THE GENEVA ASSOCIATION

Insurance Sector Investments and Their Impact on Financial Stability

—AN EMPIRICAL STUDY

JUNE 2016

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Published by The Geneva Association—'International Association for the Study of Insurance Economics', Zurich.

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Foreword

The fallout from the Global Financial Crisis of 2008 continues to capture our attention. Under the lead of the Financial Stability Board (FSB), global regulators have developed, and begun to implement, a set of measures designed to mitigate risks associated with systemically important financial institutions. In collaboration with the International Association of Insurance Supervisors (IAIS), the FSB identified nine globally active insurers as systemically important (G-SIIs). It reflects the view that, under certain circumstances, insurers too might be a source of systemic risk large enough to adversely impact the financial system and the real economy.

Recent developments have added new wrinkles to the discussion about systemic risks originating in the insurance sector. Whereas G-SII designation places the individual firm at the centre of attention, the question now being debated is whether the insurance industry as a whole, through its concerted investment behaviour, may exacerbate financial market fluctuations. The potential for procyclicality, under extreme conditions, to impair financial stability and economic growth, is a matter currently attracting focus.

As spelled out in this report, there are many reasons why such concerted investment behaviour may exist. The report neither disputes their plausibility, nor questions the validity of studies documenting procyclicality. Instead, using empirical evidence, it challenges the systemic relevance of the alleged procyclical behaviour. The insurance business model, with liability-driven investment management at its core, should inherently make insurers, on balance, net contributors to financial stability rather than amplifiers of systemic risk.

This report has been written in order to make a meaningful contribution towards a fact-based dialogue with policymakers about systemic risk originating from the insurance sector.

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Executive Summary

Could insurers, through common movements in their investment behaviour, impact prices of financial instruments to such a degree that a collective re-allocation of assets may have systemic implications?

Could insurers, through common movements in their investment behaviour, impact prices of financial instruments to such a degree that a collective reallocation of assets may have systemic implications? This question was first raised in 2009 by an astute observer of financial markets. Reacting to the repercussions of the Global Financial Crisis, which also had impacted the portfolios of insurers and pension funds, Jean-Claude Trichet, the President of the European Central Bank, argued in November 2008 that a sudden unwinding of large investment portfolios could potentially 'put at risk financial stability by triggering large swings in asset prices.'[1]

Trichet's speculative question raised the concern about whether the insurance industry, acting in cohort, could potentially cause market distortions with systemic implications in the public domain. Five years later, the Bank of England's Procyclicality Working Group gave a first comprehensive answer in a discussion paper looking specifically into the question of procyclical behaviour amongst insurers and pension funds (since the focus of this report will be on the insurance industry, and specifically on life insurers, we will henceforth drop the reference to pension funds). The working group defined such herding or procyclical behaviour 'in the short term, as the tendency to invest in a way that exacerbates market movements and contributes to asset price volatility, which can in turn contribute to asset price feedback loops' and examined whether insurers' investment behaviour might 'deepen the troughs and exaggerate the peaks of asset price or economic cycles in a way that is potentially detrimental to financial stability and long-term economic growth.'

Whilst the report of the working group was 'indicative rather than definitive,' referring to anecdotal evidence rather than definitive empirical findings, several analyses by academics and researchers in central banks, financial stability boards, and international financial institutions seemed to provide support for procyclical behaviour. However, they were mostly concerned with developments in specific asset classes and often narrow market segments. They did not address the question of whether the procyclical behaviour would have systemic implications. In other words, they did not attempt to calibrate the detected procyclicality relative to the whole market.

This report endeavours to shed light precisely on the question of whether the alleged procyclical behaviour could be systemically relevant. We dispute neither the plausibility nor the validity of studies documenting procyclicality. But we question whether such impacts could assume systemic proportions. Because the focus of our report is on the behaviour of the whole industry, our findings should not be construed to have any bearing on individual insurance undertakings deemed to be systemically important. The designation of globally active and systemically important insurers—the so-called G-SIIs—is beyond the scope of this report.

The report is motivated by the insurance business model, which differs substantially from the business model pursued by other financial services firms and large institutional investors. By virtue of their long-dated and mostly illiquid liabilities, insurers should not be prone to sudden cash drains caused by customer runs (or massive surrenders). In principle, and absent otherwise binding solvency constraints, this should allow insurers to ride out financial market turbulences; it is said that they are able to 'look through the cycle.' Thus, one would expect the asset allocation of insurers to be less volatile than the allocation of other large institutional investors. However, it should be noted that, whilst the nature of insurance is not inherently procyclical, regulation can create procyclical incentives, which has led to the exercise of regulatory forbearance in some markets during periods of market volatility.

In a first part of the report, we test this hypothesis against data for the period 1998 to 2015 (for reasons of data availability, our study is limited to the United States (U.S.) and selected European countries (and in certain cases, again for reasons of data availability, to Germany only). In summary, we found that although life insurers in these markets hold significant invested assets, their holdings represent a smaller portion of both the stock and flow of assets than other financial services investors. Moreover, we found that the asset allocations of insurers are relatively stable over time across all markets. A case study for the U.S., for which we have more granular data, revealed that, compared to banks, mutual funds and pension funds, the asset allocations of life insurers were less volatile before, during and after the financial crisis. Valuation for prudential regulation in these markets has generally been based on book/cost valuations rather than current market valuation, so these firms may not be as exposed to fluctuations in market values.

An illustrative representation of our findings is reproduced in the figure below. It shows that life insurers have the lowest values for the standard deviation of quarterly changes in asset allocation across all asset classes with the exception of equity securities. In general, the values are low, ranging from 0.2 to 0.3 percentage points (pp), in particular compared to mutual funds (ranging from 0.7 to 2.3 pp) and pension funds (ranging from 0.3 to 1.7 pp). Only banks have similar standard deviations to life insurers, with values ranging from 0.1 to 0.4 pp.

1 See the chapter in Appendix A1 on '*The Potential Systemic Relevance of the Insurance Industry*' for details on the literature referred to in the executive summary.

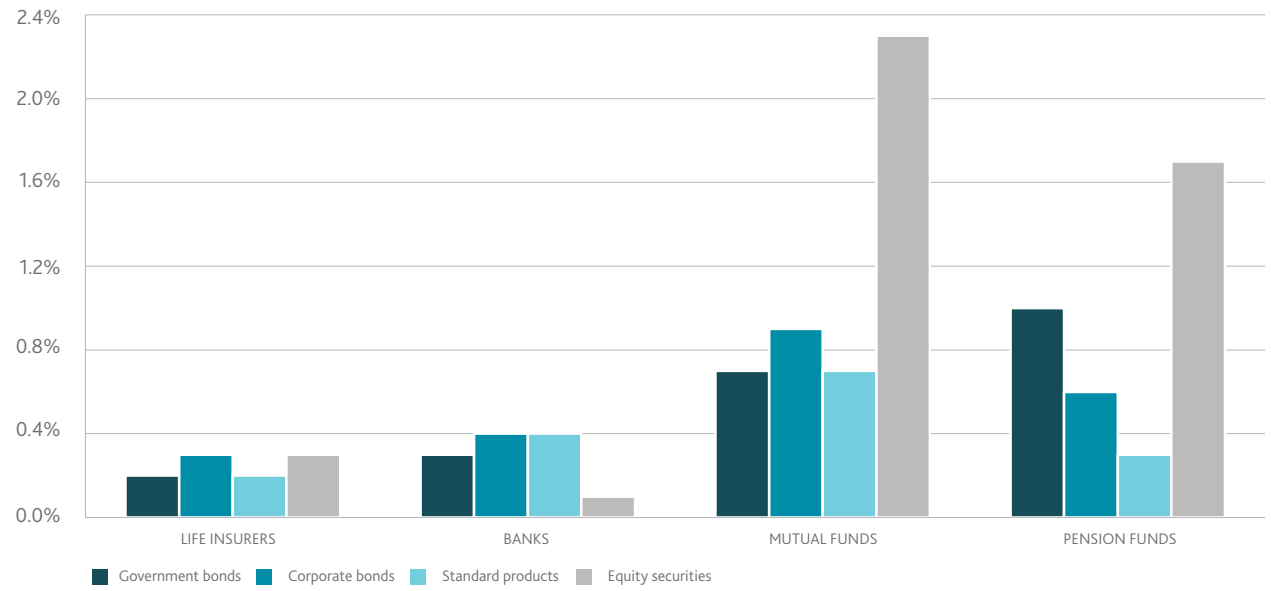
Our report also looked into the question whether insurers act in cohort with other large institutional investors, thereby reinforcing market trends and potentially amplifying them to systemic proportions. As reproduced in the figure below, over longer periods, we found a positive relationship between changes in the asset allocation of life insurers, banks and mutual funds for some asset classes (see left-hand graph on next page). This should not be surprising. After all, insurers are part of the financial market and they cannot be immune to larger market dynamics. However, looking at the changes in investment levels in absolute terms, the relationship is weaker and in fact, negative for equity securities (see right-hand graph on next page). One should also recognise that the long-term correlations are small and not always significant. We may thus reasonably conclude that the investment behaviour of insurers is in all likelihood only weakly correlated to the behaviour of other large institutional investors. Furthermore, we find that changes in asset prices are either not significantly correlated or, in the case of equity securities, even negatively correlated to changes in insurer asset allocations. In other words, in the case of equity securities, insurers tend to invest against market trends, thus exhibiting counter-cyclical behaviour.

Our study recognises that past behaviour cannot be indicative of future performance. In the second part of our report, therefore, we subject the investment portfolios of life insurers to severe shocks designed to evaluate the impact of forced asset sales (so-called fire sales). Specifically, we examine two separate de-risking scenarios, one for a hypothetical credit de-risking, and a second one for a hypothetical extreme de-risking of equity securities in which insurers shed their entire portfolio over a period of 21 trading days.

Our third scenario assumed fire sales caused by large surrenders, requiring sales of assets across all classes.

To calculate the price impact of these hypothetical fire sales, we looked at the historical relationship between changes in asset prices and changes in trading volume, and we then calculated the implied price sensitivity for each observation. From the distribution of observed volume-price changes we focused exclusively on observations with negative price impacts, i.e. we introduced a bias towards adverse price impacts, forcing our analysis to tease out only the negative price impact of additional asset sales. The price reactions were then calibrated against

Standard deviation of quarterly changes of asset allocation percentage points by asset class, U.S., Q1 1998 to Q3 2015



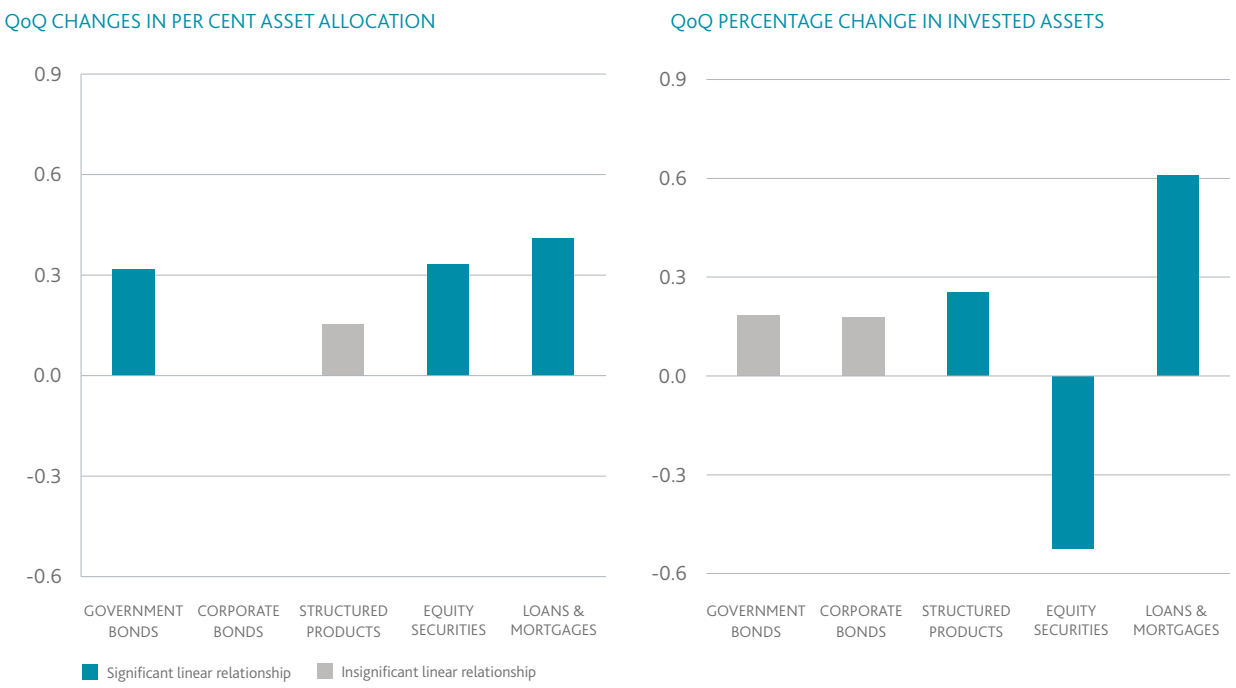
Sources: Federal Reserve, Oliver Wyman analysis.

market circuit breakers to ascertain whether they could be systemically relevant.[2]

Even under such purposefully adverse conditions, we could not find price reactions with systemic proportions. This was true for the de-risking scenarios, and it was found to hold also in the case of fire sales caused by massive surrenders. Moreover, fire sales resulting in a 5 per cent increase in average daily trading volumes would require an 8 pp increase in the surrender rate within one month for European life insurers and a 27 pp increase for U.S. life insurers.[3] This compares to the highest observed annual increase in surrender rates in the U.S. over the last 14 years of around 4 pp and to the one-year mass surrender scenarios of 30 pp. required by the IAIS (to calibrate the Insurance Capital Standard) and 40 pp used in EIOPA stress tests. Given that our hypothetical scenarios take place over only one month, they can be considered to be highly unlikely and much more severe than the stress tests imposed by global and regional supervisory bodies.

Our report recognises that the insurance industry may display procyclical investment behaviour. After all, insurers are part of the larger financial system and they cannot escape broad market trends. Like other market participants, they respond to triggers and incentives produced by the financial system and the regulatory framework guiding its working. We found, however, the market impact of insurers' investment behaviour with respect to volume and price in the two major markets we have analysed to be small and unlikely to cause systemically relevant distortions.

Correlation analysis on the investment behaviour of life insurers and banks in the U.S., Q2 2000 to Q3 2015



Sources: Federal Reserve, Oliver Wyman analysis.

Note: Fixed-income balances in the Federal Reserve data are reported as book value, and equity values are marked to market. Therefore, only equity balances are adjusted for market movements. Equity balances adjusted using the MSCI Daily TR Gross World USD index. Insurer's time series regressed on banks' time series.

2 As explained in Section 5.1, to ascertain the systemic relevance of price changes we proceed in analogy to the circuit breaker methodologies developed by a number of securities exchanges in the wake of the October 1987 U.S. stock market crash.

3 See Tables 3 and 4 in Section 5.3. for the methodology linking surrender rates to asset fire sales.

In light of these findings, we offer four broad normative implications:

- First, and following the guiding principle in medicine, policymakers should endeavour to inflict no harm. Given that the business model of insurers, absent of regulatory impositions, should not give rise to procyclical investment behaviour that is likely to cause systemic distortions to financial markets, we see no need for specific regulation in the future, and in particular, for the introduction of additional capital buffers, to address potential investment herding behaviour.

- Second, policymakers should avoid creating incentives that weaken the ability of the insurance sector to absorb financial market distress. Our analysis, though based on a limited data set, has shown that the investment portfolios of insurers were less volatile before, during and after the Global Financial Crisis than the portfolios of other financial services industries. Insurers functioned as shock absorbers and they were contributing—at least at the margin—to financial stability at a time of severe market distress.

- Third, there is a need for further research into the implications of prudential regulatory regimes based on market adjusted valuations and whether these may influence procyclical behaviour. The data available and used in this study are limited and do not fully consider the implications of prudential regimes that utilise market based valuations, such as Individual Capital Assessments (ICA) in the U.K., Solvency II in the EU, and the potential Insurance Capital Standard (ICS) being developed by the IAIS. The business model of insurers in general should not lead to procyclical behaviour, and it is important to ensure that such regulation does not create contrary incentives in this respect.

- Fourth, and related to the three points made above, policymakers should make a very conscious effort to reflect on the potential for the unintended consequences of regulation. Whilst it is in the nature of unintended consequences that they are impossible to foresee, theoretical considerations and empirical evidence referenced in our work point to the irony that procyclical behaviour, which has been indicated by policymakers as the key rationale for macroprudential regulation, can be triggered, and possibly exacerbated, by microprudential regulation. We are mindful that the Solvency II framework in the EU includes adjustment mechanisms designed to re-duce procyclicality. That said, supervisors need to walk a fine line. They should, on the one hand, be cognisant of the fact that procyclical behaviour is likely not systemically relevant, and they should, on the other hand, be mindful not to impair the shock-absorbing capacity of the insurance sector.

1. Report Objectives

Some research has indicated that the investment behaviour of insurers may be procyclical; this report does not opine on this but rather tries to estimate its likely market impact. It does not address the question of how procyclicality may be caused. Instead, we endeavour to calibrate the impact of hypothetical asset fire sales as an extreme example of investment herding behaviour. Our analysis is based on publicly available data. This imposes certain limits on data granularity.

IN-SCOPE QUESTIONS

- How do aggregate investment balances and asset allocations of insurers move over longer time periods (i.e. over multiple years)?
- How do these factors behave during specific times of financial distress (limited to quarterly movements due to data availability)?
- How do these factors for insurers compare with those of other financial institutions (i.e. banks, mutual funds and pension funds (limited to those markets where data are available)?
- How do the investment balances of insurers relate to market performance, by specific asset classes over longer time periods?
- What would be the market impact in terms of volume and price of very large asset fire sales by insurers?

OUT-OF-SCOPE QUESTIONS

- Do individual insurers cause or contribute to short-term market events or shocks (at a higher than quarterly frequency)?
- Does the aggregate industry sample allow conclusions about the designation of globally active and systemically important insurers (G-SIIs)?
- How do insurers change allocations within asset classes (e.g. by maturity, by ratings, by geography of issuer, etc.)?
- How do the balance sheets and asset allocations of individual insurance firms compare with each other?
- How does the investment behaviour of insurers differ across markets and jurisdictions?
- For fixed-income investments, how much of the change in asset balances is driven by churning or the maturing of securities vs net trading impact?

The objectives of our report are twofold. First, we will investigate the volatility of insurers' investment portfolios relative to the volatility of other large financial services industries (such as banks) and large institutional investors (mutual funds and pension funds). In doing so, we look at the industry as a whole, examining the aggregate long-term investment behaviour of insurers and other industries over an extended time period that includes the Global Financial Crisis and its aftermath through 2015. In light of the fact that the business model of insurers differs substantially from the business models of banks and mutual funds, our working hypothesis is that the historic volatility of insurers' investments will be lower than the volatility of banks and mutual funds.[1]

But, accepting the old adage that past performance is no predictor of future performance, we then subject, in a second step, selected asset positions of our aggregate sample to a number of scenarios designed to estimate the market impact on both the volume and price of large-scale asset sales over a short time period. This should allow us to give an empirically based answer to the question whether common investment behaviour in the insurance sector can generate market distortions with potentially systemic implications.

Thus, our findings based on the backward-looking performance analysis and on the results of our forward-looking scenarios should lay the foundation for a constructive and proactive engagement with regulators and policymakers. The nature of our data and the recourse to industry-wide sampling has implications for the scope and limitations of our analysis. We are, of course, conscious that statements about the investment behaviour of insurers have to be nuanced. Aggregate market statistics are the result of many factors, not all of them working in the same direction, and our results have to be interpreted with the necessary caveats.

The report's in-scope and out-of-scope questions are summarised on the preceding page. Our study is also silent on the likely causes of procyclical behaviour and, in particular, on the alleged adverse feedback loop between risk-based capital requirements and mark-to-market accounting regimes.

We had to adapt the scope of our analysis because of the paucity of data. Unfortunately, it was impossible to obtain sufficient data about the Japanese market that would have allowed a meaningful historic analysis for that market. With respect to Europe and the U.S., only the Federal Reserve provided data that (i) reached far back in time and (ii) were comparable across financial industries (banks, insurers, mutual funds and pension funds). In Europe, only the Bundesbank has a similar data set for German banks and insurers. The data do not, however, stretch as far back in time, and they are not as comprehensive as the data provided by the Federal Reserve.

This unfortunate situation prevents meaningful comparisons across the two jurisdictions, and it raises the question whether authorities make a sufficiently large enough effort in integrating the vast amounts of data collected from the industry. If systemic risk is a concern for supervisors and the conduct of macroprudential surveillance, it is difficult to see how it can be monitored without appropriate data that is also available to market participants.

It should also be noted that neither U.S. nor German data are representative of a prudential regulatory regime that incorporates a market-adjusted approach to valuation. Therefore, the implications of regimes such as Individual Capital Assessments (ICA) in the U.K., Solvency II in the EU, or the potential Insurance Capital Standard (ICS) being developed by the IAIS are not considered in this report, but are certainly worthy of further analysis.

1 The well-known specifics of the insurance business model include access to a continuous stream of premium inflows and the prevalence of, by default, long-term liability-driven investment strategies. This allows insurers to sit out temporary market dislocations; they can—in principle and absent binding solvency constraints—'look through the cycle'.

2. Insurance Sector Context

Insurers, in particular life insurers, are amongst the largest institutional investors. However, their invested assets represent a smaller proportion of the total outstanding market than those of banks, mutual funds and pension funds. Looking at the U.S. as an example, insurers' invested assets also represent less than 5 per cent of the outstanding market for any asset class, with the exception of corporate bonds. Over the past decade, insurers have significantly de-risked their asset holdings, reducing their equity exposure in particular.

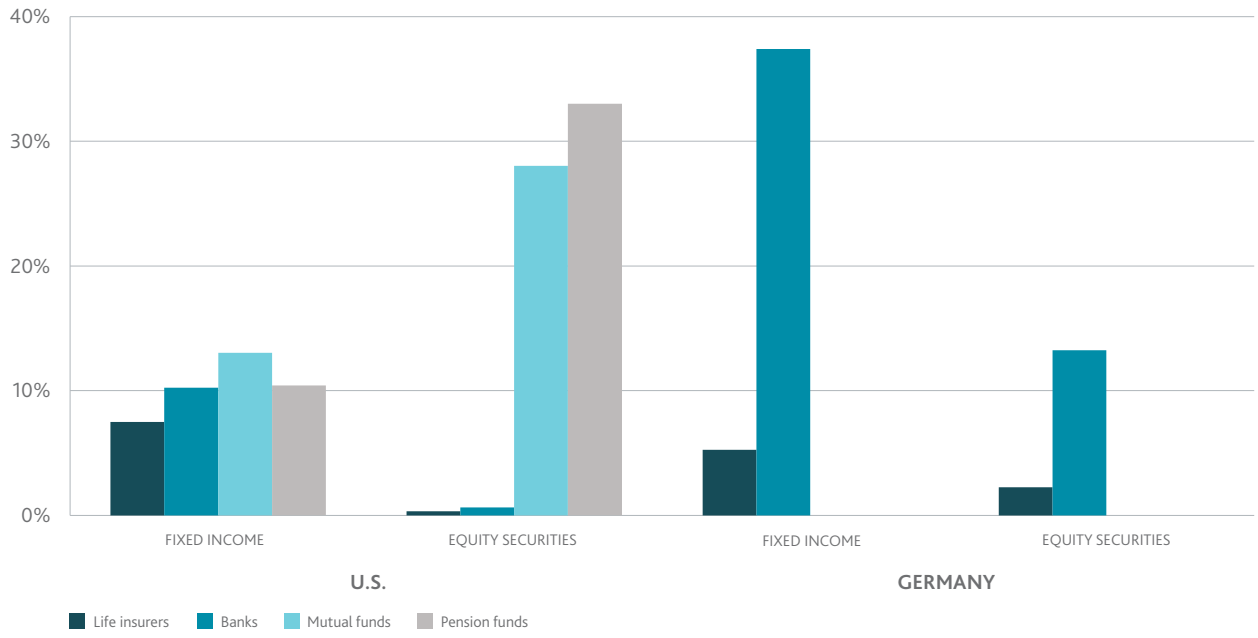
2.1 INSURERS' HOLDINGS OF FINANCIAL ASSETS

Together with investment funds and pension funds, insurers are the world's largest institutional investors. According to the OECD, global insurers in 2014 held USD 28.2 trillion in financial assets (of which more than USD 21 trillion were held by life insurers), compared to USD 33.3 trillion in the mutual funds industry and USD 28.4 trillion held by pension funds.[2] These amounts enable insurers to provide substantial funding to various financial and economic sectors. They are seen as financial intermediaries, although the nature of their inter-mediation is distinctly different from the inter-mediation seen in the business model of banks.

When, however, we compare specific asset classes held by insurers to those held by other financial services investors such as banks, mutual funds and pension funds, we see that the holdings of insurers represent a smaller portion of the market. Thus, when talking about the asset allocation of insurers potentially disrupting financial markets, one needs to consider the markets for specific asset classes.

In the case of the U.S., we see how the 0.3 per cent share of equity securities held by life insurers is much smaller compared to the share held by mutual funds and pension funds, which together hold over 60 per cent of the total outstanding market. When looking at fixed-income holdings, however, life insurers represent a more significant portion of the market (7.5 per cent) and are more comparable to

***Figure 1**:*
Invested assets held by institutional investors as a per cent of total outstanding market, Q4 2014[3]



Sources: Federal Reserve, Oliver Wyman analysis.

The large financial footprint of the insurance industry is reflected in its importance across a range of asset markets and particularly so in the market for fixed-income instruments. As reported in ***Figure 1*** above, life insurers hold significant outstanding invested assets in the German and U.S. markets, especially in fixed income.

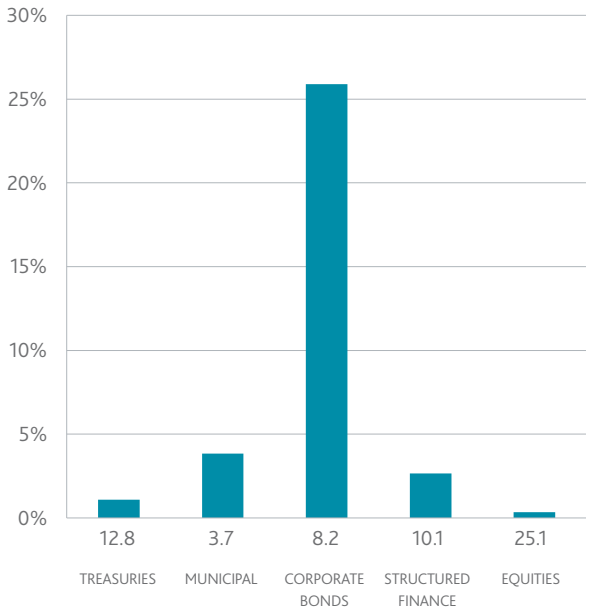
other financial investors. In Germany, banks are considerably larger investors than life insurers, both of fixed-income (approximately seven times larger) and equity securities (approximately six times larger).

In case of the U.S., we have more granular data on financial assets held by insurers in relation to the total market. ***Figure 2*** reports data across five broad asset classes, indicating that insurers hold a substantial proportion of corporate bonds, whereas their holdings of the very large U.S. equities market are negligible (as also reported in ***Figure 1***). One should point out that regulatory reasons induce U.S. insurers to

2 OECD (2015). The data refer to OECD countries plus the two non-OECD countries Russia and Latvia.

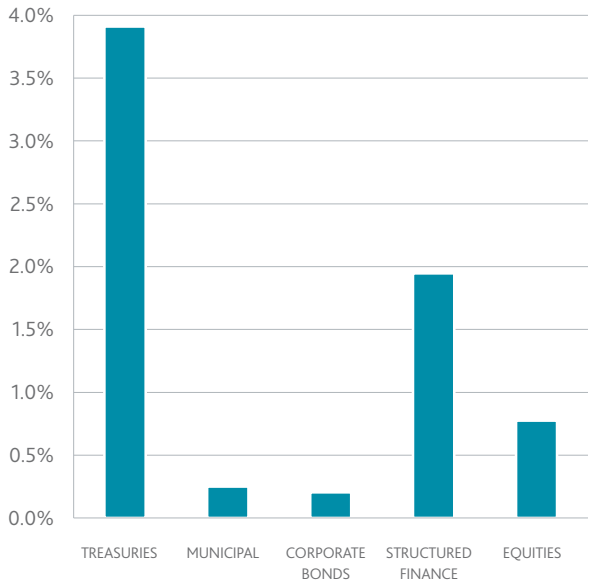
3 German data for life insurers are total global assets held. The U.S. life insurance sector comprises general accounts only. All values are market values, except for U.S. fixed-income balances, which are book value.

***Figure 2**:*
Insurers' invested assets as per cent of total outstanding market (U.S. only), Q3 2015



Sources: Federal Reserve, SIFMA.

***Figure 3**:*
Average daily trading volume (Q4 2014 to Q3 2015) as per cent of total outstanding market (U.S. only)



Sources: Federal Reserve, SIFMA.

allocate a very small proportion of their financial assets to equity securities. On the other hand, the U.S. market for Treasury securities is very large, which makes the proportion of this market held by U.S. insurers very small, even though they allocate a substantial proportion of their portfolios to these securities.

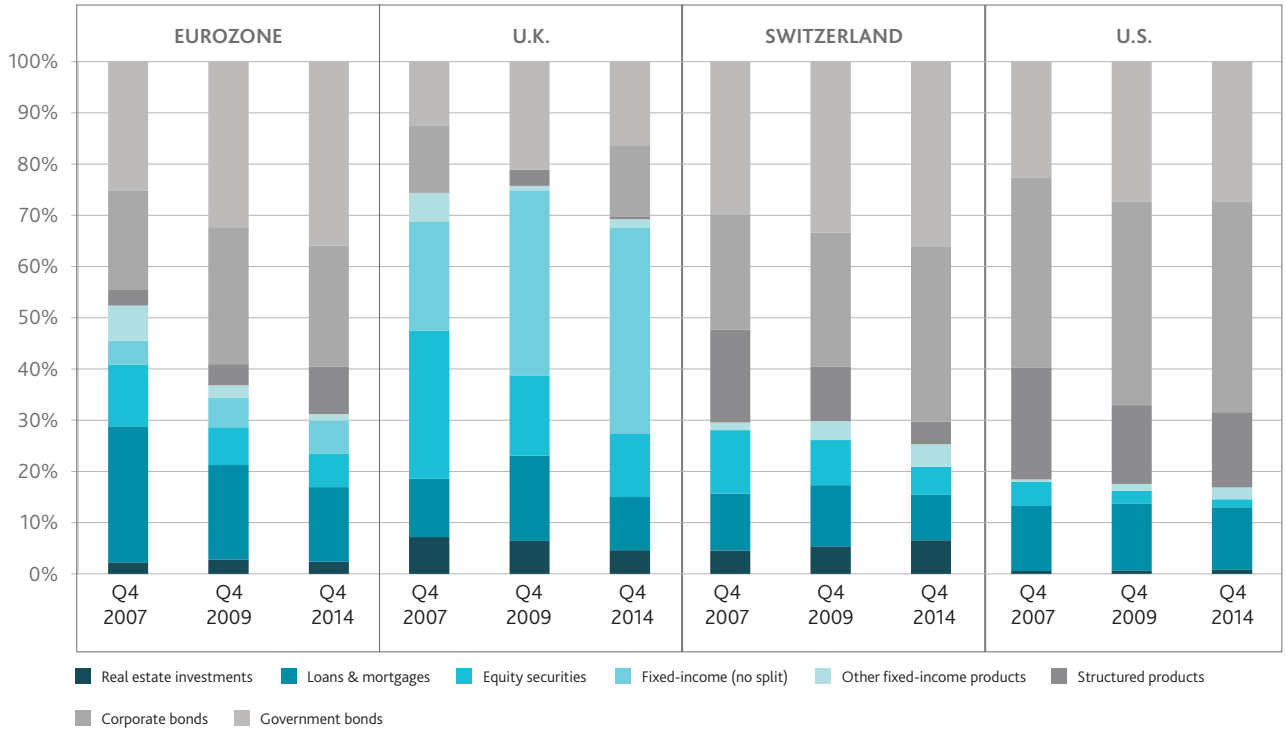
When assessing the likely impact of market transactions by insurers, one needs also to reflect on average daily trading volumes in relation to the total outstanding market. ***Figure 3*** shows that, with nearly 4 per cent of the total market, a substantial block of U.S. Treasuries are traded daily; similarly, the market for equity securities should be considered very liquid, even though not quite 1 per cent of the total market is, on average, traded daily. In contrast, the daily churn in the market for corporate bonds, in which insurers hold a substantial proportion, is comparatively low. This may imply that pronounced market activities by insurers (through large fire sales of corporate securities, for example) could have a substantial impact in that particular market. This topic is taken up in Chapter 5, where we discuss the impact of hypothetical asset fire sales for a range of different asset classes.

2.2 RECENT TRENDS IN INSURERS' ASSET ALLOCATIONS

Our review of insurers' asset allocation across different geographies (***Figure 4***) and by credit ratings (***Figure 5***) is hampered by a number of peculiar data features. Companies in the U.K. report one aggregate class of fixed-income securities, with no split provided for government bonds and corporate bonds. And U.S. companies report one big aggregate for securities rated AAA, AA and A, whereas other countries and regions provide a split by credit ratings.

That said, the data on asset allocations by countries and regions for the quarters ending in 2007, 2009 and 2014 allow some high-level conclusions about broad trends in asset allocation. First, the decline in the allocation to equity securities, which in absolute and relative terms was most pronounced in the U.K., can be interpreted as a continued de-risking of the balance sheet. This de-risking process began in 2001 after the dotcom bubble burst; it appears to have been reinforced by the experience of the Global Financial Crisis as well as the movement towards risk-based solvency regimes, in particular, Solvency II.

***Figure 4**:*
Insurer Asset Allocations by Region[4]



Sources: Bloomberg, company annual reports, Oliver Wyman analysis

Second, the de-risking theme seems to have also played a role in determining the allocation to loans and mortgages. In the period under consideration, it declined in all countries and regions, but it was most pronounced amongst insurance companies in the eurozone.

Third, a de-risking in terms of structured products can also be observed in Switzerland and the U.S., but not in the eurozone.

Fourth, the mirror image of the de-risking processes seems to be the reallocation to corporate and government bonds, which can be observed in all countries and regions. However, it remains to be seen whether it is appropriate to speak of de-risking in this context. The pro-longed low interest rate environment has eroded the profitability of many European life insurers in particular, and the current historically low interest rate levels entail the risk of an abrupt yield reversal. This so-called 'double hit scenario' was identified as a main risk with severe consequences for the European insurance sector in a stress test conducted by EIOPA in 2014.[5]

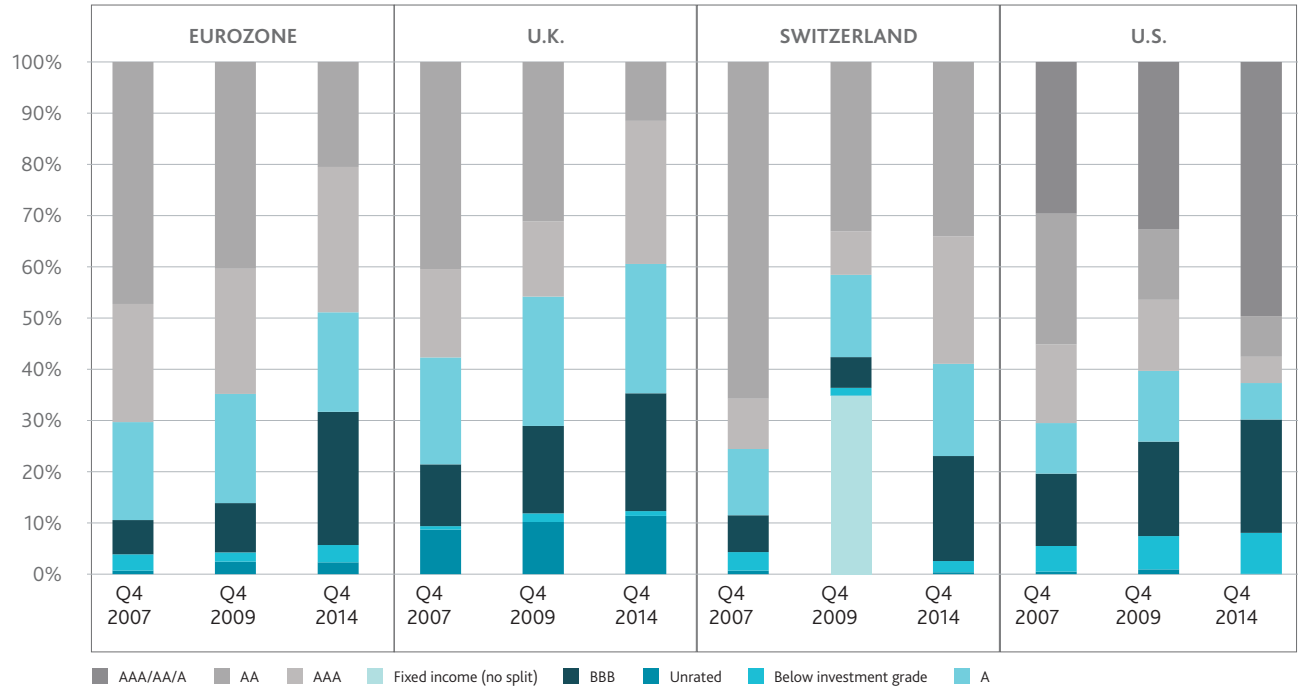
The data on fixed-income allocation by credit ratings attest to a broad decline in fixed-income securities rated A and higher (with the sole exception of the U.S.). The deterioration in credit quality was most pronounced in the eurozone, where the proportion of fixed-income securities rated A and higher declined from 89 per cent to 67 per cent. It was nearly matched by the decline in the U.K. (from 78 per cent to 65 per cent), whereas in Switzerland, the pro-portion fell from 89 per cent to only 77 per cent. The deterioration was, of course, driven by the strong decline in the availability of top-rated AAA securities, with the most dramatic decline reported by U.K. insurers. The disappearance of safe assets has been discussed repeatedly in the literature.[6] Reasons

4 The eurozone includes a sample of eurozone countries only: Germany, France, Italy and the Netherlands. It is based on a selection of insurers for each jurisdiction. Eurozone insurers: AXA, CNP, Allianz, Munich Re, Generali and Aegon; U.K. insurers: Aviva and Prudential PLC; Swiss insurers: Swiss Life, Swiss Re, Zurich; U.S. insurers: AIG, MetLife, Prudential U.S., Travelers. Data for some companies do not split out fixed-income securities to government bonds, corporate bonds and structured products. – In the case of the U.S., the class of securities listed under government bonds include treasury securities, agency and GSE-backed securities, and municipal securities.

5 See also EIOPA (2015).

6 See IMF (2012).

***Figure 5**:*
Insurers' fixed-income asset allocations by credit ratings



Sources: Bloomberg, company annual reports, Oliver Wyman analysis.
Note: Aggregated company data, U.S. government bonds are classified AAA.

for the deterioration can be found in the hardened rating environment for previously top-rated issuers, but also in the crowding out of the market through asset purchases by central banks in the pursuit of quantitative easing (see also the discussion in Appendix A1 and footnote 49).

3. Stability of Insurance Sector's Investment Behaviour

As discussed in the previous chapter, life insurers hold significant invested assets across mature markets, although these represent a smaller portion of the overall market relative to banks, mutual funds and pension funds. If we look at changes in these asset holdings over time, we also see a similar pattern whereby changes in life insurers' investments are smaller and more stable over time. Our study also found the same relationship for asset allocations over time, i.e. the proportion of total assets held for each asset class.

3.1 VOLATILITY OF LIFE INSURERS' INVESTED ASSET BALANCES AND ALLOCATION

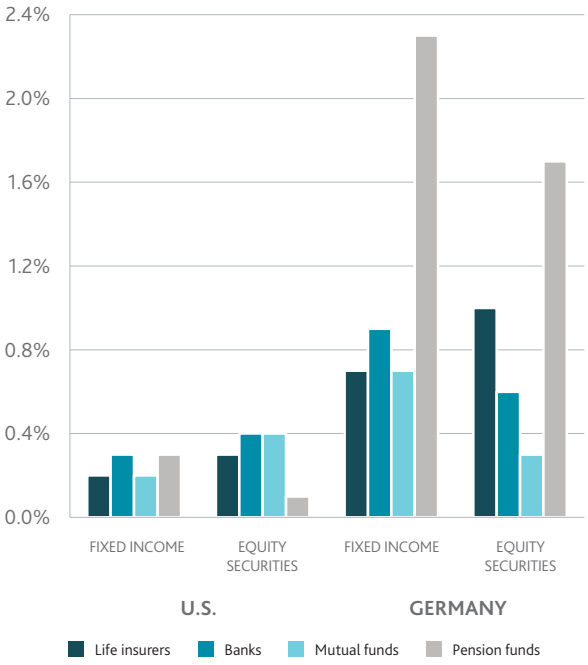
On an absolute basis, quarter-on-quarter (QoQ) changes in asset holdings for life insurers are significantly smaller than those of other institutional investors, as shown in ***Figure 6***. Looking at both the U.S. and Germany, average changes in the assets of banks, mutual funds and pension funds (as a percentage of the total market) are between 2 times and 13 times the size of those seen in life insurers.

Looking more closely at the U.S. market, where more granular public data are available, we see that life insurers exhibit a lower variation in invested assets over time relative to other institutional investors, as illustrated in ***Figures 7*** and ***8***, for fixed-income and equity securities, respectively. Between Q1 2000 and Q3 2015, average changes in the value for life insurers' holdings of fixed-income securities are similar to those for pension funds (EUR 73 billion compared to EUR 64 billion) and significantly smaller than those of either banks (EUR 116 billion) or mutual funds (EUR 196 billion). At the same time, life insurers show less variation in these changes and have by some way the lowest standard deviation (EUR 71 billion) compared to EUR 146 billion for banks, EUR 153 billion for mutual funds and EUR 199 billion for pension funds. A similar pattern is also seen when looking specifically at the periods before, during and after the Global Financial Crisis of 2007/2008.

A look at changes in U.S. life insurers' holdings of equity securities over the same period shows a similar situation. Between Q1 2000 and Q3 2015, average changes in the value for life insurers' equity security holdings were lower than those of other institutional investors (EUR 1.1 billion compared to banks EUR 1.4 billion, mutual funds EUR 74 billion and pension funds EUR 45 billion) and had a lower standard deviation (EUR 11 billion compared to banks EUR 12 billion, mutual funds EUR 89 billion and pension funds EUR 155 billion). As for fixed income security holdings, a similar pattern is seen for the periods before, during and after the Global Financial Crisis. Beginning in 2011, we note markedly higher volatility for pension funds relative to insurers (across both asset classes). It is likely attributable to the significantly large size of their holdings and their use of mark-to-market as opposed to book value accounting which would otherwise be a disincentive for large changes in asset allocations.

7 Data for German life insurers are total global assets held. The U.S. life insurance sector comprises general accounts only. All values are market values, except for U.S. fixed-income balances, which are book value.

Figure 6:
Average QoQ change in asset holdings (absolute value), annualised rate, per cent of total outstanding market, Q1 2006 to Q1 2015[7]



Sources: Federal Reserve, SIFMA.

Publicly available data of a similar nature for markets other than the U.S. market are either not available or are significantly less granular, covering fewer institutional investors, shorter time series or with less detailed breakdowns by asset class. Performing similar analysis of quarterly changes in fixed-income and equity securities for Germany based on Bundesbank data does however yield similar results.[8] Life insurer assets display lower standard deviations than those of banks and, hence, less volatility: for fixed-income assets, the standard deviation is EUR 17 billion for life insurers compared to EUR 116 billion for banks; for equity securities it is EUR 6 billion compared to EUR 39 billion.

3.2 U.S. CASE STUDY: VARIATION IN LIFE INSURER ASSET ALLOCATIONS

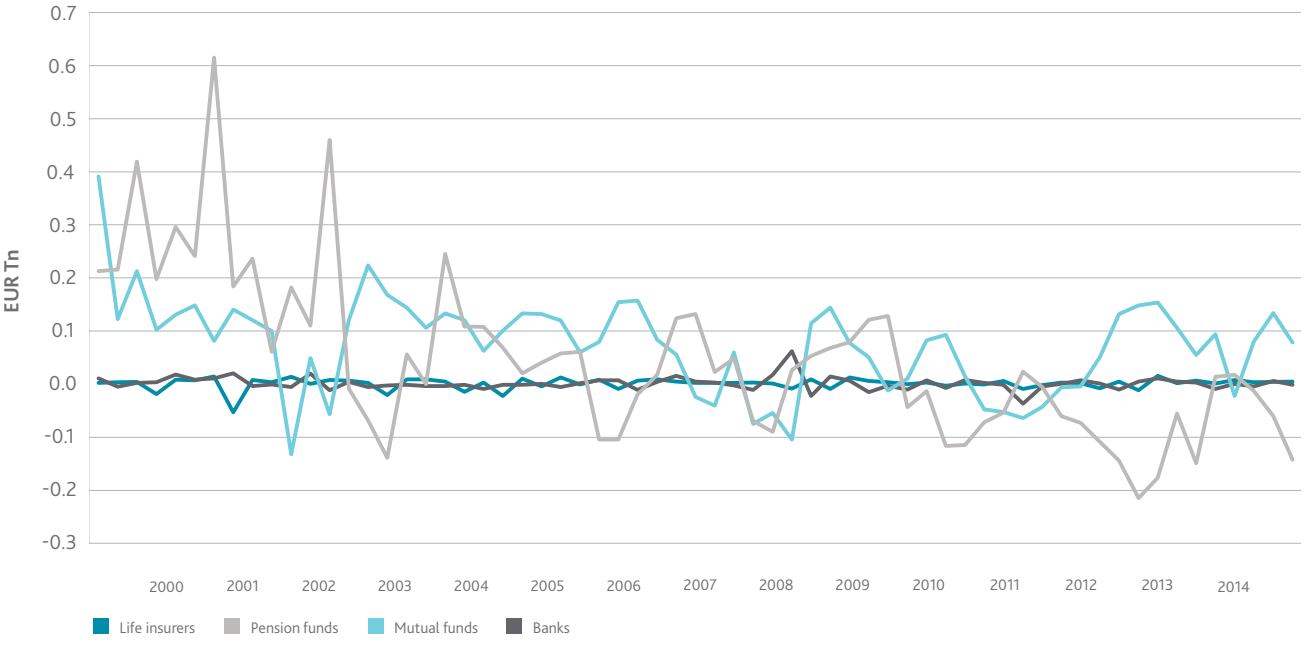
In addition to looking at absolute values of asset holdings, we also examined changes in asset allocations over time, i.e. the proportion of their total assets that institutional investors hold across each asset class. Doing this allows

8 Q2 2006 to Q1 2015; for life insurers this includes global asset holdings while for banks this includes only domestic assets.

Figure 7:
Quarterly change in invested fixed-income securities by industry, U.S. market annualised changes in book values, EUR trillion

Sources: Federal Reserve, Oliver Wyman analysis.

Figure 8:
Quarterly change in invested equity securities by industry, U.S. market annualised changes in marked to market values, EUR trillion



Sources: Federal Reserve, Oliver Wyman analysis.

us to control for changes in the total balance of invested assets over time and therefore examine relative reallocations between different asset classes and focus on insurers' investment behaviour.

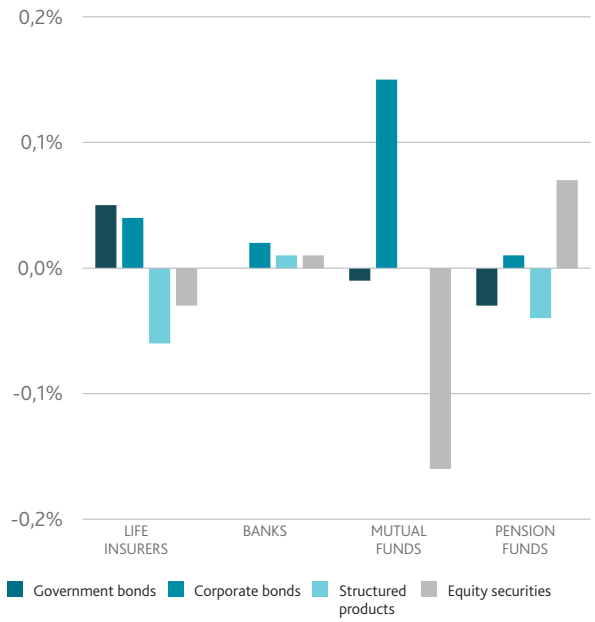
Using the U.S. as a case study, we find that quarterly changes in life insurers' invested asset allocations across different asset classes are relatively stable over time. The same appears to be true for banks, but asset allocations for mutual funds and pension funds are significantly more variable.

Figure 9 shows that average quarterly changes in asset allocations for government bonds and structured products are markedly different across institutional investors; life insurers have the largest average changes (0.05 per cent and -0.06 per cent respectively). For corporate bonds and equity securities mutual funds have the largest average changes (0.15 per cent and -0.16 per cent), significantly more so than life insurers (0.04 per cent and -0.03 per cent).

Looking at the standard deviation of these quarterly changes in asset allocation, as shown in ***Figure 10***, we see that life insurers have the lowest values across all asset classes with the exception of equity securities and that, in general, these are low (ranging from 0.2 per cent to 0.3 per cent), in particular relative to mutual funds (ranging from 0.7 per cent to 2.3 per cent) and pension funds (ranging from 0.3 per cent to 1.7 per cent). Banks have similar values to life insurers (ranging from 0.1 per cent to 0.4 per cent).

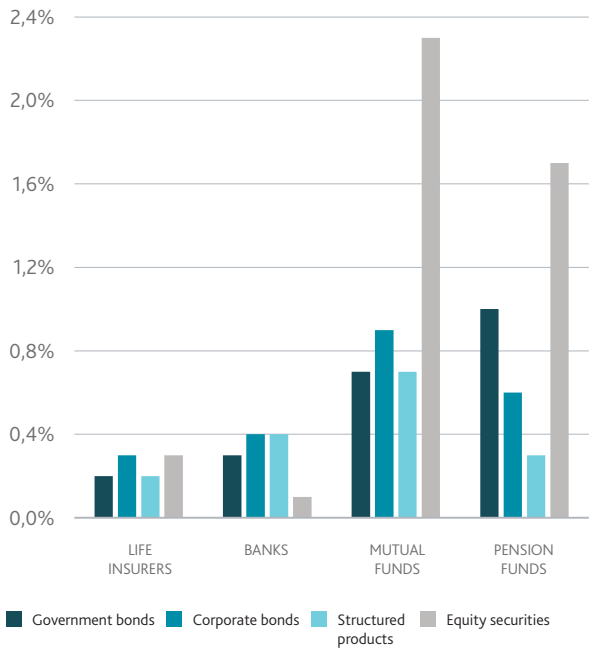
Insurers' asset allocations are more stable for all the various periods within our time series (i.e. for the full period, as well as before, during and after the Global Financial Crisis), as can be seen in ***Figures 11–13***. These charts show the cumulative change in asset allocations for government bonds, corporate bonds and equity securities, respectively, that is, the cumulative change in percentage points of total investable assets. One can observe that, although insurers have been undergoing shifts in their asset allocation, this movement has been relatively smooth over time. The longer-term trend is relatively gradual in comparison to other financial investors, which exhibit much more volatile behaviour, in particular, mutual funds and pension funds.

***Figure 9**:*
Mean of quarterly changes of asset allocation percentage points (i.e. % of invested assets) by asset class, U.S., Q1 1998 to Q3 2015



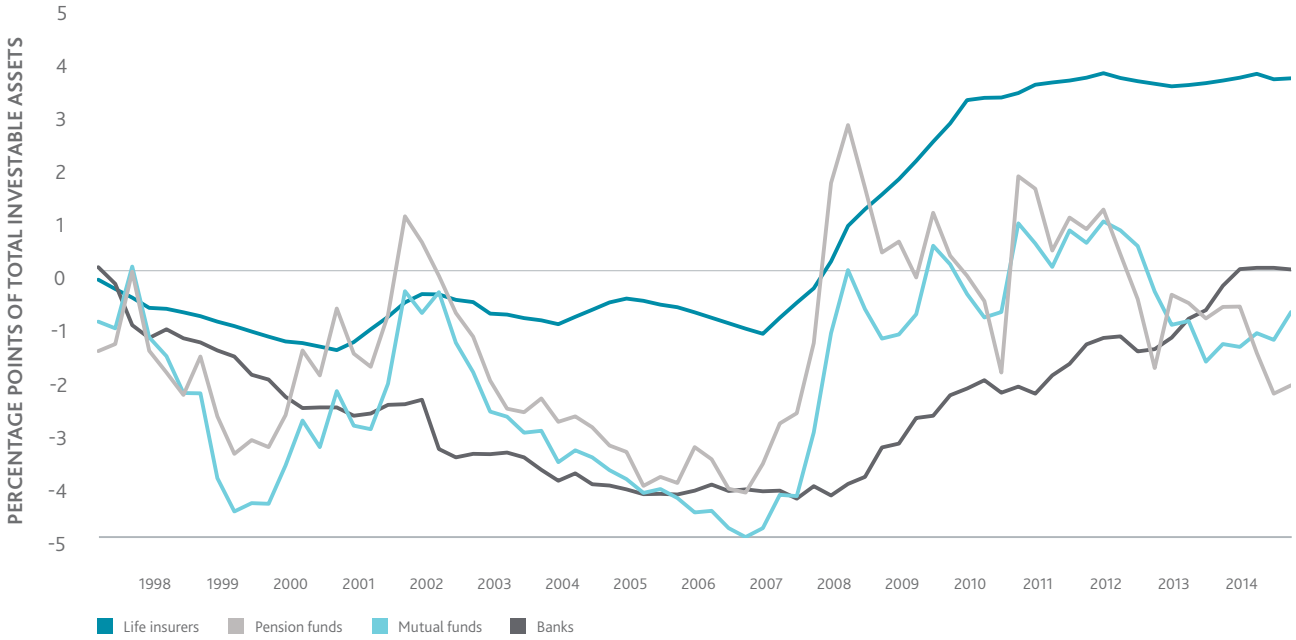
Sources: Federal Reserve, Oliver Wyman analysis.

***Figure 10**:*
Standard deviation of quarterly changes of asset allocation percentage points by asset class, U.S., Q1 1998 to Q3 2015



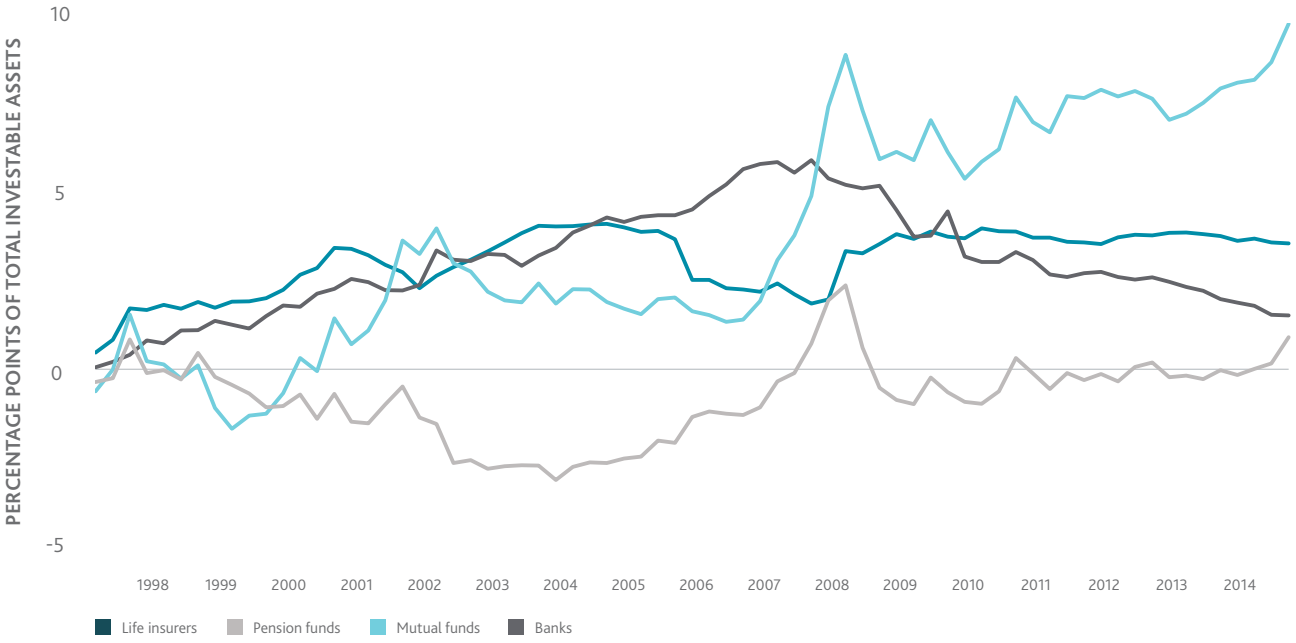
Sources: Federal Reserve, Oliver Wyman analysis.

Figure 11:
Cumulative QoQ change in asset allocation per cent—U.S. life insurers' holdings in government bonds compared to other investors



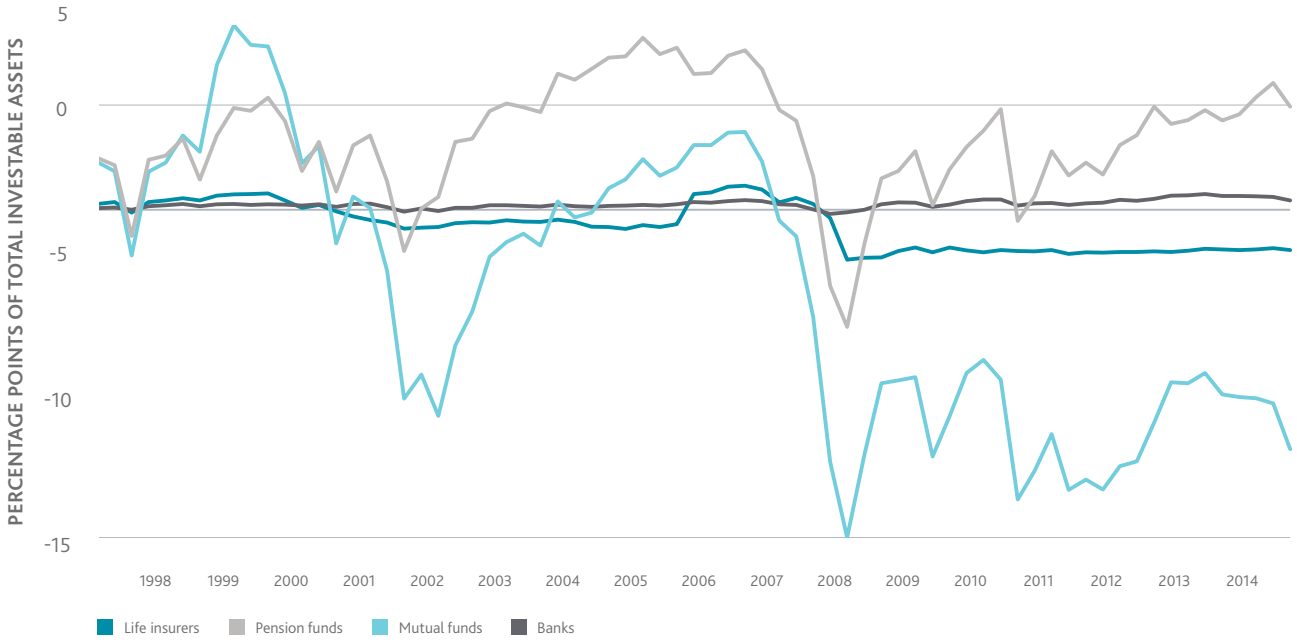
Sources: Federal Reserve, Oliver Wyman analysis.

Figure 12:
Cumulative QoQ change in asset allocation per cent—U.S. life insurers' holdings in corporate bonds compared to other investors



Sources: Federal Reserve, Oliver Wyman analysis.

Figure 13:
Cumulative QoQ change in asset allocation per cent—U.S. life insurers' holdings in equity securities compared to other investors



Sources: Federal Reserve, Oliver Wyman analysis.

4. Insurers' investment behaviour relative to other investors and the market

Having looked at the invested assets of insurers and how they change over time in comparison to other institutional investors, we now consider the extent to which their investment behaviour follows similar patterns to those of other financial investors. One could argue that, if one group of investors, such as life insurers, were to take on similar investment strategies to other financial investors, this could potentially exaggerate existing market movements with potentially systemic implications in extreme cases. Similarly, in situations of market distress, if financial investors have similar strategies and therefore display 'herding behaviour' and move in parallel, this could again potentially exacerbate market movements, leading to systemic distortions in extreme cases.

To assess the likeliness of such a situation, our study compares the historical investment behaviour of life insurers to that of banks and mutual funds. We make use of correlation and regression analyses to examine the extent to which these investors have exhibited similar behaviour to life insurers in the past, as well as look at the relationship between life insurer investment behaviour and changes in the overall market. These analyses found little evidence of life insurers moving in parallel with banks or mutual funds, or of their investment behaviour strongly accentuating market movements.

4.1. COMPARISON OF LIFE INSURERS' INVESTMENT BEHAVIOUR WITH OTHER TYPES OF INVESTOR

4.1.1. LIFE INSURERS AND BANKS

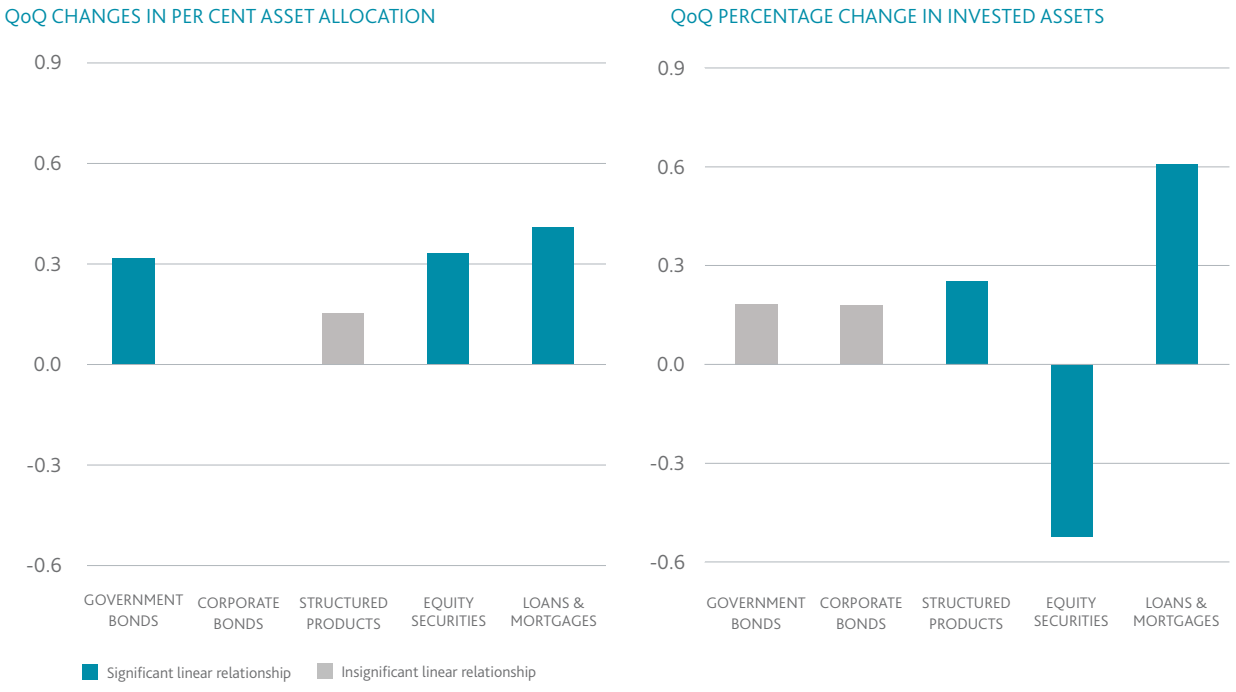
To examine the relationship between the investment behaviour of life insurers and banks, we performed correlation analyses looking at specific asset classes. For each asset class, we considered the correlation between their quarterly changes in asset allocations and also between their quarterly changes in invested assets. For example, we looked at how changes in life insurers' holdings of government bonds (as a percentage of total invested assets) were correlated to the same changes for banks; we also looked at the correlation between the percentage changes in asset values.

As can be seen in ***Figure 14***, our study found that the relationships between life insurers' and banks' asset allocations were generally weakly positive (ranging from 0.0 to 0.4) and that these relationships were not statistically significant across all asset classes. In other words, there is no strong correlation between the investment behaviour of life insurers and banks.

The relationship between the percentage changes of their invested assets shows a similar story and gives no indication of a strong correlation in investment behaviour. The relationships are generally weakly positive with the exception of that of equities, which is weakly negative; the relationships for fixed-income investments are negligible and mostly not statistically significant. Investments in equity securities and loans and mortgages show slightly higher correlations in absolute terms. The negative relationship for equity securities shows that, based on absolute values, life insurers have actually been increasing their equity holdings at the same time as banks have been reducing theirs and vice versa, which indicates the opposite of the aforementioned herding behaviour.

Our findings are in line with those of other academic studies, including the network analysis of the EU insurance sector performed by the European Systemic Risk Board, which found low interconnectivity between the network of EU insurance groups, banks and other financial institutions.[9]

Figure 14:
Correlation analysis on the investment behaviour of life insurers and banks in the U.S., Q2 2000 to Q3 2015



Sources: Federal Reserve, Oliver Wyman analysis.

Note: Fixed-income balances in the Federal Reserve data are reported as book value, and equity values are marked to market. Therefore, only equity balances are adjusted for market movements. Equity balances adjusted using the MSCI Daily TR Gross World USD index. Insurer's time series regressed on banks' time series.

9 Alves *et al.* (2015).

4.1.2. LIFE INSURERS AND MUTUAL FUNDS

Comparing life insurers and mutual funds, the correlation in changes in asset allocation is also weakly positive, albeit slightly more pronounced than with banks; and for equity securities, the correlation is higher at 0.7, as shown in ***Figure 15***.

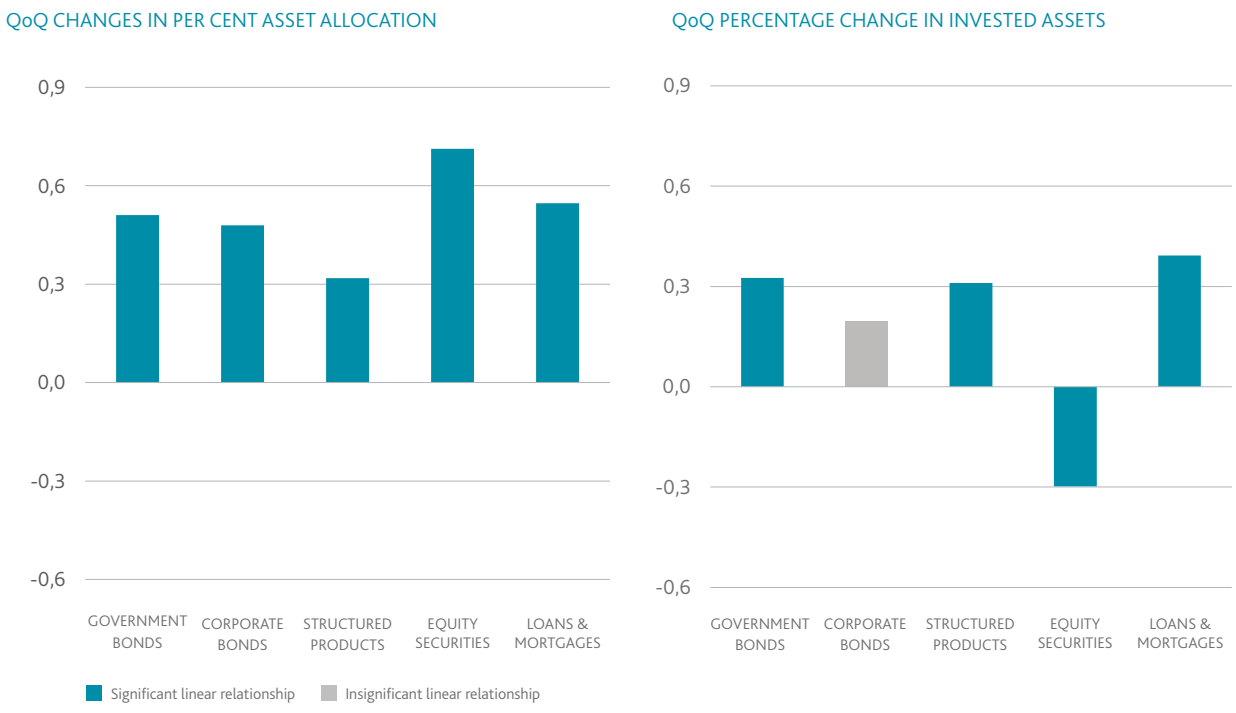
Looking at the correlation in percentage changes in asset values, we found that this relationship is also weak between life insurers and mutual funds. As was the case with banks, the negative correlation in percentage changes of equity securities can also be seen in the case of life insurers and mutual funds, suggesting that the life insurance sector is behaving countercyclically for this asset class. This hypothesis was confirmed by comparing the insurers' investment pattern to market movement, as one can read in 4.2. Overall, given the weak relationships, there is no strong correlation between the investment behaviour of life insurers and mutual funds.

4.2. RELATIONSHIP BETWEEN MARKET MOVEMENTS AND LIFE INSURERS' INVESTMENTS

In order to determine whether the investment behaviour of the life insurance industry is related to price changes seen in the wider market, we also examined the relationship between market prices (modelled using suitable market indices) and changes in life insurers' invested assets using a regression analysis.

Where changes in life insurers' assets were based on observed market values, the pure market impact was removed from the data in order isolate the effect of changes in asset mix due to investment decisions by insurance companies. The adjusted changes in asset allocations due to insurers' investment decisions were then compared to the observed changes in market prices.

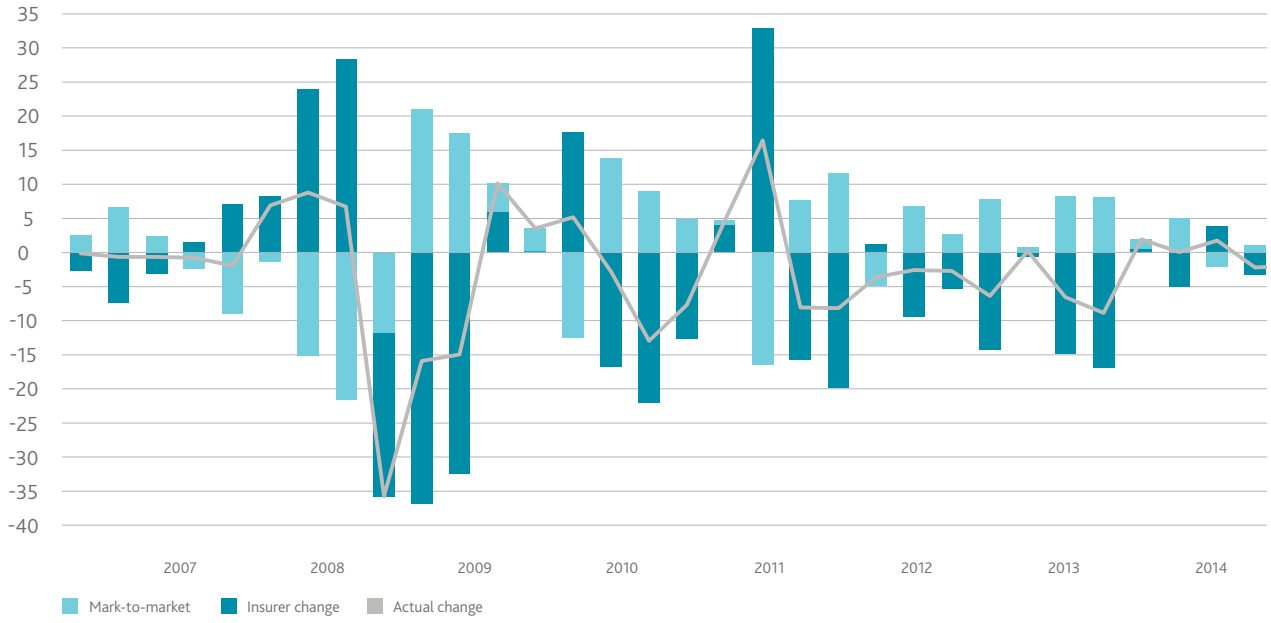
Figure 15:
Correlation analysis on the investment behaviour of life insurers and mutual funds in the U.S., Q2 2000 to Q3 2015



Sources: Federal Reserve, Oliver Wyman analysis.

Note: Fixed-income balances in the Federal Reserve data are reported as book value, and equity values are marked to market. Therefore, only equity balances are adjusted for market movements. Equity balances are adjusted using the MSCI Daily TR Gross World USD index. Insurers' time series regressed on mutual funds' time series.

Figure 16:
Equity securities holdings of U.S. life insurers, QoQ change in investment balances, decomposed into pure market changes and adjusted allocation change decisions



Sources: Bloomberg, Federal Reserve, Oliver Wyman analysis.
Note: Mark-to-market impact modelled on the MSCI Daily TR Gross World USD index.

The adjustment for the market impact is illustrated in ***Figure 16*** for U.S. life insurer holdings of equity securities. Actual changes in equity securities can be seen from the grey line on the graph, these changes were then decomposed into the pure market changes (modelled using the MSCI Daily TR Gross World USD index) as shown in dark red, and the implied life insurer investment decisions shown in light red.

The results of our regression analysis are shown in ***Table 1*** for Europe (comprising the eurozone, the U.K. and Switzerland) and in ***Table 2*** for the U.S. We found no evidence that life insurers' investment behaviour impacts market prices. On the contrary, our analyses found that, in Europe, the relationship between changes in life insurers' invested assets and changes in market indices were negative (correlation coefficient of -0.1 for fixed-income securities and -0.7 for equity securities); i.e. in Europe, market prices for certain asset classes fall when insurers increase their allocation to that asset class. In the U.S., there was a nonsignificant positive relationship for corporate bonds (correlation coefficient of 0.6), whilst the other asset classes had no relationship or negative relationships.

The only relationships that were found to be statistically significant were those for changes in invested equities securities, both of which were negatively correlated to market changes (correlation coefficients of -0.7 for Europe and -0.4 for the U.S.). This would suggest countercyclical behaviour on the part of life insurers, which is in keeping with the results discussed in Section 4.1, where changes in life insurer investments in equity securities were found to be negatively related to those of banks and mutual funds.

Table 1:
Regression analysis of market index performance on life insurers' invested assets changes, after adjusting for pure market impact; eurozone including Switzerland and U.K., Q1 2007 to Q1 2015

	COEFFICIENT	P-VALUE	R^2	MARKET INDEX (DEPENDENT VARIABLE)
Fixed income	-0.13	0.09	0.09	BofA ML Euro Market Index
Equity securities	-0.67	0.00	0.29	MSCI Daily TR Gross World USD

Sources: Bloomberg, Federal Reserve, Oliver Wyman analysis
Note: Highlighted values show a statistically significant relationship. Regression calculated as $Y = \beta X + \varepsilon$ where the dependent variable (Y) is the market index and independent variable (X) is the changes in life insurers' invested assets.

Table 2:
Regression analysis of market index performance on life insurers' invested assets changes, after adjusting for pure market impact, U.S., Q1 2007 to Q1 2015

	COEFFICIENT	P-VALUE	R^2	MARKET INDEX (DEPENDENT VARIABLE)
Government bonds	0.02	0.87	0.00	BofA ML AII Maturity US Government Index
Corporate bonds	0.56	0.38	0.02	BofA ML AAA-A US Corp. Index
Structured products	-0.32	0.12	0.08	BofA ML 0-10 Yr US MBS Index
Equity securities	-0.42	0.02	0.16	MSCI Daily TR Gross World USD

Sources: Bloomberg, Federal Reserve, Oliver Wyman analysis
Note: Highlighted values show a statistically significant relationship. Regression calculated as $Y = \beta X + \varepsilon$ where the dependent variable (Y) is the market index and independent variable (X) is the changes in life insurers' invested assets.

5. Assessment of Potential Asset Fire Sales

The previous chapters focused on the analysis of historical data, where we found low volatility in the asset allocation of insurers compared to other large institutional investors. We also found scant support for the claim that the investment behaviour of life insurers would correlate with the behaviour of other large investors. We now look prospectively to examine what the impact of such behaviour would be in the presence of large, collective asset sales. Our study focuses specifically on fire sales of financial assets by life insurers as the most extreme example of such theoretical co-movements in investment behaviour.

In this section, we show that even in extreme and unrealistic asset fire sale scenarios, life insurers are unlikely to systemically distort financial markets. The scenarios we discuss are intentionally improbable, but focus on those areas where fire sales could potentially happen as a result of either rapid de-risking or an extreme surrender event. Specifically, we examine two types of hypothetical asset fire sales: asset sales triggered by a need to de-risk and as-set sales triggered by unusually high surrenders and hence, a need to sale assets to raise enough cash for policyholder payouts.

Potential triggers for de-risking scenarios could relate to severe solvency shocks or changes in regulatory regimes. Solvency-related shocks are most likely to be idiosyncratic insurance events effecting individual insurers with weak balance sheets; they would be unlikely to affect the whole industry simultaneously. Regulatory drivers, whilst potentially significant, are unlikely to act over short time frames (as in our scenarios).[10]

Potential triggers for extreme surrender events could relate to changes in the tax treatment of insurance products (more likely to affect new business rather than in-force business), reputational events (usually limited to individual firms) or severe macroeconomic distress forcing policyholders to raise funds from insurance policies.

5.1. IMPACT ASSESSMENT OF HYPOTHETICAL ASSET FIRE SALES

In order to examine hypothetical future scenarios where the investment behaviour of life insurers might have systemic implications, we looked at the impact of asset fire sales across different asset classes. For these scenarios, we looked at Europe and the U.S. separately and considered the sale of invested financial assets held by life insurers in their general account.[11] We did not consider unit-linked assets for these scenarios, given that for these products (and hence their assets), investment decisions are made by policyholders not by the insurers. We have also excluded product-specific scenarios, for example, hedging behaviours specific to certain product types, in order to ensure our scenarios are applicable across all relevant geographies.

Our assessment of hypothetical asset fire sales looked at the impact on market prices of life insurers selling assets at the same time, resulting from a significant increase in the volume of trading in a short space of time. The sensitivity of asset prices to changes in trading volumes is a key feature of our scenarios. From an examination of the econometric literature, there appears to be no standard method used for establishing price sensitivity to changes in volume. The literature dealing with the impacts of herding behaviour and forced asset sales (or fire sales) acknowledges the challenge of isolating the impact of volume changes on prices from that of other factors, such as asset class fundamentals, investor sentiment or the economic environment. One approach widely used is based on the return properties of equity share prices by isolating systematic patterns in returns after certain events that were identified to be forced sales.[12]

In our pragmatic approach, we compared the implied increases in traded assets with the average daily trading volumes in each asset class and calculated the sensitivity of prices for each different asset class to such changes in volume. The empirical recourse to changes in volume and price allowed us to calibrate the price sensitivity assumptions used in our hypothetical scenarios.

To calibrate price sensitivity, we looked at the historical relationship between changes in asset prices and changes in trading volume and calculated the implied price sensitivity for each observation. Only data points where changes in volume were larger than 10 per cent were used in order to isolate those points where changes in price were more likely to be due to changes in volume rather than other factors.[13] ***Figure 17*** shows the distribution of implied relative price sensitivity calculated in this way for corporate bonds.[14] As one can see, there are both negative and positive values; a negative value indicates that, as volume increases, prices fall, i.e. the volume increase is driven by an increase in the securities supply, whereas a positive value indicates that, as volume increases, prices also increase, i.e. the volume increase is driven by an increase in demand (leaving out other possible explanations such as broader dynamics in the macrofinancial environment or changes in market sentiments). Given that our focus is on price impacts of hypothetical fire sales that increase the supply of securities, we have directed our attention exclusively on the observations with negative price impacts, those shown in blue on the chart. This introduces from the outset a bias towards adverse price impacts. We are making our analysis purposely one-sided to tease out the impact of additional asset sales.

An implied price sensitivity of zero as shown in ***Figure 17*** would mean that there is no price impact of new asset sales in the market. An implied price sensitivity of -1 per cent would mean that a 100 per cent increase in trading volume is associated with a price decrease of 1 per cent.

As one can observe, on average, there is no uniform quantitative relationship between price and volume, and the price sensitivity is variable over time, which is true of all asset classes examined. For the calibration of our parameters, we have taken the 75th percentile as our best estimate assumption, with a range around this based on the best case (where there is zero price impact) and a very low calibration based on the 95th percentile.[15] These parameters reflect the price sensitivity insurers would face if they sold assets under normal (75th percentile) market conditions, with the 95th percentile rendering a very low price sensitivity estimate for normal market conditions. The question we are attempting to answer with our base analysis in subsections 5.2.1. and 5.2.2. is whether insurers could cause systemic distortions

10 For empirical studies of asset fires sales related to regulatory pressure, see the literature discussed in Appendix A1, in particular Ambrose *et al.* (2010) and Ellul *et al.* (2011); for the equivalent related to fair value accounting, see Laux (2011).

11 In contrast to previous sections, the sample of insurers used for the stress tests involving hypothetical fire sales extends to all undertakings domiciled in European member countries of the OECD. The relevant data on financial assets were culled from the OECD Insurance Statistics

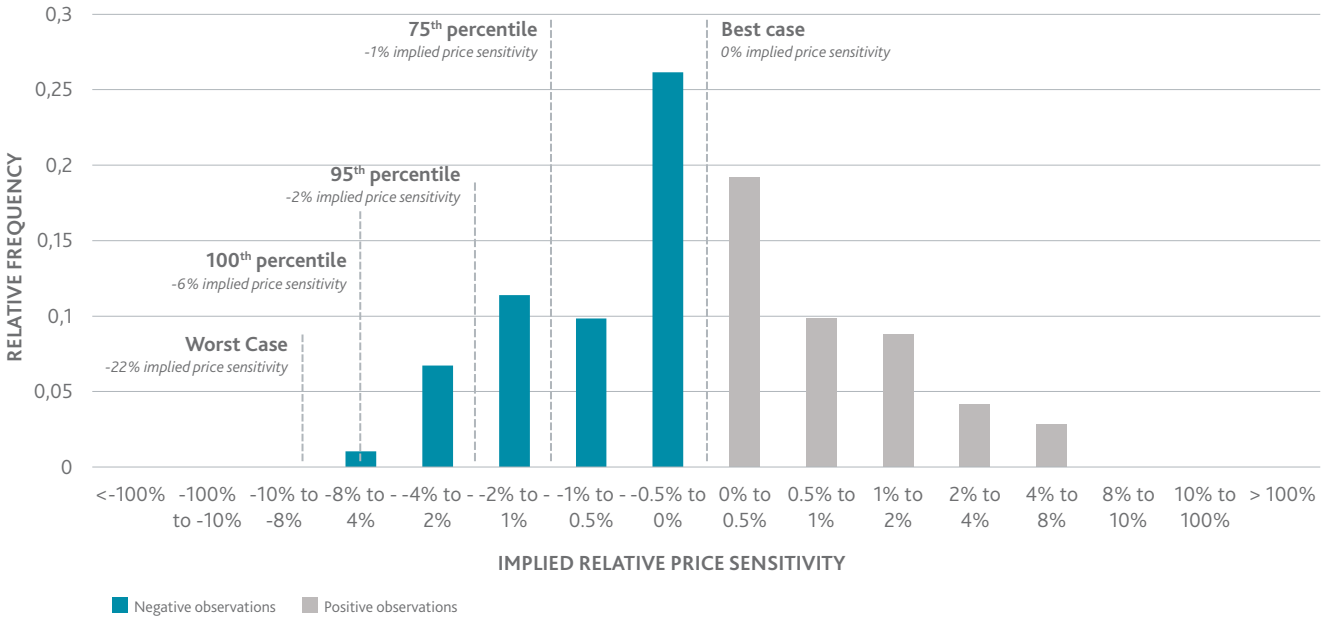
12 See, for example, Coval and Stafford (2007).

13 Analyses based on a rolling five-day average

14 Relative price sensitivity is defined as the relative change in asset price divided by the relative change in trading volume, i.e. a value of -1% means that asset prices decline by 1% when trading volume increases by 100%.

15 The 75th percentile of the entire distribution equates approximately to the 50th percentile and hence the best estimate of the negative part of the distribution.

Figure 17:
Implied elasticity for corporate bonds based on changes in volume and price from 2012 to 2015, five-day rolling average[16]



Sources: Bloomberg Market Breadth Investment Grade Bond Dollar Volume (NTMBIV) index; Barclays U.S. Corporate Investment Grade index.

to capital markets in otherwise normal circumstances. Given that we assumed volume to be the only factor responsible for the observed negative implied price sensitivity, the estimated price impact will be overstated and therefore can be considered to be conservative.

The price sensitivity for the worst-case scenario (the one observed during the Global Financial Crisis) can also be seen in ***Figure 17***. In subsection 5.2.3., we use this as price impact parameter and analyse what would happen if insurers had to sell large amounts of assets in already distressed markets, i.e. we examine a hypothetical industry-wide de-risking occurring simultaneously with the worst observed dislocation in financial markets observed in almost one century. Even in such a 'perfect storm' scenario, we find that the price impacts remain relatively low, with the exception of European equities.

The following sections make use of the above approach to look at the impacts on market prices of three different hypothetical fire sale scenarios: Two de-risking scenarios (credit de-risking and equity de-risking) as well as asset fire sales caused by massive surrenders. As there is no standard framework for ascertaining the systemic relevance of volatile asset prices, to ascertain whether the calculated price impacts are systemically relevant, we have recourse to the market circuit breakers that in the U.S. were introduced by the New York Stock Exchange (NYSE) after the market crash in October 1987 and since then have been adopted by many other exchanges.

Currently, the NYSE sets three circuit breaker levels, Level 1 at a decline of 7 per cent, Level 2 at 13 per cent, and Level 3 at 20 per cent, with the percentages referencing the average closing price of the S&P 500 for the month preceding any quarter. Whilst market declines corresponding to Levels 1 and 2 result in a trading stop of 15 minutes (unless the decline occurs after 3:25 pm, when no stops are required), only a Level 3 decline would bring trading to a complete halt for the remainder of the day.

Circuit breakers were obviously introduced to stem market stampedes, the extreme cases of procyclical herding behaviour and thus likely of systemic proportion. One can therefore reasonably translate the circuit breaker approach for the evaluation of our scenarios. Phrasing it again, conservatively, we would define only a negative price impact of 20 per cent or more to be systemically relevant. By way of reference: bear markets are typically called when several

16 Implied relative price sensitivity measured as the change in price/change in volume over any given period. Only spread impact on price is examined, estimated based on the options adjusted spread (OAS) and modified duration (i.e. from period to period, per cent price change = modified duration x absolute change in OAS). Five-day rolling average gives a broader (i.e. fatter tailed) distribution than using single day changes and is therefore conservative, i.e. gives a more negative implied elasticity in the tail of the distribution.

broad market indices (such as the S&P 500 or the Dow Jones Industrial Average) decline by 20 per cent or more over at least a period of two months.

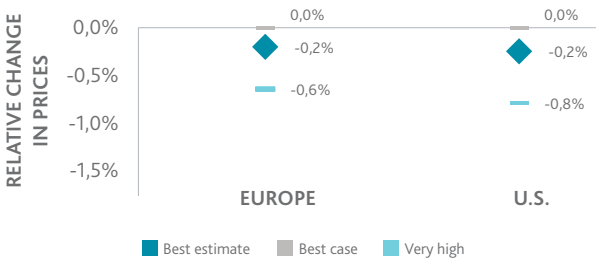
5.2. ASSET FIRE SALES DUE TO LARGE-SCALE DE-RISKING

The most significant asset-related risks on insurers' balance sheets are credit and equity risks. Hence, in this subsection we analyse an extreme credit and an extreme equity de-risking scenario.

5.2.1. CREDIT DE-RISKING

In our hypothetical credit de-risking scenario, we have assumed that life insurers sell 10 per cent of their corporate bonds within one month and that these sales are spread evenly across the month.[17] This represents a significant portfolio of life insurers' fixed-income assets and is a highly unlikely scenario in the real world, given that insurers are typically able to time asset disposals over a longer period that one month and allow for when there is sufficient liquidity in the market. It is difficult to conceive of a situation whereby all life insurers within a given market (or, as in the case of our scenarios, all Europe or all of the U.S.) would need to dispose of 10 per cent of their corporate bonds within one month. Assuming these sales were spread evenly, it would correspond to a 32 per cent relative increase in average daily trading volumes for Europe and a 40 per cent relative increase for the U.S. ***Figure 18*** gives the implied impact on market prices for such a scenario for both Europe and the U.S. Based on our best estimate assumptions, the relative change in corporate bond prices would be only -0.2 per cent and, even for our 'very high' price sensitivity assumption, it would only be -0.6 per cent for Europe and -0.8 per cent for the U.S. As such, in line with evaluation criterion developed earlier, we find no evidence that a significant corporate bond asset fire sale would have systemic implications.

Figure 18:
Hypothetical credit de-risking scenario—estimated impact on market prices for life insurers selling 10 per cent of their corporate bonds within one month[18, 19]



PRICE SENSITIVITY PARAMETERS		
Best case	0%	Best observation
Best estimate	-1%	75th percentile
Very high	-2%	95th percentile

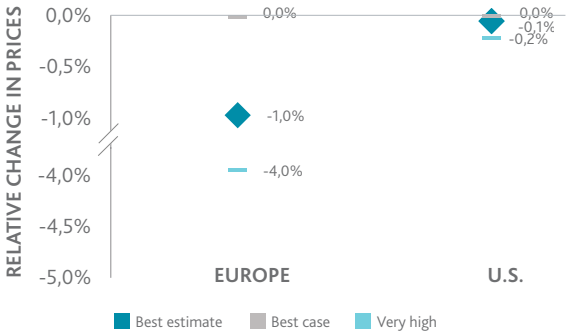
Sources: OECD, Trax, WFE, London Stock Exchange, Borsa Italiana, Federal Reserve, Sifma, Oliver Wyman analysis.

17 A calendar month comprises 21 trading days.

5.2.2. EQUITY DE-RISKING

In our hypothetical equity de-risking scenario, we have assumed that life insurers sell 100 per cent of their equity securities within one month and that these sales are spread evenly across the month. This represents a scenario that is equally impossible to believe could happen in the real world and as such is highly conservative. Given the small

Figure 19:
Hypothetical equity de-risking scenario—estimated impact on market prices for life insurers selling 100 per cent of their equity securities within one month[20]



PRICE SENSITIVITY PARAMETERS		
Best case	0%	Best observation
Best estimate	-2%	75th percentile
Very high	-8%	95th percentile

Sources: OECD, Trax, WFE, London Stock Exchange, Borsa Italiana, Federal Reserve, Sifma, Oliver Wyman analysis.

18 One month is assumed to be 21 trading days with asset sales split evenly across these days. The price impact shown is the relative change in price calculated as: relative change in volume x price sensitivity.

19 Impact using 100th percentile price sensitivity for 2012-15 (i.e. worst observed value) would be -1.9% for Europe and -2.4 % for the U.S.

20 Impact using 100th percentile price sensitivity for 2012–2015 (i.e. worst observed value) would be -9.4% for Europe and -0.5% for the U.S.

size of life insurers' equity holdings relative to the size of the market, the scenario (assuming sales are spread across the month) would correspond to a relative increase in average daily trading volumes of 49 per cent for Europe and 3 per cent for the U.S. As one can see from ***Figure 19,*** even if the life insurance industry were to sell all their equities within one month, the price impact would be small and not out of line with normal market volatility. Based on our best estimate assumptions, the relative change in equity prices would be only -1.0 per cent for Europe and -0.1 per cent for the U.S. Even for our 'very high' price sensitivity assumption, this would only be -4.0 per cent for Europe and -0.2 per cent for the U.S. The difference between these two markets is driven by the comparatively lower allocation to equities by U.S. life insurers relative to their European counterparts. Given these results and the severity of the scenario, again, we find no evidence that a significant equity fire sale would have systemic implications.

5.2.3. WORST CASE SCENARIO IMPACT ANALYSIS

In the previous subsections, we examined extreme and unrealistic scenarios for asset fire sales and observed that even under these circumstances life insurers have limited—if any—potential to systemically distort financial markets.

We looked at the historical relationship between changes in asset prices and changes in trading volume in order to calculate the implied price sensitivity. The sensitivities used include a number of areas of conservatism, including the use of only data points where changes in volume were larger than 10 per cent, the use of only observations with negative price impacts (i.e. in the left tail of the histogram), and the simplification that only changes in volume are driving price impacts. Hence, we can consider the price impacts of asset fire sales by insurers estimated in subsections 5.2.1 and 5.2.2 as conservative estimates of what would hap¬pen if insurers had to sell large amounts of assets in normal market circumstances.

One drawback of these scenarios is that they look at the insurance sector in isolation and under *ceteris paribus* conditions. Whilst they are useful to examine the impact of specific fire sales on the backdrop of an overall benign financial market environment, one could reasonably argue that in stressed financial market conditions all investors are under pressure at the same time and insurers may not be the only ones attempting to find liquidity or strength¬en their capital positions. However, such simultaneity is difficult to capture. It would require describing and solving a general equilibrium model that includes the behaviour of all financial market participants over time.

Fortunately, our data allow for a way to circumvent an otherwise near-intractable problem. The histogram of changes in volume and prices of investment grade fixed-income assets (Figure 17) for the period 2007 to 2015 includes observations generated during the nadir of the Global Financial Crisis. As one would expect, this period includes the highest observed price sensitivities (in absolute terms), when institutional investors across the board (not only insurers) sold assets at a very large scale. It is thus reasonable to argue that an analysis of the price impact of insurer asset fire sales with the worst possible observed parameters tells us how much insurers could impact the market in markets that are already distressed and where there are other large sellers as well.

With these points in mind, this section looks at the implied impact if we were to introduce further conservatism to our previous assumptions and use the 100th percentile price sensitivity for all available data, including the data covering the Global Financial Crisis.

The impacts using the 100th percentile price sensitivity for all available data would be as follows. Our extreme credit de-risking scenario (where all life insurers sell 10 per cent of their corporate bonds within one month) would result in a relative price impact of -8.7 per cent for the U.S. and -7.1 per cent for Europe. The extreme equity de-risking scenario (where all life insurers sell 100 per cent of their equity holdings within one month) would generate a relative price impact of -1.1 per cent for the U.S. and -19.2 per cent for Europe. The final extreme surrender scenario (where all life insurers sell assets equivalent to 5 per cent of average daily trading volumes) would result in a relative price impact of -1.1 per cent for the U.S. and -2.0 per cent for Europe.

As previously discussed, the hypothetical fire sale scenarios outlined are intentionally improbable and unrealistic. In this section we have gone even further and applied the worst observed price sensitivity (-22%), a data point that was the result of an extreme market condition during the Global Financial Crisis. In fact, it was the worst since the big market crash that heralded the Great Depression of the 1930s. At the high point of the recent Global Financial Crisis, liquidity had dried up for a broad spectrum of financial assets and most market participants showed signs of severe distress. It is thus reasonable to argue that this data point can serve as a proxy for extreme stress, adequately reflecting the properties of a severe deterioration in market conditions simultaneously impacting all market participants. The impacts described in this section apply these worst-case parameters to intentionally unrealistic fire sale scenarios and as such assume that insurers were to attempt this extreme de-risking during the peak of the Global Financial Crisis. But

even under such a worst-case scenario, the price impacts are relatively low, with the exception of European equities.

5.3. ASSET FIRE SALES CAUSED BY LARGE SURRENDERS

In our hypothetical scenario in which asset fire sales are caused by large surrenders, we assumed that a systemic event would result in increased surrenders across all life insurers at the same time, requiring asset sales across all asset types. In this analysis, we looked at different sensitivities in terms of the scale of asset fire sales by insurers; they are based on the relative increase in average daily trading volumes whereby we assume that fire sales by insurers increase trading volumes by 1 per cent, 2 per cent or 5 per cent. We then look at what these sales would represent in terms of the scale of surrenders and also the implied impacts on market prices in the same way as the scenarios described above.

Table 3 illustrates what these scenarios would mean for European life insurers in terms of the value of assets sold (it is assumed that sales take place over the course of one month) and the surrender rates this would imply; ***Table 4*** does the same for the U.S.. In the most extreme scenario, where the asset sales result in a 5 per cent relative increase in average daily trading volumes, it would require an 8 percentage point (pp) increase within one month in the surrender rate for Europe and a 27 pp increase for U.S. life insurers. This compares to the highest observed annual increase in surrender rates in the U.S. over the last 14 years of ~4 pp[21] and to one-year mass surrender scenarios of 30 pp required by the IAIS, and 35 pp by EIOPA.[22] Given that our hypothetical scenarios take place over only one month, they can be considered to be severe and highly unlikely stresses.

Table 3:
Hypothetical surrender-driven fire sale scenarios—implied asset sales and surrender rates for European life insurers

% OF DAILY TRADING VOLUMES SOLD	TOTAL SALES WITHIN ONE MONTH (EUR bn)	TOTAL SALES AS A % OF INSURER'S ASSETS	EQUIVALENT SURRENDER RATE (% POINT INCREASE)
1%	48.9	1.1%	2
2%	97.8	2.2%	3
5%	244.5	5.4%	8

Table 4:
Hypothetical surrender-driven fire sale scenarios—implied asset sales and surrender rates for U.S. life insurers[23]

% OF DAILY TRADING VOLUMES SOLD	TOTAL SALES WITHIN ONE MONTH (EUR bn)	TOTAL SALES AS A % OF INSURER'S ASSETS	EQUIVALENT SURRENDER RATE (% POINT INCREASE)
1%	277	7.2%	14
2%	381	9.9%	19
5%	529	13.7%	27

If we consider the implied impacts of these scenarios on market prices, we find that despite their requiring a severe increase in surrender rates, the price impacts would be negligible. ***Figure 20*** shows the impacts on market prices for European life insurers; here, one sees that based on our best estimate price sensitivity assumptions, even when

21 The Geneva Association (2012).
22 EIOPA (2015), p. 149.
23 Collective life insurer assets are assumed to be fully fungible, i.e. the entire industry is combined into a single entity, and surrenderable liabilities are assumed to be equal to 80 per cent of insurer assets for Europe and 60 per cent for the U.S. We have assumed no surrender charges and that surrenders and the resultant asset sales occur over 21 trading days (days within one month when markets would be open).

asset fire sales correspond to 5 per cent of average daily trading volumes, the price impact is -0.1 per cent or less for all asset classes. For the 'very high' sensitivity assumptions (corresponding to the 90th percentile), the impact is still only -0.4 per cent for equity securities and -0.1 per cent for both government bonds and corporate bonds

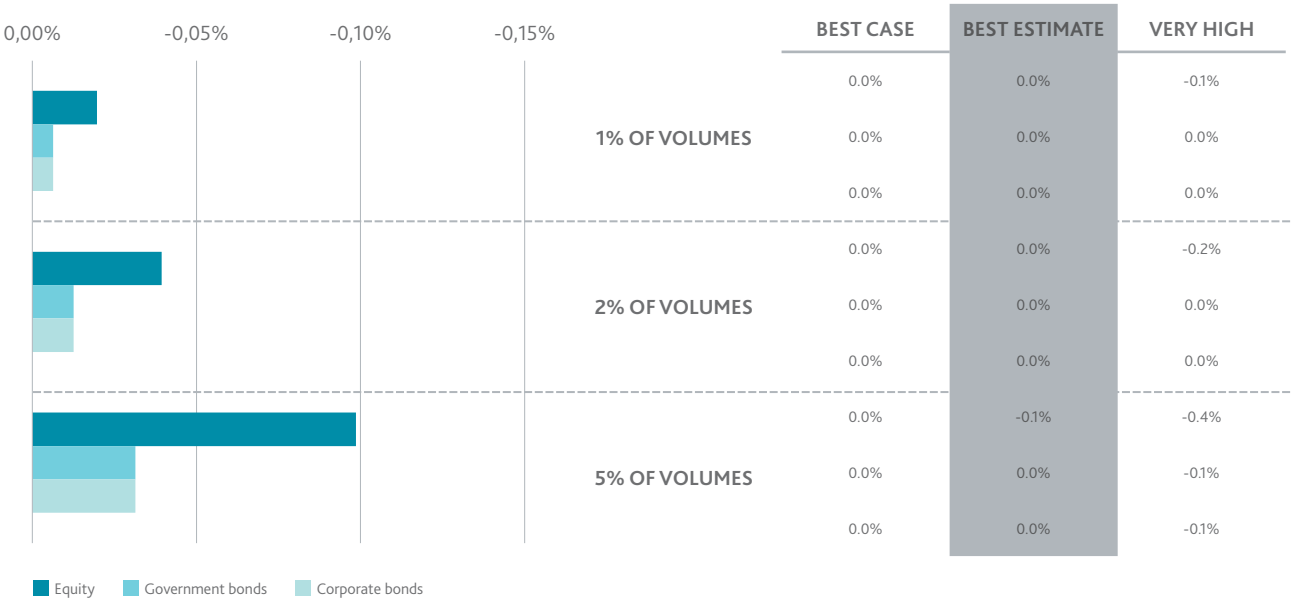
Figure 21 shows the equivalent impacts on market prices for U.S. life insurers. Based on our best estimate assumptions, even when asset fire sales correspond to 5 per cent of average daily trading volumes, the price impact is -0.25 per cent or less for all asset classes.

The highest impacts are seen for municipal securities and agency bonds (both -0.25 per cent) whilst the impacts for equity securities, government bonds and corporate bonds are negligible at -0.05 per cent, -0.01 per cent and -0.03 per cent respectively. For the 'very high' assumptions, the impact is still only -0.7 per cent or less for all asset classes. Again, none of these price reactions can be considered to be systemically relevant.

24 The price impacts using 100th percentile price sensitivity for 2012–2015 (i.e. worst observed value) for 5 per cent of trading volumes would be -1.0 per cent for equity securities, -0.3% for government bonds and -0.3 per cent for corporate bonds.

25 The price impacts using 100th percentile price sensitivity for 2012–2015 (i.e. worst observed value) for 5% of trading volumes would be -0.5% for equity securities, -0.1% for government bonds, -0.3% for corporate bonds, -0.7% for municipal securities, -0.7% for agency bonds and -0.4% for agency backed structured products.

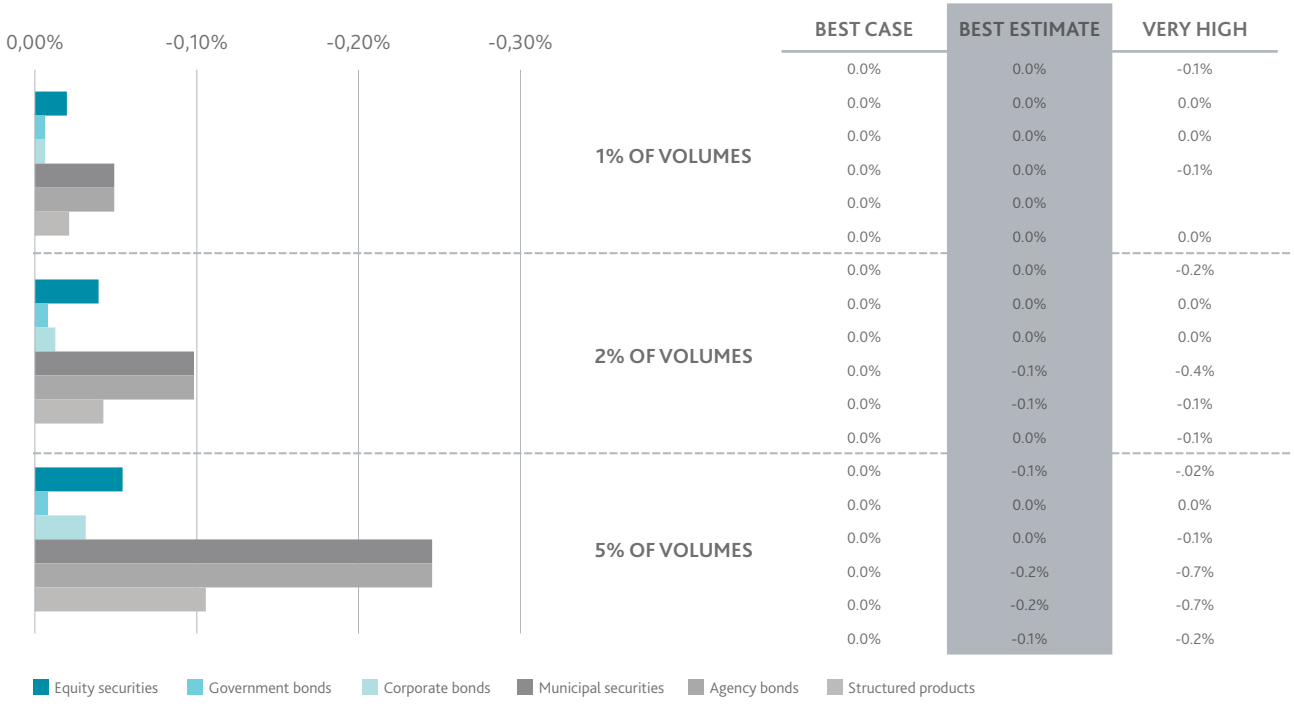
Figure 20:
Hypothetical surrender-driven fire sale scenarios—estimated impacts on market prices for European life insurers[24]



	BEST CASE	BEST ESTIMATE	VERY HIGH
1% OF VOLUMES	0.0%	0.0%	-0.1%
	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%
2% OF VOLUMES	0.0%	0.0%	-0.2%
	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%
5% OF VOLUMES	0.0%	-0.1%	-0.4%
	0.0%	0.0%	-0.1%
	0.0%	0.0%	-0.1%

Sources: OECD, Trax, WFE, London Stock Exchange, Borsa Italiana, Oliver Wyman analysis.

Figure 21:
Hypothetical surrender-driven fire sale scenarios—estimated impacts on market prices for U.S. life insurers [25]



	BEST CASE	BEST ESTIMATE	VERY HIGH
1% OF VOLUMES	0.0%	0.0%	-0.1%
	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%
	0.0%	0.0%	-0.1%
	0.0%	0.0%	
	0.0%	0.0%	0.0%
2% OF VOLUMES	0.0%	0.0%	-0.2%
	0.0%	0.0%	0.0%
	0.0%	0.0%	0.0%
	0.0%	-0.1%	-0.4%
	0.0%	-0.1%	-0.1%
	0.0%	0.0%	-0.1%
5% OF VOLUMES	0.0%	-0.1%	-.02%
	0.0%	0.0%	0.0%
	0.0%	0.0%	-0.1%
	0.0%	-0.2%	-0.7%
	0.0%	-0.2%	-0.7%
	0.0%	-0.1%	-0.2%

Sources: Federal Reserve, Sifma, Oliver Wyman analysis

6. Conclusion

What are the normative implications of these findings?

This report recognises that the insurance industry may display procyclical investment behaviour. After all, insurers are part of the larger financial system and they cannot escape broad market trends. Like other market participants, they respond to triggers and incentives produced by the financial system and the regulatory framework guiding its working. We found, however, the market impact of insurers' investment behaviour with respect to volume and price to be small and unlikely to cause systemically relevant distortions. What are the normative implications of these findings?

An answer to this question has to consider that the regulatory framework is currently undergoing major changes. In the EU, Solvency II is in its first year of implementation. Although EU insurers have long ago started to prepare for the transition to the new regime, an assessment of its full impact continues to be a considerable time away. Solvency II contains measures designed to prevent insurers responding procyclically to excessive short-term market volatility. They should mitigate the risk of asset fire sales and thus have a stabilising effect. However, a verdict whether the measures meet their intended purpose is some time off. Meanwhile, supervisors should ensure that the measures can work as designed.

On an international level, work is under way towards a global insurance capital standard (ICS) that would apply for the world's largest internationally active insurance groups. Designed to ensure regulatory comparability and consistency across jurisdictions and to help create a level playing field, the ICS may also facilitate early problem identification and mitigate the risk of market-distressing insolvencies. Whilst it may include measures to contain procyclicality, one could argue that an unintended consequence of global standards could ironically be just the opposite: more procyclicality. If insurers subject to different capital requirements in the jurisdictions of their domiciles were to adopt more prescriptive global standards that did not sufficiently reflect their business model, their investment behaviour could arguably become more correlated and would likely be more procyclical.

In light of these regional and global developments, we offer four broad principles to guide future policymaking.

- First, and following the guiding principle in medicine, policymakers should endeavour to inflict no harm. Given that the business model of insurers, absent regulatory impositions, should not give rise to procyclical investment behaviour likely to cause systemic distortions to financial markets, we see no need for future regulation and in particular, for the introduction of capital buffers to address potential investment herding behaviour.

- Second, policymakers should avoid creating incentives that weaken the ability of the insurance sector to absorb financial market distress. Our analysis, though based on a limited data set, has shown that the investment portfolios of insurers were less volatile before, during and after the Global Financial Crisis than the portfolios of other financial services industries. Insurers functioned as shock absorbers and they were contributing—at least at the margin—to financial stability at a time of severe market distress.

- Third, there is a need for further research into the implications of prudential regulatory regimes based on market adjusted valuations, and whether these may influence procyclical behaviour. The data available and used in this study are limited, and the implications of prudential regimes that utilise market based valuations, such as Individual Capital Assessments (ICA) in the U.K., Solvency II in the EU and the potential ICS being developed by the IAIS have not been fully considered. The business model of insurers in general should not lead to procyclical behaviour, and it is important to ensure that such regulation does not create contrary incentives in this respect.

- Fourth, and related to the three points made above, policymakers should make a very conscious effort to reflect about the potential for the unintended consequences of regulation. Whilst it is in the nature of unintended consequences that they are impossible to foresee, theoretical considerations and empirical evidence referenced in our work point to the irony that procyclical behaviour, which has been indicated by policymakers as the key rationale for macroprudential regulation, can be triggered, and possibly exacerbated, by microprudential regulation. We are mindful that the Solvency II framework in the EU foresees adjustment mechanisms designed to reduce procyclicality. That said, supervisors need to walk a fine line. They should, on the one hand, be cognisant of the fact that procyclical behaviour is likely not systemically relevant, and they should, on the other hand, be mindful not to impair the shock-absorbing capacity of the insurance sector.

Finally, and unrelated to the four principles developed above, our work has been painfully constrained by the lack of sufficiently detailed, publicly available data. Although authorities collect a wealth of data from financial-sector firms, and, under Solvency II, insurers are now being asked

to supply even more detailed information, they are doing an inadequate job in making publicly available data that are consistently aggregated and comparable across various financial sectors. This would be instrumental towards creating transparency and providing early warning signals about developments that could generate financial market instability. It does not suffice to collect ever more data for analysis in a supervisory black box. Financial sector firms, too, should be in a position to make informed decisions about broader market developments that might affect their business and potentially their solvency further down the line. In order to make such decisions, they must have access to reliable, relevant, and consistent data. Thus, it would behove authorities to refrain from increasingly superfluous data collection and pay more attention to the timely dissemination of carefully aggregated data that enable market participants to make well-informed judgments about financial market conditions.

Appendix A

A.1. THE POTENTIAL SYSTEMIC RELEVANCE OF THE INSURANCE INDUSTRY

A SHORT WALK THROUGH RELEVANT LITERATURE

It is not readily evident why insurers would trigger systemic risk. Whilst the business model of banks is prone to runs with potentially systemic consequences, the balance sheet of insurers is based on long-dated and mostly illiquid liabilities, whilst their assets tend to be highly liquid—in both cases, the mirror image of bank balance sheets. For these reasons, it has been widely accepted that the risk of liquidity runs in insurance is negligible. At the same time, technical insurance risks tend to be idiosyncratic and are therefore unlikely to be amplified by the behaviour of the industry. Based on these considerations, in 2011, the International Association of Insurance Supervisors (IAIS) concluded that 'traditional insurance is unlikely to become a source of systemic risk.'[26]

However, the Global Financial Crisis of 2008 seems to have raised a few question marks. It made clear that large and complex insurance groups that engaged in what the IAIS termed 'non-traditional and non-insurance' (NTNI) activities could well be systemically relevant and endanger the stability of the financial system. It adopted the standard definition of systemic risk as 'a risk of disruption to financial services that is (i) caused by an impairment of all or parts of the financial system and (ii) has the potential to have serious negative consequences for the real economy.'[27] More importantly, the IAIS also accepted the view that 'all types of financial intermediaries, markets and infrastructure can potentially be systemically important to some degree.'[28]

These views established a regulatory programme focused on individual undertakings, which eventually led to the designation of nine globally active insurance groups to be systemically important. These were the G-SIIs, which comprised a subset of the systemically important financial institutions, or SIFIs in short. With the designation of individual firms, global standard-setters made clear that their primary concern was related to individual financial institutions, which could be called the bottom-up or micro view of systemic risk.

At the same time, a top-down view of systemic risk was proposed. One of the first to sketch this perspective was ECB President Jean-Claude Trichet. In November 2009, in a speech to CEIOPS, the predecessor of EIOPA, Trichet based the argument on the large investment portfolios of insurers and pension funds. He was concerned that an unwinding of positions—or asset fire sales in the terminology of this paper—could, in the extreme, 'put at risk financial stability by triggering large swings in asset prices.'[29]

The identification of SIFIs became also a topic for academic research. Amongst the various empirical measures proposed were (i) models of systemic interconnectedness based on a combination of principal component analysis and Granger causality tests, (ii) models based on conditional value at risk (CoVaR), and (iii) models built on measures of aggregate capital shortfall.[30]

The virtue of these models is that they exploit the property of financial asset prices (such as spreads of credit default swaps and bonds as well as equity prices), which allows for a real time assessment of systemic risks developing in the financial system. The ready availability of such data makes the models attractive for central banks and other regulatory bodies engaged in macroprudential surveillance. It enables them to monitor financial market developments in real time. One recent example of such an exercise is the International Monetary Fund's 2016 spring Global Financial Stability Report (GFSR).[31]

However, a major drawback of these models is that they adopt bank-centric models of systemic risk that do not properly reflect the intrinsic differences of the insurance business model. Specifically, models based on capital shortfalls imply that insurers close to breaching solvency requirements would immediately lose access to funding when, in fact, insurers are stably funded at all times through

26 IAIS (2011).
27 BIS, FSB and IMF (2009).
28 *Ibid.*

29 Trichet (2009).
30 In a synthesis review, Berdin and Sottocornola (2015) apply the three approaches to examine the systemic relevance for a sample of European banks, insurers and non-financial companies. Acharya *et al.* (2016) recently introduced an extended version of the capital shortfall model that adds a fire-sale externality through liquid liabilities to account for specific characteristics of large, complex life insurers.
31 See in particular Chapter 3, 'The insurance sector – trends and systemic risk implications,' in IMF (2016). The Fund's researchers claim 'that across advanced economies the contribution of life insurers to systemic risk has increased in recent years, although it clearly remains below that of banks.' However, a closer review re¬veals that the increase 'is largely due to common exposure to aggregate risk, caused partly by a rise in insurers' interest rate sensitivity.' The Fund ascertains that the role of insurers as recipient of systemic risk has grown in recent times and that insurers, on account of their increased interest rate insensitivity, are 'unlikely to fulfil their role as financial intermediaries precisely when other parts of the financial system are failing to do so as well.' In other words, while systemic risk may not originate in the insurance sector (in fact, the IMF found that insurers' investment portfolios have not become riskier), the sector nevertheless contributes to systemic risk because its resilience has been weakened on account of the current interest rate environment. This is indeed a novel twist to an already contorted debate.

contractual premium payments. This is in contrast to the capital requirement in banking, where a capacity for instant loss absorbency is needed to stem sudden cash drains from depositors and prevent a chain of systemic contagion from unravelling.

Moverover, market measures exclude by design the class of unlisted mutual insurers, which in a number of jurisdictions comprise a large share of the market. The various lists generated on the basis of financial market data include also firms (such as insurance brokers) that by virtue of their business are very unlikely to qualify as systemically important.

Reliance on market prices also entails the risk of spurious correlations. Irresberger *et al.* show that during the financial crisis share prices of U.S. insurers were affected significantly by crisis sentiments rather than underlying fundamentals that would have attested to their comparatively low exposure and contribution to the crisis.[32] The authors found that, 'aggregate sentiment lead [sic] to unusually high, unjustifiable uncertainty about insurer stock prices, which implies that investors did not necessarily base their decision on rational assessments of insurers' actual exposure to the crisis.' And equally remarkable is their conclusion that, when comparing the insurance and banking, 'the effects of crisis sentiment were dominant in the former part of the financial sector, although the crisis originated in the latter.' If sentiments rather than fundamentals were indeed impacting insurer-related market price developments, then systemic risk measures based on market prices would exaggerate the systemic risk attributed to insurers.

Finally, the usefulness for supervisory purposes of the various risk rankings generated by this research appears to be rather limited. In a brief survey of systemic risk measures, ECB researchers found 'substantial evidence that the cross-sectional consistency between different systemic risk ranking methodologies is far from perfect.'[33] They also found that 'different systemic risk measures signal different messages at a time when they are, arguably, the most important.'

That said, most studies found the contribution of individual banks to systemic risk to be much larger than the contribution of individual insurers.[34] The findings are in line with a recent network analysis examining the interaction of 29 large EU insurance groups with their financial counterparties.[35] The network of insurers, banks and other financial institutions showed 'low interconnectivity overall, compared for instance to the interactions of the largest EU banks alone.'[36]

One specific concern that was also discussed in the IMF's recent GFRS centres on the question whether insurers (and pension funds as another group of large institutional investors with long-dated liabilities and a correspondingly long time horizon) tend to invest procyclically. In a study by the Bank of England, procyclicality is defined 'in the short term, as the tendency to invest in a way that exacerbates market movements and contributes to asset price volatility, which can in turn contribute to asset price feedback loops.'[37] The Bank fears that, in the medium term, this tendency might 'deepen the troughs and exaggerate the peaks of asset price or economic cycles in a way that is potentially detrimental to financial stability and long-term economic growth.'

This, of course, is the standard definition of systemic risk. However, in this revised and amplified version, it implies that not only individual firms can contribute to systemic risk, but the sector as a whole. This industry-wide view of systemic risk would obviously have implications for the design and implementation of macroprudential supervision, which may differ from the toolkits deployed in microprudential supervision.

It should be emphasised though that the findings of the Bank of England and the study by the European Systemic Risk Board are 'indicative rather than definitive.'[38] They are based on *a priori* reasoning that could account for procyclicality, such as 'liability characteristics, regulation, accounting and valuation methodologies, or industry practices (including the tendency for similar investment strategies or "herding").'[39]

That said, a number of studies appear to document procyclical behaviour of insurers in certain instances. One of the first studies in this vein analysed the impact of forced selling by U.S. insurers in response to regulatory downgrades.[40] It found that such asset fire sales, 'coupled with a relative lack of liquidity, [were] likely to generate significant and persistent price pressures.' More recently, Domanski *et al.* reported that German life insurers, in an attempt to reduce the negative duration gap[41] between assets and liabilities, may have actually exerted downward pressure on interest rates in the years after 2012, thereby accentuating the negative duration gap. And Bijlsmaa and Vermeulen found that during the sovereign debt crisis in the eurozone, a group of 60 European insurers

32 Irresberger at al. (2016).
33 ECB (2015).
34 Chen *et al.* (2013).
35 Alves *et al.* (2015).
36 However, the analysis revealed also a higher level of connectivity for a small number of insurance groups.
37 Bank of England (2014). The Bank's sectoral perspective was taken up again by French *et al.* (2015) and reflected in ESRB (2015).
38 ESRB (2015).
39 Bank of England, *op. cit*.
40 Ellul *et al.* (2011).
41 Domanski *et al.* (2015).

exhibited a concerted flight to quality, which again contributed to procyclicality.[42] It is not clear, however, to what extent these findings can be generalised. For example, the finding of Domanski *et al.* may be grounded in the specific liability structure of German life insurers. Their large proportion of endowment products seems to have been responsible for the wide duration gap, which is well above the average observed in European jurisdictions.

Moreover, empirical findings on the procyclicality of insurers are not uniform. Ambrose *et al.*, for example, examined situations where U.S. insurers were selling large quantities of bonds in response to regulatory requirements. They found that the 'widespread selling of bonds in and of itself does not lead to pressure on the price.' As long as dealers knew that trades were conducted by uninformed investors, they were 'able to absorb the additional supply without adjusting the price much, if at all.'[43] And in a modelling framework that allowed for an active balance-sheet management to maintain the value-at-risk at a target level, Tasco and Battiston found that 'strong compliance with capital requirements, usually alleged to be procyclical, does not increase systemic risk unless the asset market is illiquid.'[44]

Sectoral systemicness has also been identified in other financial services industries. Ever since Raghuram Rajan spoiled Alan Greenspan's farewell party in Jackson Hole, it has become a standard in the academic literature to see herding behaviour as prevalent, given the agency problem in third-party asset management.[45] Rajan identified as one culprit the common benchmarks under which asset managers typically perform. More recently, Feroli *et al*. have mustered evidence to show that delegated decision-making (another characteristic inherent in third-party asset management) engenders yield-chasing, which in turn can both amplify market movements and trigger sharp reversals in market momentum.[46] In a similar vein, Igan and Pinheiro have shown that linking the compensation of asset managers to the relative performance objectives of their portfolios is likely to generate market procyclicality.[47] They detected an increase in correlations between markets (i.e. contagion) and increased price volatility. Finally, the IMF has recently identified mutual funds as particularly vulnerable to vicious cycles leading to large-scale redemptions, which could be seen as a manifestation of undesired procyclicality.[48]

In addition to herding behaviour as a result of agency problems, regulatory incentives and fair-value reporting requirements have been identified as factors that could generate sectoral co-movements in insurers' investments. The Bank of England's Procyclicality Working Group developed a theoretical model to illustrate how 'risk-based capital or funding requirements may interact with mark-to-market valuation regimes in a way that encourages procyclicality, because sudden falls in the value of assets may reduce measured solvency due to marking to market, at the same time as they increase risk-based capital or funding requirements.' [49]

Regulators are, of course, not ignorant to the possibility of a adverse feedback loop between risk-based capital requirements and mark-to-market valuation regimes. The new Solvency II framework includes measures that aim to mitigate procyclicality at times of financial distress, and the so-called long-term guarantee package is directly geared towards reducing balance sheet volatility and thus reducing the risk of asset fire sales.[50] However, at this point, it is too early for an assessment of the efficacy of these measures.

Whilst the Bank of England's discussion paper was largely based on theoretical reasoning, which in parts was buttressed by anecdotal evidence, there is a growing body of empirical work in support of the theory.[51] For example, Merrill *et al.* reviewed transactions in the market for residential mortgage-backed securities (RMBS) in the years 2006 to 2009 and found that, during the financial crisis, capital-constrained insurers were more likely to sell RMBS at lower

42 Bijlsmaa and Vermeulen (2015).

43 Ambrose *et al.* (2010); the results are obtained on the condition that bond traders were considered to be "not informed."

44 Tasca and Battiston (2012). The converse is, of course, also evident: if 'the asset market is illiquid, even a weak compliance with capital requirements increases significantly systemic risk.'

45 See Rajan (2005). Raghuram Rajan, then the IMF's chief economist and now Governor of the Reserve Bank of India, chose the August 2005 annual gathering of central bankers and economists at Jackson Hole, Wyoming, to deliver a paper entitled, 'Has Financial Development Made the World Riskier?'. He concluded (pre¬sciently) in front of a crowd that included, and was honouring, a chief architect of this new financial paradigm, the retiring Federal Reserve Chairman, Alan Greenspan. Of course, empirical studies of herding behaviour predate Rajan. The standard reference to an early contribution would be Cutler *et al.* (1990) and Lakonishok *et al.* (1992).

46 Feroli *et al.* (2014).

47 Igan and Pinheiro (2015).

48 IMF (2015).

49 Bank of England (2014). The distortions introduced by mark-to-market accounting regimes and why they affect in particular investors with long-term and illiquid liabilities (such as those on insurance balance sheets) was modelled cogently by Plantin *et al.* (2008).

50 See ESRB (2015) for a concise discussion of these issues.

51 The working group saw 'anecdotal evidence that there was a significant reduction in equity holding for non-linked (i.e. with-profit and non-profit) products in the early 2000s' (in response to the dotcom bubble burst), but it also registered a lower degree of procyclicality during the financial crisis of 2008, noting however, that the data did not capture the use of derivatives, which may have had a significant procyclical potential. *Op. cit.* p. 22.

prices than insurers that were not capital constrained.[52] Insurers under solvency pressure were, in other words, more likely to engage in so-called fire sales than insurers with healthier balance sheets. In a similar vein, Ellul *et al.* present empirical evidence that 'fire sales in financial institutions can occur precisely due to regulatory constraints.'[53]

However, the view that fair-value accounting regimes would invariable trigger widespread asset fire sales continues to be contested. According to Laux, there is no evidence for such adverse feedback loops.[54] He claims to the contrary that the absence of fair-value accounting may have exacerbated the financial crisis because it allowed banks to portray a healthier picture than fair-value would have allowed and thus delayed much-needed corrective action.

To add yet another brush stroke to an already complex picture, recent policy measures by central banks may have constrained the market options of institutional investors and herded them in one direction. As the IMF noted recently, 'by removing low-risk, long-duration assets from the market through quantitative easing, and by lowering short-term rates to near zero (or even negative levels), officials have herded market participants into riskier and longer- duration assets.'[55] In the same report, the IMF also commented on changes in the market structure observed in recent years. It identified in particular a larger concentration of corporate bonds held by mutual funds, pension funds, and insurance companies, which in the Fund's view 'are associated with less resilient liquidity.'[56] This is likely to foster procyclical behaviour, as markets that are less liquid are more prone to exacerbating sudden shocks.

All factors potentially fostering procyclicality may interact simultaneously, and they are difficult to isolate. It seems to be clear, however, that procyclicality, or more broadly, the common investment behaviour of financial firms, changes our conversation about systemic risk. First, the absence of leverage may no longer indicate an absence of systemic risk, and second, financial instability need no longer be associated with insolvencies of systemically important financial institutions.[57] If the market impact of sectoral behaviour is significant, the question of systemic relevance would indeed add a new dimension, away from the focus on individual institutions to the potential systemic relevance of whole industries. Needless to say, that this would also have implications for the regulatory architecture. The roots of systemic risk attributed to a cohort of investors are likely to differ quite substantially from the systemic risk associated with individual SIFIs.

But, before jumping to conclusions, one should have a better understanding of facts and empirical relevance. Whilst the Bank of England's discussion paper talks about 'anecdotal evidence' of fire sales conducted by U.K. life insurers in response to the dotcom market collapse in 2001, the behaviour of U.K. life insurers during the recent financial crisis was, again according to the Bank, much less volatile. And, whilst many of the studies summarised above seem to document procyclical behaviour in particular asset markets, they are, in most cases, silent about the volume and price impacts it may generate.

52 Merrill *et al.* (2012).
53 Ellul *et al.* (2016).
54 Laux (2011). He also states quite correctly that 'the recognition of fair values is no substitute for the disclosure of information. In particular, when fair values are based on models, disclosures should allow investors to judge the validity of the reported fair values.'
55 IMF (2015), p. 25.
56 *Op. cit.*, p. 49.
57 These points were made by Feroli *et al.* (2014).

A.2. BIBLIOGRAPHY

Acharya, V.V., Philippon, T. and Richardson, M. (2016) Measuring systemic risk for insurance companies.' Oxford University Press, forthcoming.

Alves, I. Brinkhoff, J., Georgiev, S., Héam, J.-C., Moldovan, I. and Scotto di Carlo, M. (2015) Network analysis of the EU insurance sector, ESRB Occasional Paper, No. 7. Available at https://www.esrb.europa.eu/pub/pdf/occasional/20150713_occasional_paper_7.pdf?b8702f91876905848089b9f07a6f40d0

Ambrose, B.W., Cai, K.N. and Helwege, J. (2010) Fallen angels and price pressure, working paper. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1781196.

Bank of England (2014) Procyclicality and structural trends in investment allocation by insurance companies and pension funds: A discussion paper by the Bank of England and the Procyclicality Working Group. Available at http://www.bankofengland.co.uk/publications/Documents/news/2014/dp310714.pdf.

Berdin, Elia and Sottocornola, Matteo (2015) Assessing Systemic Risk of the European Insurance Industry. Available at https://eiopa.europa.eu/Publications/Reports/Assessing%20Systemic%20Risk%20of%20the%20European%20Insurance%20Industry.pdf.

Bijlsmaa, M. and Vermeulen, R. (2015) Insurance companies' trading behaviour during the European sovereign debt crisis: Flight home or flight to quality? De Nederlansche Bank, Working Paper No. 468. Available at http://www.dnb.nl/en/binaries/Working%20paper%20468_tcm47-319804.pdf.

BIS, FSB and IMF (2009) Guidance to assess the systemic importance of financial institutions, markets and instruments: Initial Considerations. Report to the G20 finance ministers and central bank governors. Available at http://www.fsb.org/wp-content/uploads/r_091107c.pdf?page_moved=1.

Chen, H., Cummins J.D., Viswanathan, K.S. and Weiss, M.A. (2013) 'Systemic risk and the interconnectedness between banks and insurers: an econometric analysis', The Journal of Risk and Insurance 81(3): 623–652. Available at http://onlinelibrary.wiley.com/doi/10.1111/j.1539-6975.2012.01503.x/abstract.

Coval, J. and Stafford, E. (2007) 'Asset fire sales (and purchase) in equity markets', Journal of Financial Economics 86(2): 479–512.

Cutler, D., Poterba, J.M. and Summers, L.H. (1990) 'Speculative dynamics and the role of feedback traders', American Economic Review 80(2): 63–68.

Domanski, D., Shin, H.S. and Sushko, V. (2015) The hunt for duration: Not waving but drowning?, BIS Working Papers No 519. Available at http://www.bis.org/publ/work519.htm.

ECB (2015) Financial Stability Review, November 2015, pp. 80-82. Available at https://www.ecb.europa.eu/pub/pdf/other/financialstabilityreview201511.en.pdf.

EIOPA (2015) Financial Stability Report: December 2015. Available at https://eiopa.europa.eu/Publications/Reports/Financial_Stability_Report_December_2015.pdf.

Ellul, A., Jotikasthira, C. and Lundblad, C.T. (2011) 'Regulatory pressure and fire sales in the corporate bond markets', Journal of Financial Economics 101(3): 596–620 . Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1362182.

Ellul A., Jotikasthira C. and Lundblad CT (2016) Spillover Effects from Risk Regulation on the Asset Side to Asset Market, Oxford University Press, forthcoming.

ESRB (2015) Report on systemic risks in the EU insurance sector, available at https://www.esrb.europa.eu/pub/pdf/other/2015-12-16-esrb_report_systemic_risks_EU_insurance_sector.en.pdf."

Feroli, M., Kashyap, A.K., Schoenholtz, K. and Shin, H.S. (2014) Market tantrums and monetary policy, Chicago Booth Research Paper No. 14–09. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2409092 .

French, A. Vital, M. and Minot, D. (2015) 'Insurance and financial stability', Bank of England, Quarterly Bulletin 2015(Q3): 242–258. Available at http://www.bankofengland.co.uk/publications/Documents/quarterlybulletin/2015/q303.pdf .

The Geneva Association (2012) Surrenders in the Life Insurance Industry and Their Impact on Liquidity, Geneva: The Geneva Association. Available at https://www.genevaassociation.org/media/99452/ga2012-surrenders_in_the_life_insurance_industry.pdf .

IAIS (2011) Insurance and Financial Stability, Basel: International Association of Insurance Supervisors. Available at http://forinsurer.com/files/file00400.pdf .

Igan, D. and Pinheiro, M. (2015) Delegated portfolio management, benchmarking, and the effects on financial markets, IMF Working Paper 15/198. Available at https://www.imf.org/external/pubs/cat/longres.aspx?sk=43262.0 .

IMF (2012) 'Safe assets: Financial system cornerstone?', in Global Financial Stability Report: The Quest for Lasting Stability, pp. 81–122. Available at https://www.imf.org/External/Pubs/FT/GFSR/2012/01/pdf/c3.pdf .

IMF (2015) Global Financial Stability Report: Vulnerabilities, Legacies, and policy challenges—Risks Rotating to Emerging Markets. Available at http://www.imf.org/External/Pubs/FT/GFSR/2015/02/index.htm .

IMF (2016) Global Financial Stability Report—Potential Policies for a Successful Normalization; Chapter 3: The Insurance Sector—Trends and Systemic Risk Implications. Available at https://www.imf.org/External/Pubs/FT/GFSR/2016/01/index.htm.

Irresberger, F., König, F.E. and Weiß, G.N.F. (2016) 'Crisis sentiment in the U.S. insurance sector,' Journal of Risk and Insurance, forthcoming.

Lakonishok, J., Shleifer, A. and Vishny, R.W. (1992) 'The impact of institutional trading on stock prices', Journal of Financial Economics, 32(1): 23–43.

Laux, Christian (2011) Financial instruments, financial reporting, and financial stability, working paper, Vienna University of Economics and Business. Available at http://www.icaew.com/~/media/corporate/files/technical/financial%20reporting/information%20for%20better%20markets/financial%20instruments%20financial%20reporting%20and%20financial%20stability.ashx.

Merrill, C.B., Nadauld, T.D., Stulz, R.M. and Sherlund, S. (2012) Did capital requirements and fair value accounting spark fire sales in distressed mortgage-backed securities? NBER Working Paper 18270. Available at http://www.nber.org/papers/w18270.

OECD (2015) OECD Business and Finance Outlook 2015, Paris: OECD Publishing. Available at http://www.oecd.org/finance/oecd-business-and-finance-outlook-2015-9789264234291-en.htm.

Plantin, G., Sapra, H. and Shin, H.S. (2008) 'Marking-to-market: Panacea or Pandora's Box?' Journal of Accounting Research, Vol. 46(2): 435–460. Available at http://onlinelibrary.wiley.com/doi/10.1111/j.1475-679X.2008.00281.x/abstract.

Rajan, R. (2005) 'Has financial development made the world riskier?', paper presented at Federal Reserve Bank of Kansas City Symposium, Jackson Hole, Wyoming, 25–27 August. Available at http://www.nber.org/papers/w11728.pdf.

Tasca, P. and Battiston, S. (2012) Market procyclicality and systemic risk. ETH Risk Center—Working Paper Series ETH-RC-12-012. Available at https://www.sg.ethz.ch/media/publication_files/ETH-RC-12-012.pdf.

Trichet, J.-C. (2009) 'Insurance companies, pension funds and the new EU supervisory architecture', speech delivered to the CEIOPS conference 2009, Frankfurt a. M., 18. November. Available at https://www.ecb.europa.eu/press/key/date/2009/html/sp091118.en.html.

A.3. ACKNOWLEDGEMENTS

This report is an extension of the major research project on the financial crisis and financial stability that The Geneva Association launched in February 2008 as part of its Insurance and Finance Research Programme.

The production of this report was coordinated under the general guidance of Daniel M. Hofmann, the Association's Senior Advisor for Financial Stability and Insurance Economics.

The Geneva Association is grateful to Professors Martin Eling, St. Gallen, and Gregor N.F. Weiss, Leipzig, for their contributions and guidance as sparring partners in the development of this report. Thanks are also due to subject-matter experts at Aegon, Allianz, Aviva, Axa, Generali, Manulife, MetLife, Munich Re, Prudential plc, Prudential Financial, SCOR, Swiss Re, Tokio Marine and XL Catlin for their support in the production of this paper.

This report is the latest in a series of Geneva Association white papers initiated in 2009 that contribute a fact-based analysis for the global discussions on insurance and financial stability. This report uses empirical evidence to examine whether potentially procyclical behaviour alleged to come from the insurance industry in market downturns could be systemically relevant.

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