19	0.65	0.89	-0.25	-0.72	0.33
	BMP-KP	0.45	0.06*	0.06**	0.37	0.00***	0.47
	GST	0.29	0.02**	0.00***	0.38	0.00***	0.45
SII-Non SII	dCAAR	-0.22	1.62	0.01	0.23	-1.25	-0.74
	p-value	0.4	0.02**	0.5	0.34	0.01***	0.14
	Wilcoxon	0.44	0.03**	0.5	0.45	0.05***	0.2
SII-Other	dCAAR	-1.05	2.64	-0.08	0.66	-0.18	-0.19
	p-value	0.01***	0.00***	0.34	0.41	0.21	0.35
	Wilcoxon	0.02**	0.00***	0.11	0.47	0.22	0.28
EU	CAAR	-0.75	2.25	1.39	1.02	0.43	1.22
	BMP-KP	0.35	0.31	0.27	0.08*	0.33	0.02**
	GST	0.18	0.03**	0.27	0.10*	0.03**	0.01**
US	CAAR	-1.25	2.24	-0.27	0.23	-0.63	-0.79
	BMP-KP	0.11	0.43	0.22	0.3	0.16	0.00***
	GST	0.00***	0.38	0.17	0.01	0.05**	0.02**
ROW	CAAR	-1.4	1.71	0.76	-0.81	0.16	1.02
	BMP-KP	0.5	0.45	0.48	0.4	0.44	0.01**
	GST	0.04**	0.02**	0.21	0.28	0.25	0.02**
EU-US	dCAAR	0.5	0	1.67	0.79	1.06	2.01
	p-value	0.22	0.5	0.04**	0.02**	0.01***	0.01**
	Wilcoxon	0.08*	0.2	0.05**	0.04**	0.01***	0.07*
EU-ROW	dCAAR	0.65	0.54	0.63	1.83	0.27	0.19
	p-value	0.22	0.26	0.23	0.01***	0.34	0.39
	Wilcoxon	0.01***	0.03**	0.01***	0.01***	0.00***	0.04**

Significant at ***1% **5% *10%

Appendix C: Robustness checks

Table A1: Market model with common world index

	Event	1	2	3	4	5	6
IAIGs	CAAR	-1.07	2.04	0.8	0.24	0.06	0.79
	BMP-KP	0.08*	0.27	0.35	0.22	0.48	0.25
	GST	0.03**	0.00***	0.04**	0.05**	0.42	0.01**
Other	CAAR	0.05	0.77	0.53	-0.33	-0.76	0.33
	BMP-KP	0.45	0.06*	0.06*	0.37	0.00***	0.47
	GST	0.29	0.02**	0.00***	0.38	0.00***	0.45
Reinsurers	CAAR	0.96	-0.36	1.66	1.04	-0.2	0.74
	BMP-KP	0.15	0.00***	0.08*	0.08*	0.29	0.36
	GST	0.34	0.07*	0.00***	0.02**	0.38	0.28
IAIGs-Other	dCAAR	-1.12	1.27	0.27	0.57	0.82	0.46
	p-value	0.01***	0.01***	0.32	0.09*	0.01***	0.18
	Wilcoxon	0.02**	0.01***	0.32	0.02**	0.01***	0.16
IAIGs-Reins	dCAAR	-2.03	2.4	-0.86	-0.8	0.26	0.27
	p-value	0.03**	0.06*	0.13	0.22	0.41	0.36
	Wilcoxon	0.26	0.14	0.37	0.33	0.44	0.32
Significant at ***1% **5% *10%							

Appendix C: Robustness checks
Table A1: Market model with common world index (continued)

	Event	1	2	3	4	5	6
SII	CAAR	-1.48	3.43	-0.22	-0.3	0.32	-0.43
	BMP-KP	0.00***	0.05**	0.04**	0.22	0.2	0.22
	GST	0.01***	0.01***	0.15	0.45	0.41	0.17
Non SII	CAAR	-1.06	2.33	-0.66	0.25	0.32	0.33
	BMP-KP	0.14	0.17	0.23	0.19	0.34	0.38
	GST	0.01***	0.02**	0.05**	0.05*	0.11	0.24
OTHER	CAAR	-0.34	-0.2	-0.22	-0.07	-0.1	-0.9
	BMP-KP	0.28	0.00***	0.38	0.35	0.03**	0.05*
	GST	0.02**	0.02**	0.07*	0.23	0.14	0.00***
SII-Non SII	dCAAR	-0.42	1.1	0.44	-0.55	0	-0.76
	p-value	0.25	0.16	0.31	0.16	0.5	0.25
	Wilcoxon	0.19	0.03**	0.07*	0.4	0.18	0.46
SII-Other	dCAAR	-1.14	3.63	0	-0.23	0.42	
	p-value	0.00***	0.00***	0.14	0.31	0.10*	
	Wilcoxon	0.03**	0.01***	0.33	0.36	0.13	
EU	CAAR	-0.16	-0.66	0.3	0	0.27	0.83
	BMP-KP	0.33	0.01***	0.34	0.39	0.21	0.23
	GST	0.46	0.00***	0.02***	0.1	0.04**	0.04**
US	CAAR	-1.93	1.92	0.72	1.14	-0.79	-0.64
	BMP-KP	0.01***	0.45	0.03**	0.03**	0.14	0.00***
	GST	0.00***	0.00***	0.02**	0.14	0.23	0.00***
ROW	CAAR	-1.23	1.65	-1.5	-0.5	0.87	-0.44
	BMP-KP	0.5	0.44	0.48	0.43	0.49	0.46
	GST	0.00***	0.17	0.42	0.00***	0.13	0.39
EU-US	dCAAR	1.26	1.76	-1.18	-1.18	1.36	1.47
	p-value	0.09*	0.18	0.19	0.02**	0.05*	0.08*
	Wilcoxon	0.11	0.21	0.35	0.13	0.01***	0.17
EU-ROW	dCAAR	0.56	2.03	1.04	0.46	-0.3	0.67
	p-value	0.3	0.08*	0.14	0.26	0.36	0.13
	Wilcoxon	0.01***	0.03**	0.18	0.38	0.00***	0.22
Significant at ***1% **5% *10%							

Appendix C: Robustness checks
Table A2: [-2, 2] Window

	Event	**1**	**2**	**3**	**4**	**5**	**6**
IAIGs	CAAR	-1.16	2.59	-0.56	0.12	0.32	0.15
	BMP-KP	0.12	0.16	0.15	0.32	0.33	0.49
	GST	0.00***	0.00***	0.02**	0.14	0.19	0.44
Other	CAAR	-0.31	-0.16	-0.24	-0.1	-0.16	-0.9
	BMP-KP	0.28	0.00***	0.38	0.35	0.03**	0.05*
	GST	0.02**	0.02**	0.07*	0.23	0.14	0.00***
Reinsurers	CAAR	0.62	-2.92	-1.8	0.26	0.59	-2.05
	BMP-KP	0.36	0.05	0.04	0.29	0.07	0.03**
	GST	0.34	0.08	0.11	0.01	0.02	0.08*
IAIGs-Other	dCAAR	-0.85	2.75	-0.32	0.22	0.48	1.05
	p-value	0.01***	0.01***	0.15	0.34	0.03**	0.05*
	Wilcoxon	0.00***	0.10*	0.00***	0.00***	0.24	0.11
IAIGs-Reins	dCAAR	-1.78	5.51	1.24	-0.14	-0.27	2.2
	p-value	0.17	0.07*	0.14	0.45	0.4	0.05*
	Wilcoxon	0.44	0.10*	0.2	0.44	0.49	0.13
Significant at ***1% **5% *10%							

Appendix C: Robustness checks
Table A2: [-2, 2] Window (continued)

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