Risk Management and MBS Risk-taking of Financial Institutions

Preliminary and please do not quote or circulate without the authors' consent

Jane Chen, Shanghai University of Finance & Economics
Eric Higgins, Kansas State University
Han Xia, University of Texas at Dallas
Hong Zou, University of Hong Kong

Abstract

Despite claims that failure for risk management to constrain financial institutions' risk taking via investing in "toxic" mortgage-backed securities (MBS) is a culprit for the 2008 financial crisis, there is little direct evidence due to the lack of firm-level data on MBS holdings. Using US insurers as a laboratory for which there are detailed holding data, we shed new light on this issue. We find that the effects of risk management (proxied by practicing enterprise risk management (ERM) or not) on risk taking via MBS investment hinge on the nature of reporting regulations and businesses that differ between property/casualty and life insurance. Property/casualty insurers practicing ERM were less exposed to MBS at the onset of the financial crisis, and suffered smaller losses in the crisis. Importantly, we report that property/casualty insurers that had a larger MBS exposure at the onset of the crisis experienced a lower subsequent premium growth, suggesting a spillover effect from investment to the product market. These patterns are absent for life insurers. Our findings highlight how the nature of business and regulations can have a first-order effect on the functioning of risk management, and show a negative externality of MBS investment as a risk-taking channel. Our results have important policymaking implications for the regulation of risk management in financial institutions.

Keywords: mortgage backed securities (MBS); financial institutions, risk management; governance; insurance

We would like to thank Mike Adams, Isil Erel, Paolo Fulghieri, Yuyan Guan, Zhongda He, Stephan Siegel, Zhaogang Song, Sheridan Titman, Cong Wang, and participants at seminars in Renmin University, Shanghai University of Finance and Economics, Southwestern University of Finance and Economics for helpful comments. Zou acknowledges the financial support from a competitive GRF grant from Research Grants Council of the Hong Kong Special Administrative Region, China (Project No. HKU197213B).

Risk Management and MBS Risk-Taking of Financial Institutions

1. Introduction

The 2008 financial crisis was the most severe crisis since the 1929-1933 Great Depression. Numerous discussions on the causes of the crisis pointed to two related conjectures: financial institutions (FIs) had substantial exposures to mortgage-backed securities (MBS) [1] that subsequently became "toxic" and their value plunged in the crisis, and risk management (and perhaps corporate governance in general) in many FIs have failed to constrain the risk-taking via MBS investment. It is therefore important to understand whether risk management affects FIs' investment in MBS and the consequences of such investment. Nevertheless, related empirical evidence is surprisingly scant due largely to the lack of good data on MBS holdings.[2]

To our best knowledge, using *estimates* of bank holdings of highly-rated securitization tranches of MBS, Erel et al. (2014) is the only study examining the determinants of subprime MBS exposure for US FIs. Our study addresses the dearth of evidence on FIs' exposure to MBS by using US insurers as a natural laboratory for which there are detailed actual holding data. Specifically, we examine whether firms' risk management affects risk-taking via MBS investment before the crisis, whether firms see signs of the crisis and start to offload some MBS positions right before the onset of the crisis, whether the MBS investment leads to lower investment performance in the crisis and has a spillover effect to product market competition.

More importantly, MBS investment decisions of non-bank FIs (e.g., insurers) provide a cleaner setting for the examination of risk taking via MBS investment by FIs. This is because the

[1] We exclude residential mortgage backed securities issued by government sponsored enterprises (e.g., Freddie Mac, Fannie Mae and Ginnie Mae) from analysis because these securities are backed by explicit or implicit government guarantee and so are of a low risk. Throughout the paper, we use MBS and subprime securities interchangeably for simplicity.

[2] Beltratti and Stulz (2012, p.6) point out that "it would be useful to have measures of the exposure of banks to subprime loans, but such data is not available from Bankscope or, for that matter, any public source."

exposure to MBS in many banks is not the result of their *active* investment but a by-product of the loan securitization process or driven by "having skin in the game" (Erel et al., 2014).

Second, understanding investment in MBS by non-bank FIs (e.g., insurers, mutual funds) is also interesting in its own right given that these FIs are major institutional investors in the capital market and play a key role in supplying (or reducing) market liquidity during the financial crisis.[3] Indeed, insurers hold about one-third of corporate bonds in the US and invest heavily in MBS (Ellul et al., 2011). In addition, among non-bank FIs, insurers had the largest asset base as of 2007 and reported the largest amount of losses in the financial crisis (He et al., 2010). Third, insurers can specialize in writing life insurance or property & casualty (PC) businesses that are of different duration and volatility. These two types of insurers also follow different regulatory accounting rules for bonds of speculative grades. The insurance industry thus provides a rich setting in which to examine the risk-taking incentives of FIs and how regulatory difference could shape the functioning of risk management and risk taking of FIs (Ellul et al., 2013a).

Finally, insurers are in the business of dealing with risk and are supposed to be professionals who have core competencies in managing risks. Examination of the MBS investment decisions of such risk management "specialists" will provide a unique perspective on how risk management affects FIs' risk-taking and performance. Ex ante, insurers that mainly deal with pure risks (either having an accidental loss or not) may not have expertise in dealing with credit and market risks involved in MBS investment. Indeed, a recent lawsuit highlights the importance of answering this question. On December 27, 2010, insurance company Allstate sued mortgage-originator Countrywide Financial Corporation (now a part of Bank of America) over

[3] Ellul et al. (2011) analyze the fire sale of downgraded corporate bonds by regulatory-constrained insurers over the period 2001-2005. Ellul et al. (2013a) show that different accounting treatment of downgraded (assets-backed) securities can help explain the different trading behaviors of life and property-casualty (P/C) insurers. Manconi et al. (2012) highlight the different patterns in trading between mutual funds and insurance companies when there is a rating downgrade on the securities held by them. Ben-David et al. (2012) show how hedge funds reduce equity holdings in the crisis in response to tightening funding.

huge losses arising from Allstate's $700 million investment in Countrywide's residential mortgage-backed securities (RMBS). In the filing, Allstate alleges that "the certificates were sold pursuant to registration statements and prospectuses that contained untrue statements and omissions of material facts." A Bank of America spokesman responded by saying that, "this unfortunately appears to be a situation where a sophisticated investor is looking for someone to blame for a downturn in the economy and losses on an investment it made."[4] On the other hand, if the risk management techniques and expertise that insurers develop in doing their insurance business are transferrable to MBS investment, insurers may be able to identify and treat the risk involved in MBS investment. Our study is also one of the first attempts to extend the line of inquiry on the effects of risk management on risk-taking into non-bank FIs and sheds light on whether insurers as "specialists" of risk management can appropriately assess and treat the risk inherent in MBS investment.

Our basic hypothesis is that on average firms with better risk management are likely to have a lower exposure to subprime MBS at the onset of the crisis.[5] This is because good risk management should enable firms to better identify and treat risks (Ellul and Yerramilli, 2013). Two features of MBS may add tension to our hypothesis and make it more interesting to examine whether risk management affects the exposure to MBS at the onset of the crisis. First, MBS are typically rated high but at the same time offer a higher return than other securities with comparable ratings. This feature could be interpreted to be an indication for a higher risk by firms with good risk management (if the market is assumed to be efficient).[6] But such MBS could also be interpreted as good deals for shareholders if the management believes that the favorable yield difference is due to market mispricing (though this is unlikely) or a compensation

[4] David Benoit, "Allstate Sues Countrywide over Toxic Investments," *The Wall Street Journal*, December 29, 2010, accessed online.

[5] Consistent with this view, our data show that Berkshire Hathaway had very little exposure to MBS (about 0.08% of its total assets at the end of fiscal year 2006).

[6] This reasoning suggests that some of the MBS ratings could be inaccurate (see He, Qian and Strahan, 2011) for related evidence).

for the complexity of such securities (Erel et al., 2014). If so, holding MBS is likely to offer a higher return and lower the amount of regulatory capital required ex ante in case of market mispricing of such securities. Second, MBS are complex securities and investors (e.g., insurers) may have difficulty in assessing the risks correctly because of limitations or biases even if the intention of making such investments is good (Fahlenbrach and Stulz, 2011).

Our second hypothesis pertains to how the nature of business and regulatory environment may shape the functioning of risk management and thereby firms' risk taking. Specifically, we predict that PC insurers are more conservative and invest less in MBS than life insurers, and the constraining effect of risk management on MBS investment is stronger in PC insurers than in life insurers. Life insurers rely on mortality tables, have long-term and more stable liabilities, and can enjoy the natural hedge between life insurance and annuity business. In contrast, PC insurers face short-term and more volatile liabilities that may occur randomly. In addition, PC insurers need to mark to market certain risky bonds, while life insurers can use historical cost accounting for most bonds.[7] This accounting difference means that PC insurers' capital is under more pressure for risky bonds (Ellul et al., 2013a, 2013b). Therefore, life insurers tend to have a larger risk bearing capacity than PC insurers. We thus expect PC insurers to invest less in MBS and risk management to have a stronger effect in constraining risk taking via MBS investment in PC insurers.

Using a sample of U.S. public insurers that are covered by Compustat, we find that firms practicing enterprise risk management (ERM)[8] were less exposed to MBS at the onset of the financial crisis and suffered less investment losses on MBS in the crisis period. However, the evidence on the effects of corporate governance is mixed: board monitoring proxied by more

[7] See section 2.3 for more a detailed discussion.

[8] ERM, emerged in the late 1990s, is a systematic approach to assessing and managing risk from all sources at the organization level and under a unified framework to increase the value of the organization. Unlike the traditional silo approach that deals with risk separately, ERM emphasizes the understanding of correlations among risks, aggregating risks of an organization into portfolios, and hedging residual risks.

independent and female directors lowers MBS investment; a higher level of institutional ownership is found to be associated with more MBS investments. We also find that PC insurers invest significantly less in MBS, and more importantly, the constraining effect of risk management on MBS investment is mainly concentrated in PC insurers. Taken together, these results suggest that business nature and regulatory difference have a first-order effect on the functioning of risk management and firms' risk taking. A policymaking implication is that regulation on risk management of financial institutions should consider the nature of different businesses and reflects regulatory differences (e.g., life vs. PC insurers).

As Beltratti and Stulz (2012) note, reverse causality is not a grave concern for research examining the effect of corporate governance on corporate outcomes in the financial crisis that is largely an exogenous shock. However, the negative effect between risk management and MBS exposure we find could be due to the existence of omitted correlated variables. For example, it is possible that a more conservative insurer practices ERM and simultaneously lowers the MBS investment. Our instrumenting strategy is to explore the average improvement in risk management (i.e., the use of ERM) in size-benchmarked groups around the 9/11 terrorist attack of the World Trade Centre in 2001 as an instrument for ERM before the 2008 financial crisis.[9] The 9/11 attack was a different exogenous event and occurred well before the 2008 financial crisis. More importantly, many insurers were hit hard on both the liability underwriting side and asset investment side in the 2001 event, and risk management was significantly improved since then. Our baseline result is robust to the instrumental variable estimation.

In addition to the simple binary measure of risk management (i.e., practicing ERM or not), we also use a continuous risk management index similar to the one used in Ellul and Yerramilli (2013) and find consistent results. We also find that a higher level of MBS exposure is associated with larger investment losses in the crisis and PC insurers appear to suffer smaller

[9] A similar approach is also used in Ellul and Yerramilli (2013) where they instrument banks' risk management by the change in risk management around the 1998 Russian debt crisis..

losses on MBS consistent with their lower exposures at the onset of the crisis. Moreover, we find that there appears an adverse spillover effect of MBS investment on subsequent product market competition (measured by premium growth) and this pattern is only existent in PC insurers. The evidence is broadly consistent with the view that MBS investment is a risk-taking behavior and risk management conditional on the nature of business and regulations may help constrain the risk-taking behavior of financial institutions.

We contribute to the literature in several ways. First, using insurers as a laboratory, we directly shed light on subprime securities risk-taking by FIs. We know of no prior studies that have directly examined how risk management affects subprime MBS investment by FIs and the consequences of MBS investment with actual holding data. Our study differs from Erel et al. (2014) in two ways: they analyze the determinants of banks' exposure to subprime securities, and they use estimated instead of actual holdings because banks do not disclose investment in MBS. Ellul et al. (2013a; 2013b) also use detailed holding data of insurers, but their primary focus is on the implications of historical cost accounting and mark-to-market accounting for trading and systemic risks in the market in case of a rating downgrade to the securities they hold. In contrast, our focus is on the effect of risk management (and corporate governance) on insurers' MBS investment and trading and whether there is a spillover effect of MBS investment to product market competition. In addition, they use a larger sample of insurers (most of them are unlisted) and we focus on a sample of listed insurers so that we can collect risk management and governance information for them. More importantly, Ellul et al. (2013a, 2013b) examine asset-backed securities (ABS) that are broader in scope, while we focus on MBS that became "toxic" and played a critical role in weakening FIs' balance sheets in the crisis. Despite these differences, there is one thing in common: we both find that PC insurers appear to be more conservative in gaining exposures to structural securities at the onset of the financial crisis. In a related but different context, Becker and Ivashina (2014) report that insurance companies exhibit risk taking by reaching for yield in the corporate bond market and the phenomenon is more pronounced in

firms with poor corporate governance (poxied by block ownership and public listing status) and binding capital. They primarily examine life insurance companies and corporate bonds; in contrast, we examine the effect of risk management on MBS investment, and highlight the difference between life and PC insurance companies.

Second, we extend the inquiry on how corporate governance and risk management affect FIs' risk-taking and performance into non-bank FIs. A growing body of the research seeks to link corporate governance of banks with risk-taking and performance in the crisis and report that corporate governance measures seemed to have either no or negative effects on firm performance (e.g., see Beltratti and Stulz, 2012; Fahlenbrach and Stulz, 2011; Erkens et al., 2012; Minton et al., 2014). In contrast, only two studies (Aebi, Sabato and Schmid, 2012; Ellul and Yerramilli, 2013) focus on risk management in *banks* and report that better risk management seemed to have paid off. Common to these studies is that they invariably take a black-box approach in measuring risk-taking (e.g., via stock return volatility) and performance (e.g., stock returns). While this approach is convenient and catches all, it does not inform us of the specific channels of risk-taking. We depart from this approach by directly focusing on subprime MBS investment, thereby pinpointing an exact channel of risk-taking. We find consistent evidence supporting the view that MBS investment is risky and firms with better risk management had less exposure to such securities in PC insurers but not in life insurers. Since life insurers and banks are similar in asset and liability structures (Ellul et al., 2013a), and as insurers, banks also face capital requirements that are sensitive to the credit quality of structural finance securities (Merrill et al., 2012), the results on the link between risk management and subprime MBS investment from our insurance sample could be potentially relevant to banks. In this vein, our finding of the lack of evidence between risk management and life insurers' MBS investment is potentially consistent with Erel et al.'s (2014) finding that US banks' holdings of highly rated tranches do not reflect "bad" risk management but are largely related to their loan securitization activities.[10]

[10] Our evidence that some governance mechanisms (e.g., board independence) help constrain risk taking via MBS

Third, we are one of the first to directly show that FIs' investments in MBS have a negative spillover effect on product market competition: we find that PC insurers whose MBS exposure is among the top quintile group at the onset of the financial crisis are more likely to register a negative premium growth in subsequent years. This evidence not only sheds further light on the negative externalities of MBS investment but also helps understand how investment policy and product competition interact in financial institutions.

Fourth, while there might have been some irregularities in information disclosure by the originators of MBS[11], our results partially echo Bank of America's defense against the allegation made by Allstate. If a sophisticated FI has "good" risk management in place, the institution should have been able to perceive the higher risk inherent in these structured securities and should have refrained from placing a big bet on these securities. Therefore, weak risk management appears to be (at least partially) responsible for the heavy losses sustained by many FIs in the crisis.

Finally, our paper also adds to an emerging finance literature (e.g., Campbell and Taksler, 2003; Krishnan et al., 2005; Bessembinder et al., 2006; Ellul et al., 2011) that studies the important roles of insurance companies in the bond market. These studies have all used the National Association of Insurance Commissioners (NAIC) database on insurance companies (that we also use) and focused on bond trading. Our study complements this literature by providing evidence on the investment and trading of a particular type of bonds - subprime MBS.

We organize the remainder of the paper as follows. In Section 2, we describe our data and variable measurement. In Section 3, we report our empirical results. Section 4 concludes.

---

and others mechanisms (e.g., institutional ownership) encourage risk taking via MBS also differs from the findings from prior bank-based studies that examine governance and overall firm risk.

[11] *US sues 17 big banks over financial-crisis losses*, see http://rp2.abs-cbnnews.com/business/09/02/11/us-sues-17-big-banks-over-financial-crisis-losses.

2. Data and variable measurement

2.1 Sample selection

We focus on public insurers in the US because unlisted firms are not required to report their ERM activity and corporate governance information. We use the CRSP/Compustat database to identify our initial sample (SIC codes between 6311 and 6399). The sample period is from 2005 to 2008. We remove insurers without 10-K filings. Consistent with prior studies (e.g., Berry-Stolzle et al., 2012), we drop insurer-year observations with negative or zero surplus, total assets, and net premiums written.

We combine three data sources after compiling the initial sample. First, we use the annual 10-K filings and proxy circulars from the Edgar system to collect ERM and corporate governance information.[12] We follow Hoyt and Liebengerg (2011) to manually identify whether a company practices ERM in a year. We collect information on the board of directors, detailed stock and option grant information for the CEO from the SEC filings. Such information enables us to code the proportion of independent directors and female directors as board monitoring proxies and to compute CEO's *vega* as a risk-taking incentive proxy which we use as controls in our regression model. We obtain a firm's institutional ownership at the end of a fiscal year from the Thomson Financial Ownership database, which compiles the information on institutional equity holdings disclosed in 13F filings.

Second, we use the National Association of Insurance Commissioners (NAIC) database to get information on MBS holdings.[13] The Schedule D data in the NAIC database have detailed information on bond holding by each insurer at the end of each year and record of each bond transaction occurred during that year. While this database has been used by a number of prior studies (Campbell and Taksler, 2003; Krishnanet al., 2005; Bessembinder et al., 2006; Ellul et al.,

[12] Standard databases (e.g., Riskmetrics and Execucomp) do not have good coverage of public insurers.

[13] We rely on Bloomberg securities type information to identify the MBS we include in the analysis (after excluding residential mortgage-based securities issued by government agencies).

2011), their focus is on the corporate bond market. We further obtain financial statement information (e.g., total assets, leverage, reinsurance) from INFOPRO that is based on the NAIC data.

We perform analysis at the NAIC insurance company level as exposures to MBS and financial information are at the NAIC insurance company level. We first match the name of public insurers with individual insurers in the NAIC database; if unsuccessful, we then match the public insurer's subsidiaries reported in Exhibit 21 of 10-Ks with insurers in the NAIC database. A Compustat public insurance firm may correspond to several (subsidiary) insurance firms in the NAIC database, and in this case we assume that the subsidiary firm's risk management and corporate governance variables are the same as those of its parent. That is, we assume that each firm's risk management and corporate governance is dictated at the organization/group level. This assumption is reasonable given that our key measure of risk management is whether a firm practices ERM or not. As discussed in footnote 8, the key thrust of ERM is to assess and manage risks of all sources at the organization level and under a unified framework (typically led by a Chief Risk Officer). Informal talks with some practitioners suggest that this assumption is reasonable. Using the above procedure, we end up with about 2,170 firm-year observations used in our regression analysis, with about 30% of them being for life insurers. Actual sample size varies according to different model specifications.

2.2 Models and variable measurement

To test whether risk management affects the exposure to MBS at the onset of the financial crisis. We estimate the following model:

$$MBS\ holding_{i,t} = f\ (risk\ management_{i,t-1},\ PC\ (0/1),\ corporate\ governance_{i,t-1},\ other\ control\ variables_{i,t-1})\ (1)$$

In Equation (1), the dependent variable is the MBS investment by an insurer at each fiscal year end during the period 2005 to 2007. As specified in Table 1, MBS investment is measured as the ratio of year-end total par value of MBS held by an insurer to the year-beginning total assets. As in Manconi et al. (2012), we measure exposure in par value because it is a sort of notional value and therefore is a clean measure of the extent of MBS investment (not subject to the influence of fluctuations in market price).

Our main measure of risk management is a dummy variable for whether a firm practices enterprise risk management (ERM) or not. The advantage of this variable is that it is simple and can be easily coded. Later on we also use a risk management index in the spirit of Ellul and Yerramilli (2013) to check the robustness of our results.

PC (0/1) is a dummy variable for whether a firm is a PC insurer or not. Life insurers rely on mortality tables, have a long-term and more stable liability, and tend to enjoy the natural hedge between life insurance and annuity business.[14] In contrast, PC insurers face short-term and more volatile businesses. In addition, PC insurers need to mark to market bonds falling in the NAIC designations 3-6, while life insurers can use historical cost accounting for bonds falling in the NAIC designations 1-5.[15] This accounting difference means that PC insurers' capital is under more pressure for the same bonds under the NAIC designations 3-5 compared with life insurers (Ellul et al., 2013a, 2013b). Therefore, life insurers tend to have a larger risk bearing capacity than PC insurers. We predict that other things being equal, PC insurers invest less in MBS than life insurers, and the constraining effect of risk management on MBS investment (if any) should

[14] Early death of an insured is unfavorable to a life insurer in life insurance but is desirable for its annuity business. That is, life insurers writing both life insurance and annuity business to the same group of customers enjoy a natural hedge.

[15] NAIC classifies investment into 6 classes according to credit ratings with designation 6 denoting "in or near default." PC insurers can use historical cost accounting for securities in designation 1-2, and prior to 2009, life insurers only need to mark to market securities under designation 6. See NAIC Note to *Schedule D – Part I on Long-term Bonds Owned December 31 of Current Year*.

be stronger in PC insurers. To test the difference in the effect of risk management on MBS investment, we also estimate Equation (1) separately for life and PC insurers for comparison.

2.3 Control variables

2.3.1 Corporate governance controls

Given prior studies linking corporate governance with firm risk and performance in the financial crisis, we need to control for the effects of corporate governance on MBS investment. Specifically, we control for monitoring measures including institutional ownership and board independence. We, however, have no clear prediction regarding the effect of corporate governance on the MBS exposure. On the one hand, firms with good corporate governance may be able to set incentives and risk controls in a way that avoids taking risk that does not benefit shareholders (Beltratti and Stulz, 2012). On the other hand, maximizing shareholder wealth involves taking an optimal amount of risk and overcoming executives' risk aversion (John et al., 2008). In particular, risk-taking may benefit shareholders when there is an insurance guaranty system (similar to deposit insurance in banking). As such, the relation between corporate governance and risk-taking is an empirical issue.

Adams and Ferreira (2009) report that female directors are better monitors and may be more conservative than male directors, thereby exerting a significant impact on board inputs and firm outcomes. Srinidhi et al. (2011) find that female directors improve the oversight function of the board and result in higher earnings quality. Carter et al. (2003) document a significant positive relationship between the fraction of women on the board and firm value. We therefore also include the proportion of female directors on the board as another board monitoring measure and predict it to be negatively related to a firm's subprime MBS investment.

We also control for CEO's risk-taking incentives measured by *vega* (defined as a CEO's portfolio sensitivity to a 1% change in stock-return volatility, in thousands) and expect it to have

a positive effect on MBS investment. We follow Edmans et al. (2009) to compute *vega*. To mitigate skewness, we transform the variable by taking the natural logarithm of (1 + *vega* *1000) and use it in the analysis. Minton et al. (2014) find that outsider directors' financial expertise is positively associated with the risk of US banks in the run-up to the 2007-2008 financial crisis. We hand collect and code a variable (*Banking director*) that takes the value one if an insurance company has at least one outside director with current or previous banking experience.

2.3.2 Other controls

We control for several other firm characteristics that may affect MBS investment, including logged total assets and leverage.[16] Since we view MBS investment as a way of risk taking, we also control for a firm's other risky investment and risk reduction activities. Specifically, we include a firm's proportion of fund invested in common stock, the proportion of reinsurance business, and a Herfindal index to reflect a firm's geographical diversification of business.

All firm-specific variables enter our regressions with a one-year lag and this ensures that these characteristics are at least exogenous in time. We winsorize all non-logged continuous variables at 1% at both tails to mitigate the undue influences of outliers. Please refer to Table 1 for detailed definitions and measurements of the variables used in our analysis.

[Insert Table 1 here]

3. Empirical Results

3.1. Summary statistics

[16] The results on the effect of ERM on MBS investment are robust if we use logged risk-based capital ratio instead of financial leverage, which is well expected given that these capital ratio and leverage are highly correlated.

As Table 2 shows, insurers on average invest 4.2% of total assets into risky MBS at the end of 2006. To put the number into perspective, it is about 60% of the mean level of common stock investment by insurers. Therefore, insurance companies' risky MBS exposures are economically significant. In addition, close to half of our sample firms have ERM in place, and about 70% of them are PC insurers. On average roughly two-thirds of the shares of their parent firms are held by institutional investors. Independent directors account for about 74% of the board seats and the mean ratio of female directors is about 11%.

In Panel B we present summary statistics for PC and life insurers, respectively. Clearly, life insurers are larger than PC insurers and hold more MBS (mean level 5.98% vs. 3.56%), consistent with our previous prediction based on the differences in the nature of business and reporting regulations between life and PC insurers. Life insurers also seem to have suffered more total investment losses on their MBS holdings. Moreover, life insurers are more levered and carry less reinsurance, consistent with the longer horizon of their insurance business. These differences reflect the larger risk-bearing capacity of life insurers due to the different nature of businesses and/or applicable accounting rules.

[Insert Table 2 here]

3.2 Risk management and MBS exposures before the financial crisis: Full sample analysis

We regress the holdings of MBS for the pooled period 2005-2007 and at the end of each fiscal year of 2005-2007 on lagged risk management, controlling for corporate governance and other factors. The results are reported in Table 3. White's heteroscadasticity adjusted robust standard errors are used in computing t-statistics in columns involving a single year and standard errors are clustered at the firm level to account for within-firm autocorrelations in the pooled regression.

[Insert Table 3 here]

As Table 3 shows, the coefficient on the ERM dummy is negative and statistically significant in the regressions using the MBS holdings at each year end between 2005 and 2007 and for the whole period. Therefore, there is evidence that firms that practice ERM invest less in MBS than firms that do not practice ERM. The effect of ERM on MBS investment is also economically significant. Taking the regression coefficient in the pooled regression as an example, firms implementing ERM invest about 2.15% less in MBS and this is about a 50% reduction relative to the sample mean level of MBS investment.

The results on corporate governance variables are mixed. On the one hand, firms invest less in MBS when the board of directors is more independent or when CEO has lower risk-taking incentives proxied by a lower *vega* (albeit the coefficient is insignificant in 2005). In addition, firms with a higher proportion of female directors invest significantly less in MBS, which is consistent with the view that female directors are better monitors (Adams and Ferreira, 2009) and/or more conservative in taking risks. On the other hand, firms with more institutional ownership tend to invest more in MBS (significant in three out of four columns). It is plausible that many institutional investors have focused on seeking short-term lucrative returns and encouraged firms to invest in MBS before the financial crisis. This evidence suggests that institutional investors may have failed to constrain the risk-taking via MBS investment.

Importantly, consistent with our univariate comparison, PC insurers are found to have significantly lower exposure to MBS, suggesting that PC insurers are more conservative in risk taking due to their shorter liability duration and more volatile business nature and/or more stringent accounting rule applicable to bonds of speculative grades. This finding is in line with Ellul et al. (2013b) that report PC insurers have a lower exposure to ABS. In addition, the results show that firms that are small, have more debt and funds invested in common stock tend to have

smaller exposures to MBS. These results are broadly consistent with our maintained argument that MBS investment represents a risk-taking behavior, and better risk management helps constrain such risk taking before or at the onset of the 2008 financial crisis.

3.3 Risk management and MBS exposures before the financial crisis: life vs. PC insurers

Thus far, we find that PC insurers invest less in MBS than life insurers. To directly test our second hypothesis that risk management is likely to have a stronger effect in constraining risk taking via MBS investment in PC insurers than in life insurers, we estimate Equation (1) separately for PC and life insurers. The regression results are reported in Table 4.

As predicted, the significant effect of ERM on constraining MBS investment is only limited to PC insurers. These results suggest two things. First, the short-term liability duration and volatile nature of businesses and the more stringent accounting rules applicable to PC insurers serve as powerful mechanisms that force PC insurers to be more effective in risk management and to refrain from taking risk via MBS investment. Second, even within PC insurers, there are significant cross-sectional differences in MBS investment and such investment varies with the strength of risk management.

It is also interesting to note that having at least one outsider director with banking experience is associated with a higher level of MBS investment, which may reflect that more familiarity with MBS leading to more risk taking (Minton et al., 2014) .

[Insert Table 4 here]

3.4 Robustness checks

3.4.1 Endogeneity

In this study, we focus on the effect of risk management on risky MBS investment at the onset of the 2008 financial crisis. As Beltratti and Stulz (2012) note that reverse causality is not a grave concern for research of this kind because the financial crisis is largely an exogenous shock and it does not seem plausible that the anticipation of how FIs would be affected by the events of 2007-2008 influenced their choice of risk management or governance mechanisms before 2007. This is also the approach taken in most studies that we have discussed earlier in Introduction.

However, the negative effect between risk management and MBS exposure could be because both MBS investment and risk management are jointly determined by some unobserved factors (e.g., business culture of insurers). For example, a more conservative insurer adopts ERM and simultaneously lowers the MBS investment. We mitigate this endogeneity concern by instrumental variable (IV) estimations.[17]

Following Ellul and Yerramilli (2013), we explore the average improvement in risk management (i.e., the use of ERM) around a different exogenous event that is well before the 2008 financial crisis as an instrument for ERM. We think the 9/11 terrorist attack of the World Trade Centre in 2001 serves as a good event of this kind because many insurers were hit on both the liability underwriting side and asset investment side in that event, and risk management was improved since then.[18] Specifically, we divide firms in 20 groups based on their firm size at the end of 2000 and compute for each firm the average improvement in using ERM over the 2000-2003 period (excluding the firm concerned) for firms within the same size group (i.e., Comparable $\Delta ERM_{2000\text{-}03}$) as an IV. As noted by Ellul and Yerramilli (2013), this IV has two key advantages. First, the 9/11 event that we explore has a very different nature from the 2008 financial crisis and so is unlikely to affect the MBS investment unless through ERM. Second, conditioning the IV on size groups is necessary because ERM adoption is positively related to

[17] Because it is extremely difficult to identify good IVs, most prior or contemporaneous studies (except for Ellul and Yerramilli (2013)) have chosen to add more control variables to mitigate this concern.

firm size due to the high fixed set-up cost and the larger potential gain that can be reaped in large firms.

The IV results are reported in Table 5. Panel A presents the results from the 1st-stage regression. We find that Comparable $\Delta ERM_{2000\text{-}03}$ strongly and positively predict the incidence of practicing ERM before the financial crisis and an F-test confirms the validity of the variable as an excluded IV. Panel B presents the results from the 2nd-stage regression and here we find that ERM continues to have a negative effect on the MBS investment for PC insurers and for the full sample. Therefore, it appears that the observed negative relation between ERM and MBS investment is unlikely to be simply driven by the existence of the omitted variable bias.

[Insert Table 5 here]

3.4.2 Robustness with an alternative risk management index

Thus far, our result on risk management is obtained by using a simple measure, a firm's adoption of enterprise risk management. In this section, we also provide a robustness check by using a more complicated measure – a risk management index (RMI). In the spirit of Ellul and Yerramilli (2013), we construct the index based on five hand-collected variables: ERM, whether the CRO reports to the board of directors, whether the CRO is an executive, whether the CRO's pay in among the top 5 highest paid, and CRO's centrality (CRO's annual total compensation/CEO's annual total compensation, see Ellul and Yerramilli (2013) for details). CRO's reporting to the board means that a firm's risk management is subject to to more board oversight. The other variables capture whether the CRO is influential within the organization and thereby proxy for the effectiveness of risk management. RMI is then constructed as the first principal component of these five variables, with a higher value denoting more effective risk management.

The results from using the RMI are reported in Table 6 and they are qualitatively similar when compared with the results from using ERM. Therefore, it appears that a simple measure of (ERM) severs as a reasonably good proxy for risk management.

[Insert Table 6 here]

3.5 Do firms with better risk management reduce their MBS exposures before the unfolding of the crisis?

We have shown that MBS investment represents a risk-taking behavior and risk management helps constrain such risk taking. A related and supplementary question is whether insurers with stronger risk management can actually detect the poor quality of the mortgage loans before the risk materializes. If so, we expect to see some unloading of the MBS investment before the unfolding of the crisis. On the other hand, if there are important cognitive limitations in understanding complex structural products like MBS, we should not expect to see an effect. We estimate the following Probit model:

$$Unload\ (0/1) = f(risk\ management_{i,t-1},\ corporate\ governance_{i,t-1},\ other\ control\ variables_{i,t-1})\ (2)$$

Unload (0/1) is a dummy variable that takes the value one if an insurer unloaded some MBS over a chosen window period (e.g., 2005-2006). We include the same set of controls (measured at the beginning of a chosen period) that we include in the models on the determinants of MBS holdings. If firms practicing ERM started to unload their MBS holdings before the crisis unfolded, we expect to see a positive coefficient on the risk management variable. To carry out the analysis, we only include firm-years that have MBS exposure at the beginning of a chosen period. The Probit results are reported in Table 7.

[Insert Table 7 here]

In column (1), we examine the window period 2005-2006 for the full sample (with both PC and life insurers). We find that firms that practice ERM and have a larger board representation of female directors are more likely to unload their holdings of MBS before the crisis. Therefore, cognitive limitations in understanding complex structural products such as MBS do not appear to be a serious barrier for risk-reducing trading decisions. In column (2), we look at the window 2006-2007. The results are similar except that firms with a higher level of institutional ownership appear to be unlikely to reduce their exposures before the crisis. The PC insurer dummy has a positive coefficient in both windows albeit insignificant.

In columns (3)-(6), we repeat the analysis for life and PC insurers, respectively. The additional insight we can gain from these columns is that the effect of ERM is only concentrated in PC insurers but not in life companies (and so is the effect of the proportion of female directors). In addition, PC firms with a higher level of CEO *vega* are less likely to sell off MBS in the window 2005-2006. These results provide further supports for the argument that MBS investments represent a sort of risk-taking and "good" risk management can help to control the exposures to subprime securities.

3.6 Does a higher MBS exposure result in more subsequent investment losses?

In this section, we examine the consequence of MBS investments by looking at their impact on investment performance in the crisis. A large position of MBS exposure should translate into a worse investment performance when these subprime securities became "toxic" and plunged in prices in the crisis. Finding a negative relation between MBS exposure and investment performance in the crisis will reinforce our argument that MBS investment is a way of risk taking. The model we estimate is as follows:

$$Investment\ Performance_{i,t} = f\ (MBS\ holding_{i,t-1},\ control\ variables_{i,t-1}) \qquad (3)$$

Following Ellul et al. (2013b), we measure investment performance attributable to holdings of MBS by the total realized and unrealized capital gains/losses caused by such investment scaled by the period-beginning MBS holdings.[19] As Table 2 shows, on average both PC and life insurers suffer a total of net (realized and unrealized) losses on MBS in 2007 and 2008. We also include common control variables for insurer performance including firm size, leverage, a dummy variable for whether a firm is a PC insurer, proportion of fund invested in common stock, the extent of reinsurance purchased by the insurance firm, and a geographical Herfindal index. The key variable of interest is MBS holding that is expected to have a negative sign. The regression results are reported in Table 8, respectively.

[Insert Table 8 here]

In Column (1), we first estimated a pooled model for the period 2005-2008. We find that a high MBS involvement is, on average, associated with a lower investment performance in the whole period of 2005-2008. In the next several columns, we repeat the estimation by year and find that the relation between MBS investment and the next-period investment performance is insignificant for the years 2005 and 2006, but negative for years 2007 and 2008. It is also interesting that PC insurers have obviously higher investment performance in years 2006-2008 than life insurers, potentially consistent with the argument that PC insurers invest in safer MBS investments that fared better in the financial crisis.

In the remaining columns, we further include an interaction term between MBS investment and PC insurer to directly test whether the relation between MBS investment and investment performance is different between PC and life insurers. Interestingly, we find in 2005,

[19] When insurers deem a security is suffering other-than-temporary impairment (OTTI) in value, they need to recognize the loss as realized. Our realized capital gains/losses have included any OTTI charges incurred in the year.

the interaction term is loaded negatively, suggesting that PC insurers achieve a lower return for the same amount of MBS investment than do life insurers; in contrast, in 2007, the interaction term is loaded positively, indicating that PC insurers achieve a higher return for the same amount of MBS investment than do life insurers. These results suggest that PC insurers appear to invest in higher-quality MBS than life insurers when they do invest in MBS and this explains why their investment return lags behind that of life insurers before the crisis but outperform in 2007 when the crisis began.

3.7 Does MBS investment have a spillover effect on product market competition?

The final question we look at is whether insurance companies' MBS exposure has a spillover effect on product market competition. Despite the several prior studies that have attempted to relate corporate governance or risk management to the risk and performance of financial institutions, there is little evidence on how MBS investment affects a firm's product market operations. We hypothesize that substantial MBS exposure at the onset of the financial crisis is likely to result in a loss of market shares in the future for several reasons. First, substantial MBS exposure (and losses sustained) could erode an insurer's capital base and weaken its financial strength and thereby its underwriting capacity. Second, a loss in market share may also happen because of the aggressive expansion efforts in distribution networks and advertising by financially strong competitors (see Campello, 2006), or through these competitors' predatory pricing (Fresard, 2010). In addition, the loss of market share may occur because damaged reputation and public image scare away existing and potential customers. We estimate the following model:

$$\Delta Sales_{,2007\sim t} = f\ (High\ MBS\ holding_{i,2006,}\ control\ variables_{i,2006\sim t-1}) \qquad (4)$$

In Equation (4), we measure the subsequent cumulative change in sales by cumulative growth rate in net premium earned for the period 2007-2008, 2007-2009, and 2007-2010, with

2007 as the base period. *High MBS holding* is a dummy variable that takes the value one if a firm's MBS holding is in the top quintile in the (PC or life insurance sample) at the end of 2006. We control for a firm's asset size, proportion of assets invested in stock, geographical HFI, the use of reinsurance that cedes premium written to another insurer, and new fund raised defined as (new debt raised + new equity raised - dividend payout) in a year scaled by the year-beginning assets. We measure all control variables as the simple average over the period between 2006 and year *t*-1. [20]

In Panel A of Table 9, we first estimate a Probit model in which the dependent variable is a dummy that equals one for having a growth in sales over the corresponding time period (2007-08, 2007-09 or 2007-10) and zero for otherwise. The result shows that PC insurers in the top MBS quintile group before the financial crisis have a 17% lower probability to achieve a premium growth in the 2007-2008 period, other things being equal. The result remains similar when we extend the window of analysis to three and four years. In contrast, such pattern is absent in life insurers. In addition to the aforementioned differences in business and regulatory accounting for bond investment between life and PC insurers, it may also reflect the statutory reserving requirement for new policies. Specifically, in the US, the reserve valuation of life insurers is more aggressive than mark to market accounting, whereas, the reserve valuation of PC insurers are more conservative than mark to market (Koijen and Yogo, 2014). As a result, life insurers can sell new policies by cutting prices as long as the price is above the reserve value. Consistent with this view, Koijen and Yogo (2014) find that some life insurers sold long-term policies at deep discounts relative to actuarial value in the crisis period.

In Panel B, we estimate an OLS model in which the dependent variable is the continuous cumulative premium growth rate during the corresponding periods. The results suggest that PC insurers that have a high exposure to MBS as of the end of 2006 subsequently experience a lower

[20] Measuring reinsurance and new fund raised as a cumulative figure since 2007 scaled by the 2007 assets produces similar results on the top MBS investment dummy variable.

premium growth than firms that are less exposed to MBS at the end of 2006, and the result is robust to the three windows. For example, the premium growth rate for the top MBS quintile group is 13% lower than other firms in the period 2007-2008, there is little change in premium growth rate from 2008 to 2009 (as evidenced by the same coefficient in column (2)), and the premium growth rate is lowered by another 3% in the period 2009-2010. Taken together, these results suggest that there is an adverse spillover effect of MBS investment on insurers' product market operation. Note that these patterns are only concentrated in PC insurers, consistent with the differences in business nature and regulatory reporting that we discussed previously.

[Insert Table 9 here]

4. Conclusion

Despite claims that failure for risk management to constrain financial institutions' risk taking via investing in "toxic" mortgage-backed securities (MBS) is a culprit for the 2008 financial crisis, there is little direct evidence due to the lack of firm-level data on MBS holdings. Using US insurers as a laboratory for which there are detailed holding data and treating MBS investment as a way of risk-taking, we shed new light on this issue.

We find that the effects of risk management (proxied by practicing enterprise risk management (ERM) or not) on risk taking via MBS investment hinge on the nature of reporting regulations and businesses that differ between property/casualty and life insurance. Property/casualty insurers practicing ERM were less exposed to MBS at the onset of the financial crisis, appeared to have reduced some MBS holdings before the crisis, and suffered smaller losses in the crisis. Importantly, we report that property/casualty insurers that had a larger MBS exposure at the onset of the crisis experienced a lower subsequent premium growth,

suggesting a spillover effect from investment to the product market. These patterns are absent for life insurers.

Our findings highlight how the nature of business and regulations can have a first-order effect on the functioning of risk management. Specifically, the observed difference reflects the different nature of PC and life insurance businesses (short-term PC insurance vs. long-term life insurance, uncertain and volatile PC insurance vs. relatively stable and more predictable life insurance that relies on mortality tables) as well as the different accounting rules (PC insurers need to apply mark to market accounting to securities of speculative grade). Our result on the negative spillover effect from investment to the product market shows a negative externality of MBS investment as a risk-taking channel. Our results have important policymaking implications for the regulation of risk management in financial institution: different risk management requirement may be necessary to reflect the different business nature and reporting requirements.

While there might have been irregularities in information disclosure by the originators of MBS, our results partially echo Bank of America's reply to the allegation made by Allstate. The reply goes as "this unfortunately appears to be a situation where a sophisticated investor is looking for someone to blame for a downturn in the economy and losses on an investment it made." If a FI has a "good" risk management in place, it should have been able to ascertain the high risk inherent in MBS and should have refrained from placing a big bet on these structured securities.

References

Adams, R.B., Ferreira, D., 2009. Women in the boardroom and their impact on governance and performance. Journal of Financial Economics 94, 291-309.

Aebi, V., Sabato, G., Schmid, M., 2012. Risk management, corporate governance, and bank performance in the financial crisis. Journal of Banking and Finance 36, 3213-3226..

Beltratti, A., Stulz, R., 2012. The credit crisis around the globe: Why did some banks perform better? Journal of Financial Economics 105, 1-17.

Ben-David, I., Franzoni, F., Moussawi, R., 2012, Hedge fund stock trading in the financial crisis of 2007-2009. Review of Financial Studies 25, 1-54.

Berry-Stolzle, T.R., Nini, G.P., Wende, S., 2012, External Financing in the Life Insurance Industry: Evidence from the Financial Crisis, Working Paper.

Bessembinder, H., Maxwell, W., Venkataraman, K., 2006. Market trans- parency, liquidity externalities, and institutional trading costs in corporate bonds. Journal of Financial Economics 82, 251–288.

Benoit, D., 2010. Allstate sues Countrywide over toxic investments. The Wall Street Journal, December 29, 2010.

Becker, B., Ivashina, V., 2014. Reaching for yield in the bond market. Journal of Finance, in press.

Calomiris, C.W., Higgins, E.J., Mason, J.R., 2011. The economics of the proposed mortgage servicer settlement. Available at SSRN: http://ssrn.com/abstract=1833729

Campbell, J.Y., Taksler, G.B., 2003. Equity volatility and corporate bond yields. Journal of Finance 58, 2321–2350.

Campello, M., 2006, Debt financing: Does it boost or hurt firm performance in product markets? Journal of Financial Economics 82, 135–172.

Carter, D., Simkins, B., Simpson, W., 2003. Corporate governance, board diversity, and firm value. Financial Review 38, 33-53.

Edmans, A., Gabaix , X., Landier, A., 2009. A multiplicative model of optimal CEO incentives in market equilibrium, Review of Financial Studies 22, 4881-4917.

Ellul, A., Jotikasthira, C., Lundblad, C., 2011, Regulatory pressure and fire sales in the corporate bond market. Journal of Financial Economics 101, 596-620.

Ellul, A., Jotikasthira, C., Lundblad, C.T., Wang, Y., 2013a. Is historical cost accounting a panacea? Market stress, incentive distortions, and gains trading. Available at SSRN: http://ssrn.com/abstract=1972027

Ellul, A., Jotikasthira, C., Lundblad, C.T., Wang, Y., 2013b. Mark-to-market accounting and systemic risk: Evidence from the insurance industry. Working Paper, Indiana University.

Ellul, A., Yerramilli, V., 2013. Stronger risk controls, lower risk: Evidence from U.S. bank holding companies, Journal of Finance 68, 1757-1803.

Erel, I., Nadauld, T., Stulz, R.M., 2014. Why did U.S. banks invest in highly-rated securitization tranches? Review of Financial Studies, in press.

Erkens, D.H., Hung, M., Matos, P., 2012. Corporate governance in the 2007-2008 financial crisis: Evidence from financial institutions worldwide. Journal of Corporate Finance 18, 389-411.

Fahlenbrach, R. and R.M. Stulz, 2011. Bank CEO Incentives and the Credit Crisis, Journal of Financial Economics 99, 11-26.

Fresard, L., 2010, Financial strength and product market behavior: the real effects of corporate cash holdings, Journal of Finance 65, 1097–1122.

He, J., Qian, J., Strahan, P.E., 2011. Credit ratings and the evolution of the mortgage-backed securities market. American Economic Review: Papers & Proceedings 101, 131-135.

He, Z., Khang, I.G., Krishnamurthy, A., 2010. Balance sheet adjustments during the 2008 crisis. IMF Economic Review 58, 118-156.

Hoyt, R.E., and A. P. Liebenberg, 2011, The value of enterprise risk management, Journal of risk and insurance 78, 795-822.

John, K., Litov, L., Yeung, B., 2008. Corporate governance and risk-taking. Journal of Finance 63, 1679-1728.

Koijen R.S.J., Yogo, M., 2014. The cost of financial frictions for life insurers. American Economic Review, forthcoming.

Krishnan, C.N.V., Ritchken, P.H., Thomson, J.B., 2005. Monitoring and controlling bank risk: does risky debt help? Journal of Finance 60, 343–378

Manconi, A., Massa M., Yasuda, A., 2012. The role of institutional investors in propagating the crisis of 2007-2008. Journal of Financial Economics 104, 491-518.

Merrill, C.B., Nadauld, T.D., Stulz, R.M., Shelund, S.M., 2012. Did capital requirement and fair value accounting spark fire sales in distressed mortgage-backed securities? Working Paper, Ohio State University.

Minton, B.A., Taillard, J.P.A., Williamson, R., 2014. Do independence and financial expertise of the board matter for risk taking and performance? Journal of Financial and Quantitative Analysis, forthcoming.

Srinidhi, B., Gul, F., Tsui, J., 2011. Female directors and earnings quality. Contemporary Accounting Research 28, 1610-1644.

Table 1: Variable Definition

Variables	Definition
Dependent Variables	
MBS	The ratio (measured in percentage) of mortgage-backed securities held by an insurer to the insurer's year-beginning total assets. We exclude residential mortgage-backed securities issued by US government agencies from the analysis.
Investment performance	The ratio (measured in percentage) of (Realized capital gain + other-than-temporary-impairment + unrealized capital gain from MBS) to year-beginning par value of MBS holding. Unrealized capital gain is the year-on-year change in difference between fair value and book/adjusted carrying value of MBS.
Sales growth rate	The cumulative growth rate of net premium earned from 2007 to 2008 (or 2009 or 2010).
Key Independent Variables	
ERM	A dummy variable that equals 1 if a firm adopts enterprise risk management and 0 otherwise.
CRO report to Board	A dummy variable that equals 1 if a firm's CRO reports to the board and 0 otherwise.
CRO is executive	A dummy variable that equals 1 if a firm's CRO is an executive and 0 otherwise.
CRO in top 5	A dummy variable that equals 1 if a firm's CRO is among the 5 highest paid and 0 otherwise.
CRO centrality	CRO's annual total compensation/CEO's annual total compensation (see Ellul and Yerramilli (2013))
RMI	A risk management index constructed as the first principal component of ERM, CRO report to board, CRO is executive, CRO in top 5, and CRO centrality. A higher value of RMI indicates more effective risk management
Firm Controls	
Bank director	A dummy variable that equals 1 if there is at least an outside director having current or prior commercial or investment banking experience
Independent director	The number of independent directors divided by board size.
Female director	The number of female directors divided by board size
Institutional holding	The ratio of institutional holding obtained from 13F to the total number of shares outstanding at the end of each sample year
Log (CEO Vega)	The logarithm of (1+Vega*1000), Vega is CEO's portfolio sensitivity to a 1% change in stock-return volatility (in thousand dollars).
Log (total assets)	The logarithm of total assets which are in millions
Leverage	The total liabilities divided by the total equity
PC dummy	A dummy variable that equals 1 if it is a property & casualty insurer
% Stock	The ratio (measured in percentage) of stock investment of an insurer to its year-beginning total assets
Reinsurance	The ratio of reinsurance premiums ceded to the sum of direct premiums written and reinsurance premiums assumed
Geographical HFI	Geographical diversification measured by Herfindahl index that is equals $\sum(PW_{i,s}/TPW_i)^2$ where $PW_{i,s}$ is premiums written in state s $(s=1,2,...,51)$ by insurer i in year t, and TPW_i is total premium written for all states by insurer i in year t. *HERFS* indices evaluate geographical diversifications. The higher the *HERFS* index measures, the lower diversification is.
	(Note: All non-logged continuous variables are winsorized at 1% at both tails).

Table 2: Descriptive statistics

Panel A reports the summary statistics of the main variables for the full sample. MBS is reported for a pooled period of 2005-2007 and investment performance is reported for a pooled period of 2005 -2008. All other variables are reported for a pooled period of 2004-2006. Panel B compares the summary statistics for the life and P/C insurance subsample. MBS is compared for a pooled period of 2005-2007 and each of these years, and investment performance is compared for a pooled period of 2005 -2008 and each of these years. All other variables are compared for a pooled period of 2004-2006. The t-statistics are provided in Panel B. *, **, ***: statistically significantly at the 0.10, 0.05 and 0.01 level

Panel A: Full Sample

Variable	N	Mean	SD	P25	Med	P75
Dependent variables						
$MBS_{2005-07}$	2446	4.21	6.80	0.00	0.52	6.19
Investment $Performance_{2005-08}$	3150	-3.62	8.98	-2.55	0.00	0.00
Sales growth rate for Life $Insurers_{2007-08}$	195	0.16	0.87	-0.09	-0.00	0.13
Sales growth rate for Life $Insurers_{2007-09}$	179	0.02	0.38	-0.15	-0.01	0.09
Sales growth rate for P&C $Insurers_{2007-08}$	507	0.04	0.62	-0.11	-0.02	0.05
Sales growth rate for P&C $Insurers_{2007-09}$	487	-0.03	0.34	-0.13	-0.03	0.02
Key independent variables						
ERM	2433	0.45	0.50	0.00	0.00	1.00
CRO report to board	2446	0.22	0.41	0.00	0.00	0.00
CRO is executive	2446	0.19	0.39	0.00	0.00	0.00
CRO in top5	2446	0.04	0.21	0.00	0.00	0.00
CRO centrality	2385	0.48	0.49	0.23	0.34	0.48
Firm Controls						
Bank director	2446	0.64	0.48	0.00	1.00	1.00
Independent director	2436	0.74	0.15	0.64	0.78	0.86
Female director	2436	0.11	0.09	0.00	0.10	0.17
Institutional holding	2436	0.64	0.26	0.51	0.68	0.83
Log (CEO Vega)	2426	15.36	6.56	15.60	17.88	19.25
Log (total assets)	2446	19.24	2.29	17.56	19.06	20.77
Leverage	2446	3.69	6.28	0.59	1.85	3.14
PC dummy	2446	0.73	0.44	0.00	1.00	1.00
% Stock	2430	7.29	13.34	0.00	1.10	8.95
Reinsurance	2379	0.45	0.38	0.08	0.38	0.85
Geographical HFI	2215	0.40	0.37	0.08	0.22	0.77

Panel B: Life vs. PC insurance companies

	1	2	3	4	5
	Life Insurers		PC Insurers		t-stat (Life – PC)
Variable	Mean	SE	Mean	SE	
Dependent variables					
$MBS_{2005-2007}$	5.98	0.28	3.56	0.15	7.88***
MBS 2005	5.79	0.53	3.57	0.29	3.88***
MBS 2006	5.97	0.43	3.34	0.24	5.56***
MBS 2007	6.21	0.49	3.80	0.27	4.43***
Investment $Performance_{2005-08}$	-5.79	0.37	-2.82	0.17	-8.31***
Investment Performance 2005	5.79	0.53	3.57	0.29	3.88***
Investment Performance 2006	5.97	0.43	3.34	0.24	5.57***
Investment Performance 2007	-2.12	0.30	-0.14	0.10	-8.11***
Investment Performance 2008	-19.22	1.04	-9.48	0.55	-8.71***
Sales $growth\ rate_{2007-2008}$	0.16	0.06	0.04	0.03	2.13**
Sales $growth\ rate_{2007-2009}$	0.02	0.03	-0.03	0.02	1.61
Key independent variables					
ERM	0.49	0.50	0.44	0.50	2.32**
CRO report to board	0.19	0.39	0.23	0.42	-2.44**
CRO is executive	0.15	0.36	0.21	0.41	-3.06***
CRO in top5	0.07	0.25	0.04	0.19	3.13***
CRO centrality	0.47	0.43	0.48	0.52	-0.81
Firm Controls					
Bank director	0.52	0.02	0.68	0.01	-7.69***
Independent director	0.75	0.16	0.74	0.14	2.12**
Female director	0.12	0.09	0.11	0.09	3.10***
Institutional holding	0.64	0.27	0.64	0.25	-0.23
Log (CEO Vega)	15.18	7.08	15.42	6.35	-0.83
Log(total assets)	20.43	2.64	18.81	1.97	16.36***
Leverage	9.09	9.77	1.71	2.09	30.142***
% Stock	6.35	15.09	7.63	12.63	-2.107**
Reinsurance	0.22	0.29	0.54	0.38	-19.192***
Geographical HFI	0.32	0.36	0.43	0.37	-6.094***

Table 3: Determinants of MBS investment before the crisis: Full sample

This table reports results from regressing MBS investment on risk management and corporate governance at NAIC insurance company level in each year over the period 2005-2007. The dependent variable is MBS, which is the ratio (measured in percentage) of mortgage-backed securities held by an insurer to the insurer's year-beginning total assets. All explanatory variables are measured at the beginning of a chosen period. Robust standard errors clustered at the firm level are used in pooled regression with multiple years and White's heteroskedasticity consistent standard errors are used in other columns in computing t-statistics (in parentheses). *, **, ***: statistically significantly at the 0.10, 0.05 and 0.01 level (two-tailed), respectively.

	1	2	3	4
Y=% MBS	2005-07	2005	2006	2007
ERM	-2.15***	-2.35***	-2.51***	-1.87***
	(-4.89)	(-3.69)	(-5.07)	(-3.18)
Bank director	0.91***	0.86	0.12	1.73***
	(2.91)	(1.62)	(0.25)	(3.53)
Independent director	-3.57***	-1.04	-4.76***	-5.19*
	(-2.62)	(-0.62)	(-2.95)	(-1.96)
Female director	-8.29***	-10.95***	-7.78***	-7.93***
	(-3.96)	(-3.48)	(-2.67)	(-3.03)
Institutional holding	3.54***	5.90***	1.28	3.09**
	(3.67)	(4.90)	(1.13)	(2.22)
Log (CEO Vega)	0.10***	0.03	0.20***	0.12**
	(3.19)	(0.82)	(4.86)	(2.29)
Log(total assets)	1.04***	1.05***	1.03***	1.07***
	(8.11)	(6.14)	(7.87)	(6.42)
Leverage	-0.10**	-0.07	-0.13***	-0.09**
	(-2.44)	(-1.03)	(-2.91)	(-1.97)
PC dummy	-1.74***	-1.87**	-1.75***	-1.68***
	(-3.19)	(-2.24)	(-3.16)	(-2.74)
% Stock	-0.10***	-0.09***	-0.10***	-0.10***
	(-7.56)	(-4.57)	(-8.00)	(-6.30)
Reinsurance	-0.58	-0.25	-0.80	-0.48
	(-1.00)	(-0.29)	(-1.47)	(-0.60)
Geographical HFI	0.62	0.38	0.31	1.17
	(1.06)	(0.53)	(0.51)	(1.48)
Year dummies	Yes	No	No	No
Adj.R^2	0.168	0.155	0.195	0.165
N	2,177	721	741	715

Table 4: Determinants of MBS investment before the crisis: PC vs. Life

This table reports results from regressing MBS investment on risk management and corporate governance over the period 2005-2007 for life insurance and P/C insurance firms, respectively. The dependent variable is MBS, which is the ratio (measured in percentage) of mortgage-backed securities held by an insurer to year-beginning total assets. All explanatory variables are measured at the beginning of a chosen period. Robust standard errors clustered at the firm level are used in pooled regressions with multiple years and White's heteroskedasticity consistent standard errors are used in other columns in computing t-statistics (in parentheses). *, **, ***: statistically significantly at the 0.10, 0.05 and 0.01 level (two-tailed), respectively.

	1	2	3	4	5	6	7	8
Y= % MBS			Life				PC	
	2005-07	2005	2006	2007	2005-07	2005	2006	2007
ERM	-0.19	-1.62	0.55	0.45	-3.17***	-3.24***	-3.88***	-2.89***
	(-0.21)	(-1.23)	(0.48)	(0.39)	(-6.38)	(-4.23)	(-7.13)	(-4.10)
Bank director	0.53	0.47	-0.35	2.59**	1.09***	1.88***	0.40	1.46***
	(0.75)	(0.42)	(-0.35)	(2.13)	(3.18)	(2.92)	(0.72)	(2.75)
Independent director	-5.42*	-3.55	-4.28	-3.00	-2.01	0.39	-4.01**	-4.07
	(-1.92)	(-0.78)	(-1.22)	(-0.60)	(-1.33)	(0.22)	(-2.21)	(-1.34)
Female director	-15.68***	-12.03*	-21.70***	-20.16***	-6.30***	-9.07***	-4.80*	-5.89**
	(-2.85)	(-1.67)	(-3.26)	(-2.67)	(-2.79)	(-2.92)	(-1.86)	(-1.98)
Institutional holding	4.03**	3.52	2.76	6.05**	3.19***	6.58***	0.34	2.56
	(2.26)	(1.41)	(1.54)	(2.32)	(2.97)	(5.17)	(0.24)	(1.53)
Log (CEO Vega)	-0.06	-0.12*	0.02	-0.11	0.19***	0.12***	0.27***	0.21***
	(-0.99)	(-1.67)	(0.29)	(-0.87)	(6.03)	(3.94)	(5.94)	(3.99)
Log(total assets)	0.90***	1.09***	0.78***	0.92***	1.28***	1.33***	1.20***	1.27***
	(4.60)	(4.46)	(3.62)	(3.62)	(7.24)	(5.24)	(6.58)	(5.78)
Leverage	-0.06	-0.04	-0.11**	-0.05	-0.60***	-0.95***	-0.40**	-0.41**
	(-1.30)	(-0.43)	(-2.05)	(-0.84)	(-4.20)	(-4.65)	(-2.34)	(-2.32)
% Stock	-0.11***	-0.09*	-0.12***	-0.12***	-0.10***	-0.10***	-0.10***	-0.09***
	(-4.31)	(-1.90)	(-5.69)	(-4.31)	(-5.75)	(-4.59)	(-4.95)	(-4.00)
Reinsurance	-1.45	-1.34	-1.90	-0.95	-0.46	-0.73	-0.42	0.03
	(-1.28)	(-0.78)	(-1.51)	(-0.62)	(-0.67)	(-0.74)	(-0.63)	(0.03)
Geographical HFI	1.56	1.01	1.58	2.47	0.75	0.99	0.03	1.17
	(1.04)	(0.54)	(1.07)	(1.45)	(1.17)	(1.24)	(0.04)	(1.26)
Year dummies	Yes	No	No	No	Yes	No	No	No
Adj.R2	0.131	0.083	0.135	0.157	0.183	0.202	0.211	0.155
N	589	193	207	189	1,588	528	534	526

Table 5: Determinants of MBS investment: Instrumental variable regressions

This table reports 2SLS instrumental variable regressions on the determinants of MBS investments over 2005-2007 for the full sample, life insurers, and PC insurers, respectively. The pre-crisis ERM is instrumented by improvement in risk management around the September 11, 2001 terrorist attack (Comparable $\Delta ERM_{2000-03}$), which is defined as the average increase in ERM over the period 2000-2003 for all other insurers in the same size group to which the insurer belonged in 2000. We group insurers into 20 size groups. Robust standard errors clustered at the firm level are used in computing z-statistics (in parentheses). *, **, ***: statistically significantly at the 0.10, 0.05 and 0.01 level (two-tailed), respectively.

Panel A: 1st-stage regression

Y= ERM	(1)	(2)	(3)
	Full	Life	PC
Comparable $\Delta ERM_{2000-03}$ (excluded IV)	2.19***	0.33	2.84***
	(7.58)	(0.54)	(8.26)
Other controls in Table 4 as IVs	Yes	Yes	Yes
F-test of the excluded instrument (*p*-value)	0.00	0.00	0.00
N	1,686	433	1,253

Panel B: 2nd-stage regression

Y= % MBS	(1)	(2)	(3)
	Full	Life	PC
ERM	-5.24***	-3.42	-4.49***
	(-4.25)	(-0.49)	(-4.17)
Bank director	0.71*	1.83*	0.78*
	(1.66)	(1.92)	(1.65)
Independent director	-3.39**	-1.88	-3.58**
	(-2.24)	(-0.49)	(-2.12)
Female director	-3.84*	-16.44**	-4.08*
	(-1.92)	(-2.23)	(-1.89)
Institutional holding	4.83***	0.60	5.27***
	(5.06)	(0.33)	(4.93)
Log (CEO Vega)	0.21***	-0.06	0.24***
	(5.21)	(-0.50)	(5.47)
Log(total assets)	0.99***	0.85***	1.17***
	(8.19)	(3.11)	(7.47)
Leverage	-0.03	-0.05	-0.59***
	(-0.61)	(-0.82)	(-3.68)
PC dummy	-1.67***		
	(-3.20)		
% Stock	-0.07***	-0.09***	-0.08***
	(-4.46)	(-3.39)	(-4.07)
Reinsurance	1.16*	-1.56	0.75
	(1.70)	(-0.92)	(1.03)
Geographical HFI	-0.52	0.34	-0.65
	(-0.96)	(0.23)	(-1.03)
Year Dummies	Yes	Yes	Yes
N	1,686	433	1,253

Table 6: Determinants of MBS investment: Robustness check with RMI

This table reports determinant results from robustness check with a risk management index (RMI). The dependent variable is MBS, which is the ratio (measured in percentage) of mortgage-backed securities held by an insurer to year-beginning total assets. RMI, in the spirit of Ellul and Yerramilli (2013), is constructed as the first principal component of ERM, CRO report to board, CRO is executive, CRO in top 5, and CRO centrality. Please see Table 1 for detailed definitions. A higher value of RMI indicates more effective risk management. All explanatory variables are measured at the beginning of a chosen period. Robust standard errors clustered at the firm level are used in pooled regressions with multiple years and White's heteroskedasticity consistent standard errors are used in other columns in computing t-statistics (in parentheses). *, **, ***: statistically significantly at the 0.10, 0.05 and 0.01 level (two-tailed), respectively.

	1	2	3	4	5	6	7	8	9
Y= % MBS	Pooled			Life				PC	
Year	2005-07	2005-07	2005	2006	2007	2005-07	2005	2006	2007
ERM	-0.85***	-0.18	0.25	-0.59	-0.20	-1.15***	-1.47***	-1.37***	-0.59**
	(-5.19)	(-0.48)	(0.34)	(-1.34)	(-0.54)	(-6.45)	(-5.54)	(-7.60)	(-2.02)
Bank director	1.01***	0.54	0.57	-0.36	2.18*	1.11***	1.85***	0.29	1.91***
	(3.13)	(0.75)	(0.50)	(-0.39)	(1.67)	(3.16)	(2.82)	(0.52)	(3.29)
Independent director	-4.56***	-5.45*	-6.43	-2.67	-3.17	-3.75**	-0.64	-6.47***	-5.63*
	(-3.35)	(-1.93)	(-1.34)	(-0.74)	(-0.61)	(-2.48)	(-0.34)	(-3.49)	(-1.88)
Female director	-9.23***	-15.38***	-10.18	-21.77***	-20.32**	-7.76***	-10.48***	-5.90*	-7.96***
	(-4.37)	(-2.63)	(-1.24)	(-3.22)	(-2.51)	(-3.45)	(-3.33)	(-1.82)	(-2.89)
Institutional holding	4.05***	3.92**	2.32	3.20	6.04**	4.26***	7.54***	2.42	2.54
	(3.86)	(2.08)	(0.88)	(1.64)	(2.19)	(3.54)	(5.63)	(1.59)	(1.37)
Log (CEO Vega)	0.11***	-0.05	-0.12	0.06	-0.08	0.19***	0.13***	0.28***	0.20***
	(3.50)	(-0.91)	(-1.56)	(0.84)	(-0.66)	(6.15)	(4.10)	(6.23)	(3.96)
Log(total assets)	1.07***	0.90***	0.96***	0.87***	0.95***	1.32***	1.42***	1.26***	1.29***
	(8.26)	(4.45)	(3.65)	(3.89)	(3.55)	(7.37)	(5.49)	(6.78)	(5.77)
Leverage	-0.10***	-0.06	-0.04	-0.11**	-0.05	-0.57***	-0.97***	-0.40**	-0.37**
	(-2.61)	(-1.27)	(-0.47)	(-1.98)	(-0.79)	(-3.86)	(-4.78)	(-2.11)	(-2.00)
PC dummy	-1.71***								
	(-3.13)								
% Stock	-0.10***	-0.11***	-0.09*	-0.12***	-0.12***	-0.10***	-0.10***	-0.11***	-0.10***
	(-7.59)	(-4.19)	(-1.85)	(-5.85)	(-4.20)	(-5.77)	(-4.58)	(-5.06)	(-4.24)
Reinsurance	-0.57	-1.48	-2.10	-1.61	-0.91	-0.48	-0.63	-0.37	-0.17
	(-0.99)	(-1.33)	(-1.37)	(-1.28)	(-0.59)	(-0.70)	(-0.63)	(-0.54)	(-0.17)
Geographical HFI	0.75	1.51	0.47	1.76	2.50	0.99	1.16	0.45	1.41
	(1.29)	(0.99)	(0.24)	(1.19)	(1.43)	(1.57)	(1.46)	(0.66)	(1.49)
Year dummies	Yes	Yes	No	No	No	Yes	No	No	No
Adj.R2	0.172	0.127	0.070	0.138	0.154	0.187	0.220	0.224	0.141
N	2,141	580	186	206	188	1,561	519	525	517

Table 7: Probability of MBS unloading before the crisis

The table reports the results from Probit regression of the incidence of unloading MBS holdings in various window periods before the 2008 financial crisis on risk management and corporate governance. The dependent variable is a dummy variable that takes the value one if an insurer's holding of MBS at the end of the period decreased relative to the beginning of the period. All explanatory variables are measured at the beginning of a chosen period. White's heteroskedasticity adjusted robust standard errors are used in computing t-statistics (in parentheses). *, **, ***: statistically significantly at the 0.10, 0.05 and 0.01 level (two-tailed), respectively.

Y = Unload (0/1)	1	2	3	4	5	6
	Full		Life		PC	
	2005-2006	2006-2007	2005-2006	2006-2007	2005-2006	2006-2007
ERM	0.41**	0.25*	-0.12	0.18	0.69***	0.21*
	(2.50)	(1.86)	(-0.42)	(0.65)	(3.20)	(1.92)
Bank director	-0.13	-0.44***	-0.09	-0.34	-0.09	-0.47**
	(-0.88)	(-2.62)	(-0.37)	(-1.10)	(-0.44)	(-2.26)
Independent director	0.45	-0.77	-0.31	0.35	1.25*	-1.26
	(0.80)	(-1.21)	(-0.30)	(0.30)	(1.82)	(-1.36)
Female director	1.86**	3.24***	0.63	-0.30	2.92**	4.41***
	(2.12)	(3.94)	(0.36)	(-0.15)	(2.51)	(4.57)
Institutional holding	-0.15	-0.95***	-0.05	-1.41***	-0.31	-0.36
	(-0.48)	(-3.05)	(-0.10)	(-2.95)	(-0.74)	(-0.80)
Log (CEO Vega)	0.00	0.01	0.07***	0.02	-0.05**	-0.00
	(0.06)	(0.46)	(2.99)	(0.88)	(-2.40)	(-0.11)
Log(total assets)	-0.07	-0.12**	-0.03	-0.06	-0.06	-0.15*
	(-1.44)	(-2.45)	(-0.39)	(-0.80)	(-0.85)	(-1.93)
Leverage	0.01	-0.02	0.02	-0.03*	-0.11	-0.19*
	(0.65)	(-1.60)	(1.05)	(-1.88)	(-1.11)	(-1.84)
PC dummy	0.25	0.12				
	(1.37)	(0.66)				
% Stock	0.00	-0.00	0.01	-0.01	-0.01	-0.00
	(0.67)	(-0.34)	(1.19)	(-0.40)	(-0.64)	(-0.16)
Reinsurance	0.44*	-0.16	0.00	-0.19	0.44	-0.39
	(1.95)	(-0.68)	(0.00)	(-0.41)	(1.60)	(-1.31)
Geographical HFI	-0.31	-0.39*	-0.49	-0.29	-0.27	-0.37
	(-1.55)	(-1.86)	(-1.32)	(-0.78)	(-1.01)	(-1.37)
Adj.R^2	0.076	0.099	0.087	0.085	0.132	0.127
N	401	403	144	149	257	254

Table 8: The effect of MBS investment on subsequent investment performance

This table shows how investment in MBS affects insurance companies' investment performance for a pooled period of 2005-2008. The dependent variable, investment performance (in percentage), is the sum of realized capital gain (loss), unrealized capital gain (loss) and other-than-temporary-impairment due to MBS investment scaled by year-beginning par value of MBS holding. All explanatory variables are measured at the beginning of a chosen period. Robust standard errors clustered at the firm level are used in pooled regressions with multiple years and White's heteroskedasticity consistent standard errors are used in other columns in computing t-statistics (in parentheses). *, **, ***: statistically significantly at the 0.10, 0.05 and 0.01 level (two-tailed), respectively.

	1	2	3	4	5	6	7	8	9	10
Y = Performance%	2005-08	2005	2006	2007	2008	2005-08	2005	2006	2007	2008
% MBS	-0.14***	0.00	0.00	-0.03**	-0.69***	-0.11***	0.04*	0.01	-0.07**	-0.51***
	(-6.71)	(0.46)	(1.20)	(-2.00)	(-6.23)	(-2.97)	(1.95)	(0.97)	(-2.51)	(-3.92)
PC dummy	1.52***	0.60	0.26*	1.34***	3.51***	1.74***	0.84	0.28*	1.04***	5.01***
	(3.90)	(1.09)	(1.96)	(4.47)	(2.67)	(3.72)	(1.31)	(1.92)	(3.19)	(3.13)
MBS*PC dummy						-0.04	-0.05**	-0.01	0.06*	-0.27
						(-0.99)	(-2.00)	(-0.60)	(1.83)	(-1.39)
Log(total assets)	-0.73***	-0.25***	-0.02	-0.17*	-2.31***	-0.73***	-0.25***	-0.02	-0.17*	-2.32***
	(-7.76)	(-3.45)	(-0.91)	(-1.83)	(-6.99)	(-7.75)	(-3.45)	(-0.90)	(-1.83)	(-7.01)
Leverage	-0.03	0.01	-0.00	-0.03	-0.07	-0.03	0.00	-0.01	-0.03	-0.07
	(-0.81)	(0.22)	(-0.39)	(-0.76)	(-0.73)	(-0.87)	(0.12)	(-0.42)	(-0.72)	(-0.77)
% Stock	0.02	0.01	-0.00	0.02**	0.04	0.02	0.01	-0.00	0.02**	0.05
	(1.29)	(0.47)	(-0.17)	(2.33)	(1.10)	(1.30)	(0.45)	(-0.18)	(2.24)	(1.20)
Reinsurance	-0.36	0.15	-0.11	0.43	-1.51	-0.36	0.15	-0.11	0.43	-1.56
	(-0.88)	(0.33)	(-0.87)	(1.24)	(-1.17)	(-0.88)	(0.32)	(-0.86)	(1.23)	(-1.22)
Geographical HFI	-0.31	-0.24	0.12	-0.28	-0.07	-0.32	-0.22	0.12	-0.27	-0.14
	(-0.73)	(-0.43)	(1.07)	(-0.70)	(-0.05)	(-0.75)	(-0.40)	(1.04)	(-0.68)	(-0.10)
Year Dummies	Yes	No	No	No	No	Yes	No	No	No	No
Adj. R2	0.371	0.016	0.015	0.104	0.356	0.371	0.017	0.014	0.106	0.359
N	2,854	725	724	688	717	2,854	725	724	688	717

Table 9: The effect of MBS investment on subsequent sales growth

This table shows how insurance companies' investment in MBS at the onset of the financial crisis (i.e., at the end of 2006) affects subsequent sales (i.e., net premium earned) growth in the financial crisis. The dependent variable is a dummy that equals one for having a growth in sales over corresponding time period (2007-08, 2007-09 or 2007-10) and zero for otherwise in Panel A. In Panel B, the dependent variable is the cumulative growth rate of during the corresponding periods. Top MBS dummy equals to 1 if the investment in MBS at 2006 year end belongs to the top quintile among life insurers and PC insurers, respectively. All other explanatory variables are measured as the rolling average from year 2006 up to one year before the ending year of sales growth measurement. White's heteroskedasticity consistent standard errors are used in computing t-statistics (in parentheses). Panel A is estimated by a Probit model in which the reported coefficients represent marginal effects evaluated for a change from 0 to 1 for a dummy variable and at the mean of a continuous variable. *, **, ***: statistically significantly at the 0.10, 0.05 and 0.01 level (two-tailed), respectively.

Panel A:

Y= sales growth (0/1)	Life			PC		
	2007-2008	2007-2009	2007-2010	2007-2008	2007-2009	2007-2010
Top MBS dummy	0.14	0.03	0.11	-0.17***	-0.11**	-0.09*
	(1.49)	(0.26)	(1.07)	(-3.09)	(-2.21)	(-1.74)
New fund raised	0.91**	1.10**	0.64**	0.04	0.15	0.25*
	(2.09)	(2.30)	(2.50)	(0.17)	(0.58)	(1.95)
Log(total assets)	0.01	0.01	-0.02	-0.00	0.00	-0.03*
	(0.83)	(0.75)	(-1.24)	(-0.03)	(0.14)	(-1.84)
% Stock	-0.01***	-0.01***	-0.00	-0.00*	-0.01**	-0.00
	(-3.10)	(-2.87)	(-0.78)	(-1.67)	(-2.17)	(-1.10)
Reinsurance	0.06	-0.28*	-0.17**	0.11	0.00	-0.02
	(0.36)	(-1.76)	(-2.22)	(1.49)	(0.06)	(-0.40)
Geographical HFI	0.31***	-0.00	-0.02	-0.16**	-0.12*	-0.21***
	(2.71)	(-0.03)	(-0.20)	(-2.32)	(-1.84)	(-3.15)
Adj. R2	0.059	0.042	0.056	0.031	0.013	0.026
N	185	170	164	450	453	440

Panel B:

Y=sales growth rate	Life			PC		
	2007-2008	2007-2009	2007-2010	2007-2008	2007-2009	2007-2010
Top MBS dummy	0.17	0.33	0.16	-0.13***	-0.13**	-0.16***
	(0.93)	(1.50)	(0.75)	(-2.74)	(-2.06)	(-2.71)
New fund raised	1.96*	2.01	1.82*	0.87	1.56	1.15**
	(1.83)	(1.01)	(1.84)	(1.11)	(1.40)	(2.51)
Log(total assets)	-0.02	-0.03	-0.05	-0.02	-0.05	-0.03
	(-0.32)	(-0.65)	(-1.05)	(-0.82)	(-1.53)	(-1.06)
% Stock	-0.01**	-0.01**	-0.01	-0.00	0.00	-0.00
	(-2.51)	(-2.28)	(-0.74)	(-0.77)	(0.28)	(-1.12)
Reinsurance	0.24	-0.08	-0.00	0.32**	0.38**	0.14*
	(0.72)	(-0.18)	(-0.02)	(2.55)	(2.15)	(1.94)
Geographical HFI	0.00	0.03	0.18	-0.04	0.01	-0.29**
	(0.02)	(0.16)	(0.67)	(-0.41)	(0.09)	(-2.30)
Adj. R2	0.024	0.039	0.035	0.047	0.061	0.094
N	185	170	164	450	453	440