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From the horse's mouth: surveying responses to stress by banks and insurers

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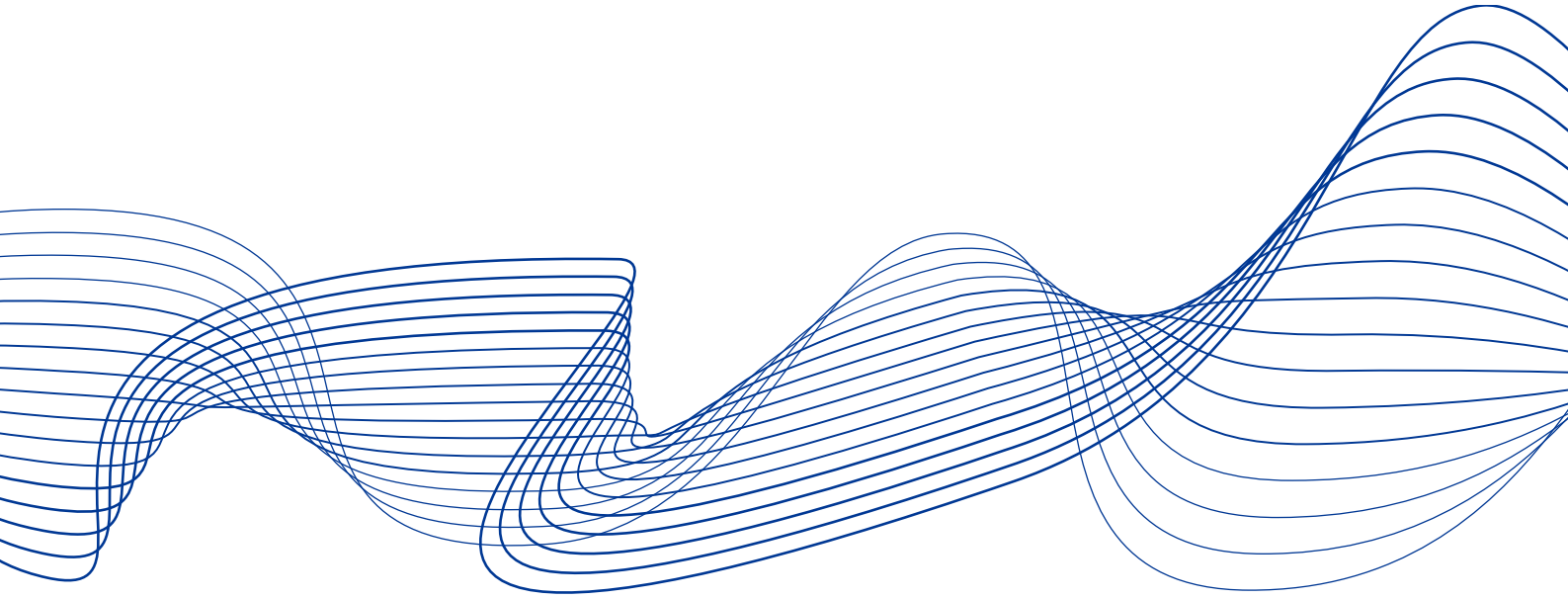

ESRB
European Systemic Risk Board
European System of Financial Supervision

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Abstract

Existing stress tests do not capture feedback loops between individual institutions and the financial system. To identify feedback loops, the European Systemic Risk Board has developed macroprudential surveys that ask banks and insurers how they would behave in a macroeconomic stress scenario. In a pilot application of these surveys, we find evidence of herding behaviour in the banking sector, notably concerning credit retrenchment. Results show that the consequences can be large, potentially undoing the initial effects of banks' remedial actions by worsening their solvency position. In contrast, insurers' responses to the survey provide little evidence of herding in response to macroeconomic stress. These results highlight the usefulness of macroprudential surveys in identifying feedback loops.

Keywords: stress tests, financial instability, macroprudential, surveys.

JEL codes: E30, E44, G10, G18, G21, G22, G28.

Executive summary

The European Systemic Risk Board (ESRB) has pioneered the development of macroprudential surveys to shed light on how financial institutions' responses to stress could generate feedback loops. These surveys ask banks and insurance companies how they would respond if a stress scenario were to materialise. Replies to these surveys come "from the horse's mouth" in that banks and insurance companies report their own expected responses to stress. By analysing survey replies, macroprudential policymakers can identify systemic risks arising from herding behaviour during periods of financial stress. The surveys therefore provide a macroprudential overlay to the large-scale microprudential stress tests that have become a cornerstone of post-crisis financial supervision.

This paper describes the surveys and their insights regarding potential adverse feedback loops. The purpose is to provide a "proof of concept" by describing the design of the surveys and summarising the results from a pilot application to banking and insurance stress tests conducted in 2014. As such, this paper does not necessarily characterise current systemic risks, but rather elucidates the value of macroprudential surveys in general and discusses the methodological issues that arise in their implementation.

The surveys capture mechanisms by which institutions' responses to stress could generate adverse feedback loops. They focus on actions that banks and insurers might take to restore solvency and liquidity positions during times of financial stress. Some of these actions – such as a retrenchment of credit supply, excessive risk-taking, asset fire sales and liquidity hoarding – can have systemic implications insofar as banks and insurance companies herd into common strategies. In particular, a widespread retrenchment of credit supply during times of stress can stymie consumption and investment, and the consequent reduction in aggregate demand can further weaken financial institutions' balance sheets. In the extreme, stress can incentivise financial institutions that are close to failure to gamble for resurrection by taking greater risks, with negative implications for financial stability. Asset fire sales can depress the value of commonly held assets, and liquidity hoarding can cause funding problems to spread between financial institutions. The macroprudential surveys attempt to measure the extent to which institutions would respond to stress in these ways, and thus whether the banking and insurance sectors could be subject to adverse feedback loops.

To identify feedback loops, good survey design is paramount. The surveys covered 28 banks and 166 insurance companies, with total assets amounting to approximately 200% of EU GDP at the end of 2013. This coverage ensures a broad representation of the two sectors, although it overlooks smaller institutions which might respond to stress differently. Most survey questions solicited quantitative responses, enabling an aggregation of replies across institutions. While the questions and answer options were designed to cover a broad range of possible responses, this paper focuses on responses that could create adverse feedback loops during times of stress, raising concerns from a financial stability perspective.

Banks' survey responses provide evidence of herding into common strategies. Four key insights emerged from banks' responses. First, their reductions in credit risk exposures during a macroeconomic stress scenario would imply a substantial reduction in credit supply to corporates.

This deleveraging would likely suppress economic activity and any associated fire sales could depress asset markets. Second, banks' reliance on retained earnings to improve capital ratios against a backdrop of weak economic growth implies a reach for yield that may require excessive risk-taking. Third, in a liquidity stress scenario, banks' widespread disposal of sovereign debt could exacerbate sovereign risks. Fourth, heavy reliance on a single contingency measure is problematic if that measure proves difficult to execute.

By contrast, insurers' survey responses provide less evidence of herding. As such, the survey does not suggest that second-round effects are likely to arise in the insurance sector through a retrenchment of credit supply, excessive risk-taking or liquidity hoarding. Nevertheless, insurers' large holdings of domestic corporate and sovereign bonds point to potential fire sale vulnerabilities, as some insurers reported sizeable footprints in these markets. Also, the survey suggests that some insurers would react to a reduction in interest rates by extending the maturity of their assets, which in turn could further suppress long-term yields and exacerbate insurers' solvency position owing to their duration mismatch.

Following the pilot surveys in 2014, the surveys have been integrated into the EU's broader stress test framework. The surveys were conducted again for banks and insurers in 2016 and are being developed further in view of future stress tests. Regular surveys could help to inform policymakers about new and changing systemic risks. In addition, the surveys could play a useful role in helping financial institutions and supervisors to better understand how recovery strategies and contingency plans might be vulnerable to herding behaviour.

1 Introduction

Large-scale stress tests are a cornerstone of post-crisis financial supervision. In the European Union (EU), the European Banking Authority (EBA) coordinated EU-wide banking sector stress tests in 2011, 2014 and 2016 (EBA, 2011, 2014a, 2016), complemented by exercises in the euro area (e.g. ECB, 2014) and in the United Kingdom (e.g. Bank of England, 2014a). Other jurisdictions in the EU have developed similar stress test exercises for banks. Outside the banking sector, the European Insurance and Occupational Pensions Authority (EIOPA) coordinated EU-wide stress tests for the insurance sector in 2011, 2014 and 2016 (EIOPA, 2011, 2014, 2016) and for the occupational pensions sector in 2015 (EIOPA, 2015, 2017). The European Securities and Markets Authority (ESMA) coordinated EU-wide stress tests for central counterparties in 2015 (ESMA, 2016). In the United States, the Supervisory Capital Assessment Program conducted in 2009 by the Federal Reserve System has evolved into the annual Comprehensive Capital Analysis and Review (Tarullo, 2014).

These large-scale stress tests have a macroprudential component as they measure the collective resilience of institutions to a common adverse scenario. Before the crisis, stress tests were typically conducted on individual institutions in isolation. Post-crisis exercises retain this focus on individual institutions, with each institution producing results based on internal models, while simultaneously testing the resilience of multiple financial institutions to a common adverse scenario. In the EU, these adverse scenarios are generated by the European Systemic Risk Board (ESRB, 2014a, 2014b, 2015, 2016a, 2016b, 2016c)[1] and aim to capture the most pertinent threats to financial stability. The two key elements, simultaneity and commonality, offer insight into the collective resilience of financial institutions and their capacity to serve the real economy, thereby providing a macroprudential dimension that was absent in pre-crisis microprudential stress tests.

A fully fledged macroprudential stress test would also capture feedback loops arising from the behavioural responses of financial institutions. Correlated responses to a common adverse scenario can create a feedback loop – both within the financial system and between the financial system and the real economy – that amplifies the initial shock (Clerc et al., 2016). Banks and insurers can take many actions to manage their capital and liquidity positions during times of stress. Section 2 focuses on some of these actions – namely the retrenchment of credit supply, excessive risk-taking, forced asset sales and liquidity hoarding – that could lead to externalities at the level of the financial system.

[1] The regulations establishing the three European Supervisory Authorities (ESAs) – the EBA, EIOPA and ESMA – give the ESRB a central role in contributing systemic elements to ESA stress tests. See Regulation (EU) No 1093/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Banking Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/78/EC (OJ L 331, 15.12.2010, p. 12); Regulation (EU) No 1094/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Insurance and Occupational Pensions Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/79/EC (OJ L 331, 15.12.2010, p. 48); and Regulation (EU) No 1095/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Securities and Markets Authority), amending Decision No 716/2009/EC and repealing Commission Decision 2009/77/EC (OJ L 331, 15.12.2010, p. 84).

Large-scale stress tests overlook behavioural responses and feedback loops owing to their assumption that balance sheets remain static. If financial institutions' balance sheets were permitted to be dynamic in a stress test – such that institutions could respond to a hypothetical adverse scenario with remedial actions – these actions would need to be incorporated into the adverse scenario to take account of macro-financial amplification effects. This revised scenario would then need to be re-run, requiring another round of calculations by financial institutions and subsequent quality assurance by authorities, begetting yet another round with an updated scenario, and so on. This iterative approach would be resource-intensive. It also poses a fundamental governance challenge: allowing financial institutions to undertake a broad range of mitigating actions – the feasibility and plausibility of which might be difficult to verify by authorities – could lead to an underestimation of the true extent of systemic distress in an adverse scenario. As a result, large-scale stress tests typically incorporate a static balance sheet constraint: financial institutions are not permitted to adjust their balance sheet over the horizon of the stress test. The consequent absence of meaningful feedback loops means that large-scale stress test exercises remain largely microprudential in nature (Greenlaw et al., 2012; Bookstaber et al., 2013; Borio et al., 2014; Demekas, 2015; Anderson et al., 2018).

Supervisory discussions with individual institutions are also likely to overlook feedback loops. Microprudential supervisors have detailed knowledge of the institutions they supervise: in addition to stress test results, supervisors have access to individual institutions' capital and recovery plans. Together with other inputs, stress test results provide valuable insights for the Supervisory Review and Evaluation Process (SREP) for banks (EBA, 2014b) and the Own Risk and Solvency Assessment (ORSA) of insurers (EIOPA, 2013). However, given the complex and confidential nature of this information, the sharing and aggregation of entity-level responses may not take place systematically, notwithstanding improvements in information-sharing brought about by the establishment of the Single Supervisory Mechanism (SSM).

Top-down stress test models provide valuable insights into feedback loops, but have limitations. Several authorities complement and cross-check the results from "bottom-up" stress tests – which are carried out by individual financial institutions using their own internal data and models, often under common assumptions (IMF, 2012) – with "top-down" stress tests, which are conducted by national authorities without the involvement of financial institutions. The top-down approach tends to incorporate assumptions regarding behavioural responses to capture feedback loops between the financial sector and the real economy (see Burrows et al. (2012) for the United Kingdom; Henry and Kok (2013) and European Central Bank (2017) for the euro area; Kitamura et al. (2014) for Japan and Anderson et al. (2018) for a global overview). These top-down stress tests provide valuable insights into feedback loops. However, the behavioural assumptions that govern the feedback loops are often ad hoc and, even if they were micro-founded, may not be stable over time (Demekas, 2015).

To overcome the limitations of existing stress tests, the ESRB has spearheaded innovative macroprudential surveys of financial institutions' responses to stress. Given the aforementioned challenges in quantifying potential feedback loops, surveying institutions about how they would respond to an adverse scenario has the potential to elicit useful insights. In contrast to bottom-up stress tests, institutions' behavioural responses to adverse circumstances are explicitly quantified; in contrast to microprudential supervisory discussions, responses can be readily

compared and aggregated across institutions; and in contrast to top-down models, the responses are conditional and “micro-founded” in the sense that they reflect the judgement of institutions participating in the stress test rather than ad hoc assumptions. While others have considered related approaches (e.g. Brunnermeier et al., 2012), to our knowledge this is the first time that such an approach has been applied in practice to capture both solvency and liquidity effects.

The first vintage of the ESRB’s macroprudential surveys complemented the EBA 2014 banking sector stress test and the EIOPA 2014 insurance stress test. The surveys were developed by experts in the ESRB’s Task Force on Stress Testing (TFST), working under the auspices of the ESRB Advisory Technical Committee (ATC). Section 2 elaborates on the objective of the surveys through the lens of economic theory. Section 3 describes how the surveys were designed. Sections 4 and 5 present the results of the surveys for banks and insurers respectively, and in doing so infer how institutions’ dynamic responses to stress could generate adverse feedback loops. Section 6 concludes. In addition, the annexes provide further detail, including on the survey questions for banks and insurers.

2 Objective of macroprudential surveys

The objective of the surveys is to shed light on how financial institutions' responses to stress could generate adverse macro-financial feedback loops. In pursuit of this objective, the surveys attempt to measure the second-round effects of macro-financial stress. This is done by asking financial institutions how they would respond to a given hypothetical adverse scenario. However, the survey results are necessarily partial in nature. In equilibrium, these second-round responses would interact with each other as well as those parts of the financial system and broader economy that are not considered in the surveys. In addition, responses by policymakers would determine equilibrium outcomes. Some of these interactions could lead to a further amplification of financial stress, while others could have a stabilising effect.

This section discusses the economic mechanisms through which macro-financial feedback loops operate and how they relate to the banking and insurance sectors. A fully fledged discussion of dynamic balance sheet optimisation by banks and insurers – including the interaction between solvency, funding liquidity and market liquidity – is beyond the scope of this paper and, in the case of banks, is provided elsewhere (e.g. Halaj, 2016). While the survey allowed banks and insurers to make use of a wide range of options to restore solvency and liquidity positions in response to stress (Annexes B and C), this section focuses on those channels through which herding behaviour is most likely to generate adverse feedback loops in the financial system.

2.1 Measures affecting solvency

Banks and insurers typically target solvency ratios over the medium term as part of their business planning. Internal targets (rather than regulatory minima) are relevant as many banks set internal capital targets that exceed capital requirements (Adrian and Shin, 2010). Insurers also aim for a solvency capital ratio that is higher than the regulatory minimum of 100%. Deviations from these internal targets, which are likely to be largest during an adverse macroeconomic stress scenario, tend to be remedied by management actions. Taken in isolation, such actions should be expected to restore an institution's capital ratio, but individual actions may have externalities which affect institutions' ability to meet targets. The aim of the ESRB's macroprudential surveys is to identify and quantify these externalities.

During times of stress, a further retrenchment of credit supply or excessive risk-taking to restore solvency positions could generate adverse feedback loops. A retrenchment of credit supply affects solvency from the perspective of an individual institution by reducing total assets (as a proportion of capital) as legacy assets gradually mature. Higher risk-taking affects profitability by rebalancing portfolios towards more risky, higher-yielding assets. These two measures are not necessarily incompatible, since aggregate credit supply could drop at the same time as banks rebalance their portfolios towards riskier assets. We now turn to these two measures in more detail and highlight how they could generate negative externalities.

Retrenchment of credit supply

A retrenchment of credit supply can choke off consumption and investment and further weaken financial institutions' balance sheets. Credit helps to fund consumption and investment by households and firms. A retrenchment in credit supply can be a rational response for an individual financial institution in the face of stress. In the absence of system-wide financial frictions, a retrenchment of credit supply by a single institution will be substituted by other institutions, negating the impact on aggregate credit supply. However, in the presence of financial frictions, retrenchment by a critical mass of institutions will diminish the substitution effect, potentially leading to an aggregate credit crunch that depresses consumption and investment (Peek and Rosengren, 2000). The ensuing recession will further weaken financial institutions' balance sheets through increased household and corporate defaults (Bernanke and Lown, 1991; Mizen, 2008; Brunnermeier, 2009). In this light, the ESRB's surveys attempt to quantify institutions' tendency to herd into retrenchment strategies that could lead to a substantial reduction in aggregate credit supply during an adverse macroeconomic scenario.

Banks are the drivers of aggregate credit supply in Europe. In contrast to other developed economies, Europe is dominated by bank-based intermediation. At about 330% of GDP, the aggregate bank balance sheet in Europe at the end of 2014 was more than three times greater than the sum of European equity and private bond market capitalisation, compared with a multiple of less than one in the United States (Langfield and Pagano, 2016a, 2016b). This dominance of bank-based intermediation means that retrenchment by banks can lead to a credit crunch insofar as capital markets and other sources of non-bank funding represent an inadequate substitute.

Insurers also affect aggregate credit supply, albeit to a lesser extent than banks. First, they originate loans directly or buy loans originated by others. Loans held by European insurers amounted to €1,300 billion at the end of 2014. Second, insurers purchase non-financial corporate bonds; at the end of 2014, their holdings of these bonds amounted to €1,400 billion (EIOPA, 2015a). Third, insurers indirectly affect banks' credit supply by funding them; at the end of 2014, their holdings of financial corporate bonds amounted to €1,600 billion (EIOPA, 2015a). Fourth, insurers also indirectly affect aggregate credit supply through the sale of insurance policies that facilitate credit creation by other financial institutions. In particular, certain insurance policies are linked to the supply of trade credit (van der Veer, 2011). Similarly, policies related to mortgages and property development, which in some cases are obligatory, affect the provision of such lending by other financial institutions (ESRB, 2015c).

Excessive risk-taking

Financial stress can incentivise financial institutions to increase their risk-taking, thereby creating further risks to financial stability. There are a number of reasons why financial institutions might engage in excessive risk-taking. For example, financial institutions can have an incentive to strategically correlate their risks to induce public sector intervention when financial stress materialises (Farhi and Tirole, 2012). Poor corporate governance and misaligned incentive structures can also contribute to excessive risk-taking (International Monetary Fund, 2014). Once under stress, managers of institutions may have an incentive to bolster returns by, for example,

investing in riskier but higher-yielding assets. In addition, they may have an incentive to extend additional lending to existing non-performing borrowers to delay the realisation of losses. In an environment in which other institutions are retrenching, search-for-yield behaviour can be countercyclical, as it stymies falling asset prices and maintains the supply of funding to borrowers in distress. However, such risk-taking can become excessive insofar as managers and shareholders in stressed financial institutions face potentially large upside gains but have little to lose if downside risks materialise (Dewatripont and Tirole, 1994). At the level of the financial system, banks' attempts to stave off default through increased risk-taking create new vulnerabilities in already weak financial institutions. It might also delay necessary adjustment in the financial sector and lead to a misallocation of resources (Peek and Rosengren, 2005).

The global financial crisis and the low interest rate environment provide some evidence consistent with excessive risk-taking under stress. For example, Icelandic banks expanded their balance sheets even as their access to capital markets was curtailed during the financial crisis (Baldursson and Portes, 2013). In the insurance sector, low regulatory capital levels and weak corporate governance are associated with a search for yield by US insurers (Becker and Ivashina, 2015; IMF, 2016). During the financial crisis, US life insurers increased risks by cutting the prices of new policies below their actuarial value to elicit and short-term cash inflows (Koijen and Yogo, 2015). In the European insurance sector, EIOPA (2014b) and the ECB (2014b) find some evidence of a search for yield by EU insurers, and attribute this to low interest rates, which may prompt insurers to invest in riskier assets in order to attain returns hitherto promised to policyholders. However, gambling for resurrection is not a necessary consequence of financial stress: there is evidence that large US financial institutions that were hit particularly hard by the crisis retrenched from risk-taking (Kirti, 2017).

2.2 Measures affecting liquidity

Funding liquidity and market liquidity are closely linked with each other and with solvency. Liquidity and solvency are linked at the level of individual financial institutions and at the level of the financial system as bank failures can exacerbate liquidity shortages (Diamond and Rajan, 2005). In particular, during times of stress, assets become more difficult to trade (market illiquidity) and more difficult to finance (funding illiquidity). These two liquidity risks can create incentives to fire-sell assets and hoard funding (Brunnermeier and Pedersen, 2009). We now discuss these two measures in turn.

Asset fire sales

Asset fire sales can generate systemic risk by depressing the value of commonly held assets. A fire sale occurs when an investor is forced to sell an asset at a large discount relative to the fair value of the asset. Such a sale might occur because an investor is unable to continue funding the asset. When potential buyers face similar funding constraints, the sale of the asset might only be realised at a discounted price. The decline in market value of the asset might also put other investors into financial distress and force them to sell other assets. This self-reinforcing process means that what might have been an individually rational response to a funding problem by

one investor causes other investors to adopt the same strategy, resulting in contagion across otherwise unrelated assets and investors (Shleifer and Vishny, 2011; Greenwood et al., 2015). This process can be amplified further as funding liquidity and market liquidity interact (Clerc et al., 2016); investors try to sell assets in markets that are becoming increasingly illiquid, leading to even larger falls in asset prices (Brunnermeier and Pedersen, 2009). In this light, the ESRB's surveys attempt to quantify the tendency of institutions to herd into strategies that might result in fire sales during a stress scenario.

The structure of banks' balance sheets poses a heightened risk of forced asset sales. Banks' assets consist in large part of loans that are illiquid and to a lesser extent of marketable debt securities and other assets that under normal market conditions are considered liquid. When faced with funding pressures, banks may be forced to sell these more liquid assets, since restructuring other parts of their balance sheets, such as their illiquid loan book, is typically more costly (French et al., 2010). In times of stress, banks might therefore tend to herd into a common strategy of selling tradable assets, causing previously liquid assets to become increasingly illiquid. This might prompt banks to liquidate parts of their loan book, for example via securitisation, at a high liquidation cost.

While the structure of insurers' balance sheets poses less risk of forced asset sales, there is some evidence of large-scale sales during times of financial stress. Given their long-term liabilities and regular premium income, insurers generally do not bear liquidity risk, even in the event of temporary market distress. Mass surrenders of insurance policies, causing liquidity pressure, are rare, but not unprecedented (e.g. in Japan during the late 1990s – Miwa, 2016). Life insurers may also have incentives to sell bonds in depressed markets because of accounting standards and risk-based capital regulation (Koijen and Yogo, 2016), and the magnitude of insurers' footprint in bond markets can lead to price dislocations. There is some evidence of procyclical investment behaviour by insurers during the dot-com crash, the 2007-08 financial crisis, and the subsequent euro area sovereign debt crisis (Bank of England, 2014b; Bijlsma, 2016), although other findings point to countercyclical behaviour (Timmer, 2018).

Liquidity hoarding

Liquidity hoarding can cause funding problems to spread between financial institutions. An institution that is perceived to be in distress will find it difficult to obtain funding from other institutions. This is particularly true in times of systemic stress, when other institutions might be uncertain about the quality of their own assets and might therefore be reluctant to take extra counterparty credit risk. Moreover, in the presence of asymmetric information, even institutions that are not in distress might be concerned that they could in future be perceived as a source of counterparty credit risk and lose access to funding. Such concerns can lead to precautionary liquidity hoarding, which restricts the supply of funding (Acharya and Merrouche, 2012; Gale and Yorulmazer, 2013; Heider et al., 2015). In such a scenario, systemic illiquidity can propagate through the network of financial institutions (Ferrara et al., 2017). In this light, the ESRB's surveys on second-round effects attempt to quantify the tendency of institutions to herd into strategies that might cause funding problems to spread between institutions during an adverse macroeconomic scenario.

Maturity transformation – funding long-term lending with short-term borrowing – is typically seen as a key function of banks (Diamond and Dybvig, 1983, 1986). Performing this function exposes banks to funding risk – the risk that their short-term borrowing will not be rolled over when it matures. Given this risk, banks might respond to stress by reducing their lending to other financial institutions or to other sectors of the economy, with negative effects on economic activity.

Insurers' business models tend to shelter them from funding risk, but their responses to stress may affect the funding of other institutions. Insurers collect premiums upfront from policyholders for services which might only be delivered years later. This "inverted production cycle" means that insurance companies are typically less exposed to funding risk, and therefore have less incentive to hoard liquidity. However, ancillary financial activities can expose insurers to liquidity risks; for example, substantial derivatives positions may require insurers to post large amounts of cash or similarly liquid, high-quality collateral (Abad et al., 2016). Also, in response to a stress scenario, insurers might affect the funding of other financial institutions in two ways. First, insurers might issue capital. If several of them try to issue capital at the same time, this herding might cause funding costs to rise, especially when other sectors are also increasing their demand for private savings. Second, insurers that provide funding to banks by holding bonds may reduce these holdings during times of stress or following bond downgrades. This may increase banks' cost of funding.

3 Design of macroprudential surveys

This section describes the design of the surveys that complemented the EBA 2014 banking sector stress test and the EIOPA 2014 insurance stress test. The surveys contain features designed to identify systemically relevant management actions and allow aggregation across institutions.

3.1 Survey questions to capture feedback loops

Each survey includes questions on institutions' strategic actions and market presence to capture mechanisms that might generate feedback loops. The questions in the surveys take into account the main strategic decisions of financial institutions following adverse shocks, in particular concerning balance sheet adjustments to restore solvency and funding liquidity. This sub-section relates the questions in both surveys to the key mechanisms they aim to capture.

Measures affecting solvency

The surveys ask how banks and insurers would expect to restore any capital shortfall relative to internal targets following an adverse macroeconomic scenario. Banks and insurers responded by quantifying how they would expect their balance sheets to evolve in the years following a stress scenario. Institutions were given a broad range of options for responding, including increasing capital levels – either through new equity issuance or by retaining earnings – or reducing risk-weighted assets (RWAs). The quantification of these balance sheet adjustments therefore captures measures to retrench lending and measures to boost profitability through increased risk-taking. This corresponds to the two key mechanisms by which individual institutions' attempts to improve solvency positions could generate systemic externalities and which are therefore of particular interest to policymakers (see Section 2.1).

Banks' attempts to restore capital positions by reducing RWAs could point to a second-round impact from a retrenchment in credit supply. To the extent that banks would attempt to meet their internal target by reducing RWAs, the bank survey asks about the extent to which RWAs would be reduced by cutting credit exposures to different categories of borrower – governments, financial institutions, corporates, including small and medium-sized enterprises (SMEs), and households. The survey also asks how individual banks expect the banking sector to behave in the same macroeconomic scenario (Annex B, question Q1). The objective of these questions is to measure the extent to which banks would respond to an adverse macroeconomic scenario by reducing credit exposures, including by restricting new credit supply.

Insurers' attempts to restore capital positions by changing asset portfolios and product mixes could point to a second-round impact from a retrenchment in credit provision. The survey for the insurance sector provides useful information on this channel. A question on short-term balance sheet adjustments (Annex C, question Q1) solicits changes in insurers' holdings of corporate debt and other assets, including direct lending and securitised debt. In addition, a

question on longer-term business models (Annex C, question Q2) permits the identification of changes in product mixes, including insurance policies that facilitate credit creation by other financial institutions.

To capture the potential for excessive risk-taking, banks were asked how they would increase profitability (Annex B, question Q2). Banks' responses quantify the extent to which they would expect to increase profitability by reducing funding or operational costs or by increasing revenue. A relative shift into revenue from higher-risk activities might point to excessive risk-taking.

The insurance survey captures both short and medium-term search-for-yield behaviour by insurers. The survey asks insurers about the extent to which they would change their investment portfolio in the short run to restore solvency, including divestments of investment-grade and non-investment-grade bonds (Annex C, question Q1). Search-for-yield behaviour could be implied by a relative shift into non-investment-grade bonds. Regarding their responses in the longer run, insurers were asked about the extent to which they would increase investments in higher-yielding securities to improve profitability (Annex C, question Q2).

Measures affecting liquidity

To shed light on liquidity risks, the survey asks banks and insurers to report their expected responses to a different set of adverse conditions. Solvency and liquidity risks are closely interlinked (see Section 2.1). To isolate liquidity risks from solvency risks, the survey poses a separate question, which asks financial institutions to report their expected responses to funding-specific stress that is not linked to the adverse scenarios in the EBA and EIOPA stress tests.

The survey asks banks to report their response to a prolonged closure of unsecured private wholesale funding markets (Annex B, question Q3). Specifically, the survey asks banks how they would adjust their funding strategy in response to a closure of all unsecured private wholesale debt funding markets for six months. The survey for insurers asks for the percentage changes in asset allocation following a price shock across different classes of assets (sovereign bonds, non-financial and financial corporate bonds, equity, and mutual funds) and different classes of credit ratings (investment-grade and non-investment-grade) (Annex C, question Q1). The impact of the scenario on potential collateral requirements for derivatives positions was not part of the insurance stress test.

The surveys also elicit information on whether institutions might sell into markets that might already be illiquid. To this end, banks and insurers were asked to assess which markets they are capable of "moving" (Annex B, question Q4 and Annex C, question Q3). In general, these institutions invest in markets that are typically considered liquid, such as major government bond markets. In these markets, it might take a lot of herding to cause price effects. In other markets, however, individual institutions can have such a dominant position that they could individually "move the market". If institutions respond that they can move the market of a certain asset and that they would sell large amounts of that asset, second-round effects are likely to be strong. To capture this, banks were requested to specify their market shares in segments of their trading book (Annex B, question Q4).

Insurers were also asked about the impact of the adverse scenario on the behaviour of policyholders. The survey focuses in particular on the impact if policyholders were to pause or terminate existing policies ("lapses") (Annex C, question Q4). This reflects the fact that, while a continuous cash inflow from insurance premiums means that life insurers are typically able to pay out policyholders who wish to terminate their policy early, they can be forced to sell assets if premium income halts and surrenders gain momentum. Such mass lapses can result in insurers needing to sell more assets than in the case of solvency shortfalls alone.

3.2 Details of survey design

The survey is designed to elicit meaningful responses and facilitate their aggregation across institutions. This requires that answers are quantifiable and cover a broad range of possible actions; that the sample is sufficiently broad to capture a large part of the banking and insurance sectors in the EU; and that the results can be validated.

Quantification

The ability to aggregate responses across institutions is a key consideration. To understand whether reactions by individual institutions to a stress might lead to macro-financial feedback loops, it is important that responses can be aggregated. As a result, questions are for the most part in closed format; institutions were required to quantify their responses. Where a quantitative question would not suffice, a qualitative question was asked. Institutions were able to add comments in free format if they wished to add further detail or provide background information to their quantitative responses.

Completeness

The questions cover a broad range of responses. Responses had to sum up to 100% of the total changes required to meet certain goals (such as capital or profit targets). In addition, institutions were given the opportunity to respond to any question with "other", specifying details of the response in a comment box. This means that possible responses also covered actions such as cost-cutting that might be a rational response to reach a profit target but are unlikely to have a systemic impact. The reason for allowing such responses was to ensure that the importance of actions that might be of systemic relevance would not be overstated relative to total actions taken. Moreover, even responses that point to actions that are unlikely to be of systemic relevance contribute to an understanding of how institutions might respond to stress and might be useful to microprudential supervisors.

Sample size and coverage

Both surveys cover a large share of their respective sectors in the EU, although they are not necessarily representative of all institutions within each sector. Broad coverage is desirable in

order to identify and assess systemic herding behaviour that might have an impact on the financial system or the real economy. At the same time, it was important to keep the survey manageable, taking into account the extra reporting burden for responding institutions. Given this trade-off, the bank survey was directed at the largest 28 banks of the 123 that participated in the 2014 EBA stress test, covering 55% of the assets held by the EU banking sector at the end of 2013. The insurance survey was directed at all participants in the 2014 EIOPA stress test, covering 62% of total assets in the EU insurance sector. While the surveys thus cover most of these respective sectors, coverage is necessarily incomplete, limiting the external validity of the results. Moreover, while the insurance survey covers a broad range of insurance companies, including life and non-life and small and large insurers, the banking sector survey is biased towards the largest institutions, whose responses to stress may differ from those of smaller banks (e.g. local savings or cooperative banks) that were not surveyed.

The surveys focus on second-round effects within each sector, thereby abstracting from general equilibrium effects. By focusing on the initial reaction to stress within a sector, the surveys are necessarily partial in nature. In equilibrium, these second-round responses would interact with each other and the broader economy. This would include other parts of the financial system not considered in the surveys (e.g. pension funds and investment funds), the non-financial system (e.g. non-financial corporates) and responses by policymakers. During times of stress, some parts of the financial system might behave in a similar way, leading to further amplification. Others might behave differently and have a dampening effect. Actions by policymakers would also affect financial stability. Taking account of these interactions would require a comprehensive general equilibrium model of the financial system, which is beyond the reach of current stress test methodologies.

Verification

Steps were taken to verify institutions' responses. Responses were sent to supervisors who are closely acquainted with individual institutions and are therefore in a position to verify responses. In addition, responses of individual institutions were cross-checked with income statement and balance sheet data to flag outliers that might indicate administrative or substantive errors in responses. Besides these checks, one might be concerned that it is difficult to verify that survey participants responded truthfully. However, the fact that institution-specific responses could be challenged by microprudential authorities, and the fact that responses would be disclosed only at an aggregate level, meant that institutions would have had an incentive to respond truthfully.

3.3 Lessons learnt

Following the pilot surveys described in this paper, subsequent surveys have incorporated the lessons learnt. The surveys were conducted again for banks and insurers in 2016 and are being further developed. Looking ahead, regular surveys will help to inform policymakers about new and changing systemic risks. In addition, the surveys could play a useful role in helping financial institutions and supervisors to better understand how recovery strategies and contingency plans might be vulnerable to other institutions herding into similar strategies.

The evaluation of the responses to the pilot surveys provided a number of insights which helped to improve subsequent generations of the survey. The survey results provided a number of useful insights that are described in the next sections. However, the analysis also reveals deficiencies in survey design. Such deficiencies are to be expected in a pilot survey and have been addressed in subsequent surveys. They include:

- Definitions: Concepts such as profits or retained earnings are not unambiguously defined and banks participating in the pilot survey may not have reported variables using common definitions. The subsequent surveys carried out in 2016 therefore linked economic concepts more clearly to variables defined in reporting obligations, in particular the COREP (Common Reporting) and FINREP (Financial Reporting) reports.

- Aggregation: The first part of the banking sector pilot survey asked participants to record actions as percentage point contributions to changes in capital ratios. To aggregate the data, this required making linearisation assumptions to convert percentage point contributions into billions of euro. To avoid this, the 2016 survey asked respondents to record responses in billions of euro.

- Omitted data: The pilot survey for insurance companies did not collect information on internal capital targets. Any action to restore capital levels to these internal targets could therefore not be quantified. These data were added in the 2016 survey for the insurance sector.

4 The banking sector survey

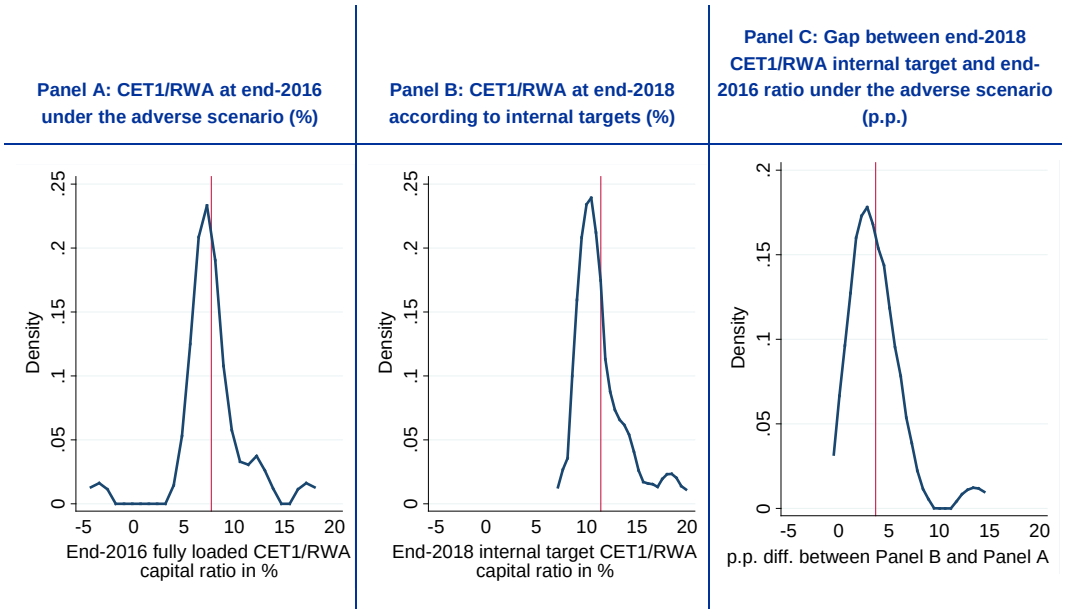
This section describes the results of the survey which complemented the EBA 2014 banking sector stress test. The EBA stress test was based on an adverse scenario designed by the ESRB (ESRB, 2014a). The scenario began in 2014 and extended until 2016. The macroprudential survey complementing the stress test was sent at the start of 2015 to the 28 largest banks (see Annex A), which collectively held €21,600 billion of assets (i.e. 160% of EU GDP). Aggregate results were discussed with representatives from participating banks at a workshop in March 2015.

4.1 Measures affecting solvency

All banks in the sample replied that they would take steps to rebuild their capital ratio if the adverse macroeconomic scenario were to materialise. The first survey question asks banks to report their common equity tier 1 capital ratio at the end of 2016 under the adverse scenario of the 2014 EBA stress test (the distribution of which is plotted in Panel A of Figure 4-1) and their internal target regulatory capital ratio at the end of 2018 (plotted in Panel B). The percentage point (p.p.) difference between these two variables for a given bank constitutes the "capital ratio gap" (plotted in Panel C of Figure 4-1). On this basis, all banks would expect to rebuild their capital ratios in response to the materialisation of the adverse scenario.

Figure 4-1

Distributions of banks' capital ratios under the adverse scenario versus target ratios



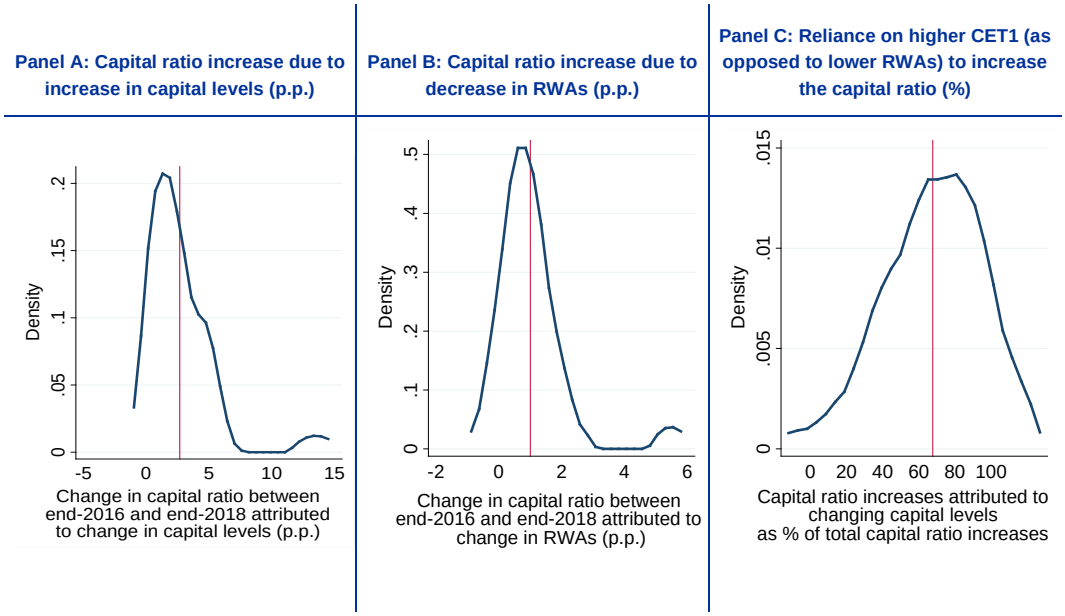
Source: ESRB and EBA.

Note: The figure plots the distributions of CET1/RWA under the adverse scenario (Panel A), CET1/RWA according to internal targets (Panel B) and the percentage point gap between the two aforementioned variables (Panel C). The vertical red lines plot the simple (unweighted) mean of each distribution.

Banks replied that they would expect to rebuild capital ratios via increases in Common Equity Tier 1 (CET1) and reductions in RWAs. Figure 4-2 shows the distributions of the extents to which banks would expect to rebuild capital ratios by increasing CET1 (Panel A) and reducing RWAs (Panel B). On average, banks reported that they would expect to close nearly three-quarters of the capital ratio gap by increasing CET1 levels (i.e. 2.7 p.p. of the 3.7 p.p. gap). The remaining quarter (i.e. 1 p.p.) would be achieved by reducing RWAs. Nevertheless, a minority of banks reported that they would rely predominantly on reductions in RWAs, as indicated by the left tail of the distribution plotted in Panel C of Figure 4-2.

Figure 4-2

Distributions of measures to close the capital ratio gap



Source: ESRB and EBA.

Note: The figure plots the distributions of the capital ratio increase due to an increase in capital levels (Panel A), a decrease in RWAs (Panel B) and the former variable expressed as a percentage of total CET1/RWA adjustment (Panel C). The vertical red lines plot the simple (unweighted) mean of each distribution.

Table 4-1 reports the relative importance of different measures to close the capital ratio gap for the average bank. The most important measures concern greater profitability (45%) and net equity issuance (28%). At 10%, reductions in credit risk exposures make a relatively small average contribution to the closing of the capital ratio gap.

Table 4-1

Average contributions of measures to close the capital ratio gap

Measure	Average contribution to closing the capital ratio gap
Increase in capital levels	**73%**
of which:	
profits	45%
equity issuance net of buybacks	28%
Decrease in RWAs for credit risk	**27%**
of which:	
reduction in credit exposure	10%
model recalibration	4%
divestments reducing RWA	3%
change in RWAs for market risk	6%
other RWA-related measures	4%

Source: ESRB and EBA.
Note: The table reports the average percentage contributions of each measure to close the capital ratio gap.

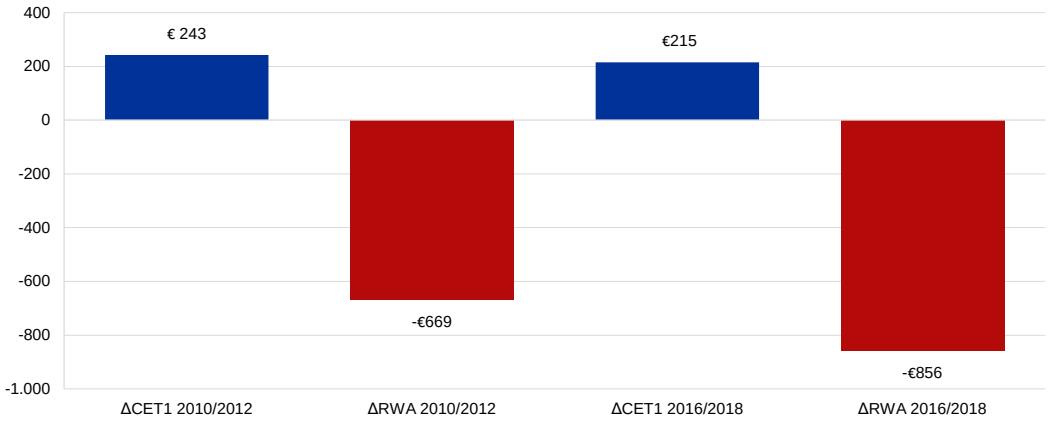
Banks' responses imply an increase in CET1 and a decrease in RWAs similar in magnitude to those experienced over 2010-12. To see this, we decompose the capital ratio gap into a change in the numerator (CET1) and a change in the denominator (RWAs) using the methodology described in Box 1.[2] In aggregate, banks' efforts to close their capital ratio gaps amount to an increase in CET1 of €215 billion and a decrease in RWAs of €856 billion. As Figure 4-3 shows, these amounts are similar to the actual changes in CET1 and RWAs that occurred over 2010-12, suggesting that banks' individual replies to the survey generate plausible aggregate implications.

[2] Banks reported their actions to close the capital gap in four main categories: (1) increased capitalisation; (2) change in RWAs for credit risk; (3) change in RWAs for market risk; and (4) other actions. Measures in the "other" category were reclassified either as CET1-type measures (that move the numerator of the CET1 capital ratio) or RWA-type measures (that move the denominator), based on the written comments that banks provided.

Figure 4-3

Changes in CET1 and RWAs to close the capital ratio gap over 2016-18 compared with changes over 2010-12

(€ billions)



Source: ESRB and EBA.
Note: The first pair of bars refer to historical changes in CET1 and RWA over 2010-12; the second pair of bars are calculated based on banks' reported capital ratio gap over 2016-18, based on the methodology described in Box 1. Historical data are retrieved from the EBA stress test (2011) and the EBA transparency exercise (2013) for a comparable sample of banks (i.e. the 28 banks listed in Annex A, except for BFA Tenedora de Acciones S.A.U., La Banque Postale and Landesbank Baden-Württemberg owing to a lack of data).

Box 1
Decomposition of the capital ratio gap into changes measured in euro

The decomposition of the capital ratio gap into implied changes in CET1 and RWAs in euro follows a three-step procedure.

In the first step, we compute the change in value of CET1 and RWAs for the two corner solutions (in which the adjustment occurs entirely through CET1 or RWAs). For example, consider a bank which has a fully loaded end-2016 CET1/RWA ratio of 10% under the adverse scenario, with €100 of CET1 and €1,000 of RWAs. This bank's reported target CET1/RWA ratio at the end of 2018 is 15%. The two corner solutions to obtain this target are to increase CET1 by €50 (from €100 to €150) or decrease RWAs by €333.33 (from €1,000 to €666.67).

In the second step, we consider the proportions of the percentage point adjustment in CET1/RWA that banks reported as being due to CET1 and RWAs, respectively. For example, consider that our hypothetical bank reported that its total adjustment of 5 p.p. in CET1/RWA comprised 1 p.p. due to CET1 and 4 p.p. due to RWAs, meaning that CET1 drives 20% of the adjustment, and RWAs 80%.

In the third step, we multiply the maximum changes in CET1 and RWAs by their respective contribution to the CET1/RWA adjustment. In our example, we multiply €50 by 20% for CET1 and

€333.33 by 80% for RWAs, giving an increase in CET1 of €10 and a decrease in RWAs of €266.66. Applying these changes to the initial values for CET1 and RWAs gives us CET1 of €100 + €10 = €110 and RWAs of €1,000 – €266.66 = €733.33. The resulting CET1/RWA ratio is then 110/733.33, which indeed equals the 15% target reported by the bank.

Based on the methodology set out in Box 1, we can break down the €215 billion increase in CET1 into its constituents, namely net equity issuance (gross issuance net of buybacks) and profits. Figure 4-4 shows that, in aggregate, banks in the sample would primarily rely on profits (€146 billion) to meet their internal target capital ratios by the end of 2018. The plausibility of this expectation is discussed in Section 4.4. Net equity issuance (€59 billion) represents a smaller part of the expected increase in CET1.

Figure 4-4
Breakdown of expected aggregate increase in CET1

(€ billions)

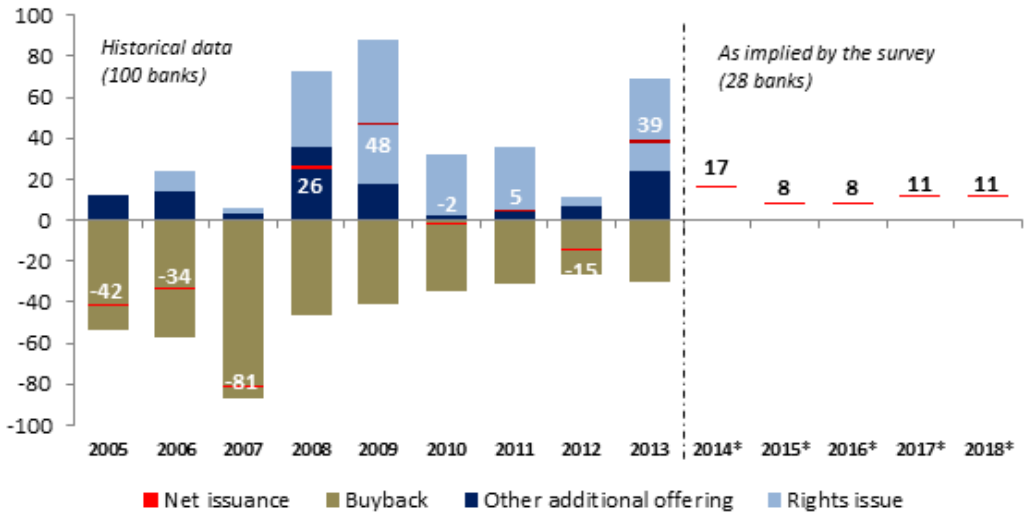
Source: ESRB and EBA.
Note: The figure plots the expected aggregate increases in components of CET1 to reach target capital ratios.

Net equity issuance of €59 billion is ambitious, but not unprecedented. Banks reported that the €59 billion of net equity issuance would be divided into approximately €17 billion by the end of 2014, €17 billion over 2015-16, and €25 billion over 2017-18, assuming that balance sheet actions are permitted before 2016. Based on historical data, Figure 4-5 suggests that these volumes may be attainable if staggered over a five-year period.

Figure 4-5

Equity issuance net of buybacks

(€ billions)



Source: Bloomberg (historical data) and ESRB and EBA (projections).
Note: The figure plots historical equity issuance by the 100 largest publicly traded banks in Europe and expected issuance by the 28 banks in the survey sample over 2014-18. The difference in samples limits comparability between the historical data and the forecast data from the survey, although the 28 banks in the survey sample far exceed the 72 out-of-sample banks in terms of size and issuance volumes. Asterisks indicate the forecast horizon.

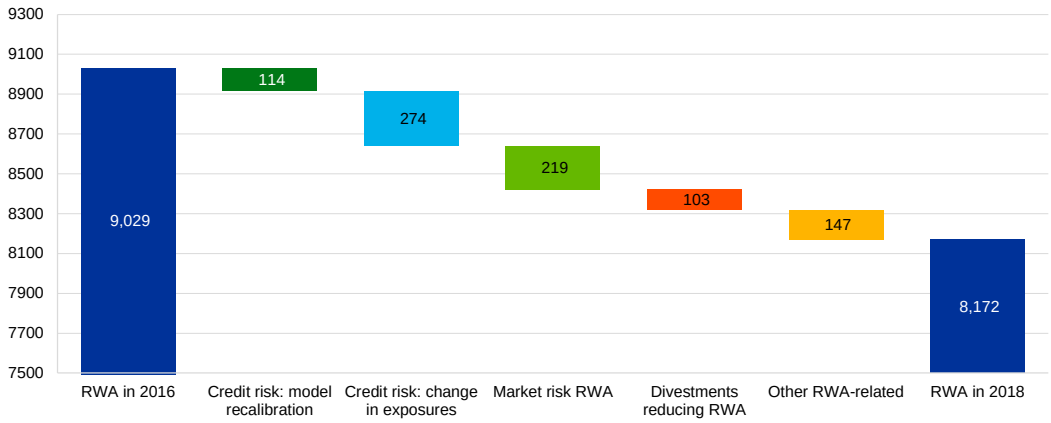
4.1.1 Retrenchment of credit supply

Banks' reduction in credit risk exposures is the largest component of the expected reduction in RWAs. Figure 4-6 shows the breakdown of the €856 billion aggregate reduction in RWAs into different categories. At €274 billion, the reduction in credit risk exposures is the largest category, followed by a reduction in RWAs for market risk (€219 billion), other RWA-related measures (€147 billion), model recalibration (€114 billion), and divestments (€103 billion). The magnitude of the reduction in some of these credit risk exposures may be concerning from the perspective of aggregate credit creation. We turn to this issue next by zooming in on the categories of exposures for which banks reported a reduction.

Figure 4-6

Expected aggregate decrease in RWAs

(€ billions)



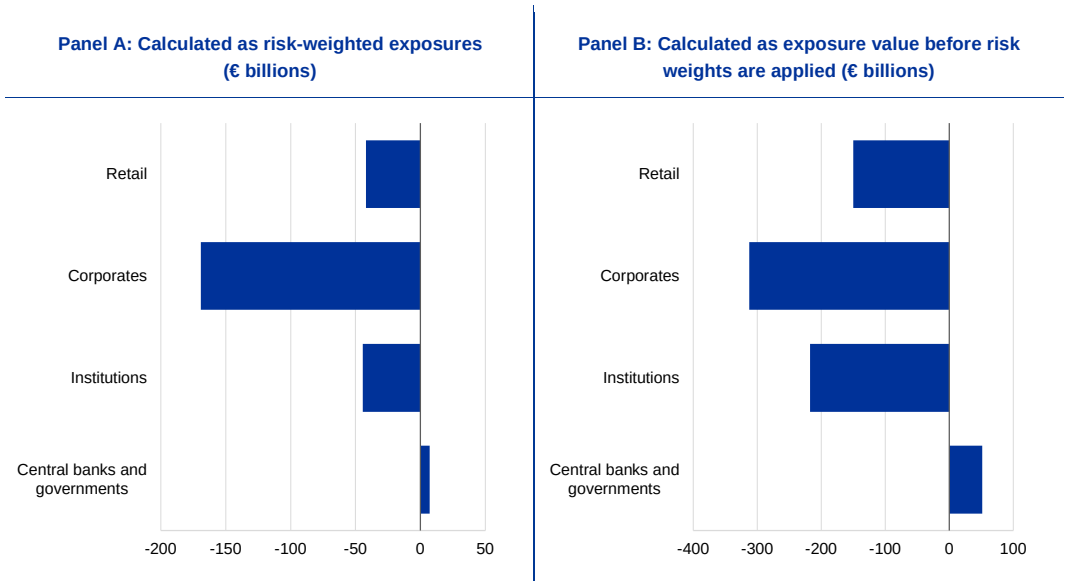
Source: ESRB and EBA.
Note: The figure plots the expected aggregate decreases in the components of RWAs to reach target capital ratios.

Figure 4-7 breaks down the reduction in credit risk exposures into four asset classes. Banks would reduce their credit risk exposures mostly with respect to corporates. Expected reductions in credit risk exposures to retail and institutions, where average risk weights are less than half those of corporates, are smaller. In unweighted terms, exposure values would fall by €313 billion for corporates, with somewhat smaller reductions for institutions (€218 billion) and retail (€150 billion), and a slight increase for governments (€52 billion).

Banks' reduction in corporate rather than government exposures may be due to the higher average risk weights that are assigned to corporate exposures. Figure 4-8 compares the share in exposure values shown in Panel B of Figure 4-7 with the shares of banks' exposures to each asset class at the end of 2013. This comparison reveals that corporates account for 50% of the reduction in exposure values, but only 30% of banks' total exposures. In contrast, exposures to central banks and governments, which account for about 20% of banks' exposures to the four asset classes, were expected to increase slightly under the macroeconomic stress scenario. This implies that, in an adverse scenario, banks would disproportionately reduce their credit risk exposures in asset classes with higher risk weights.

Figure 4-7

Expected aggregate decrease in exposures by asset class

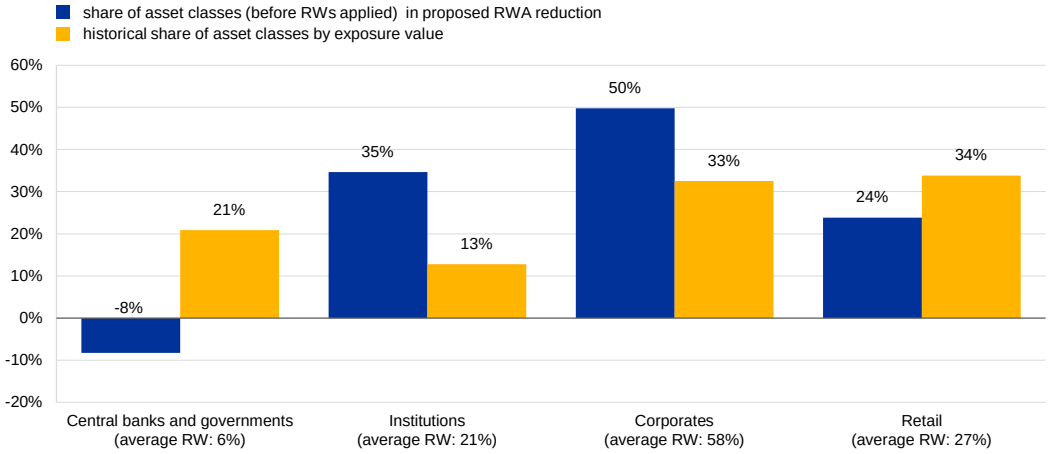


Source: ESRB and EBA.

Note: The figure shows the expected aggregate decrease in bank exposures by asset class. Panel A shows the expected aggregate decrease in credit risk exposures and Panel B shows the expected aggregate decrease in exposure value before risk weights are applied. The latter values are calculated by dividing the reduction in RWAs shown in Panel A by bank-level average risk weights by asset class (taken from EBA stress test data). The definition of asset classes follows Article 147 of the Capital Requirements Regulation (CRR). The "institutions" category consists of financial institutions, multilateral development banks, public sector entities, regional governments and local authorities (which are not treated as exposures to central governments). The "corporates" category includes all exposures not classified as exposures to governments, institutions, retail or equity.

Figure 4-8

Shares of different asset classes in RWA reduction



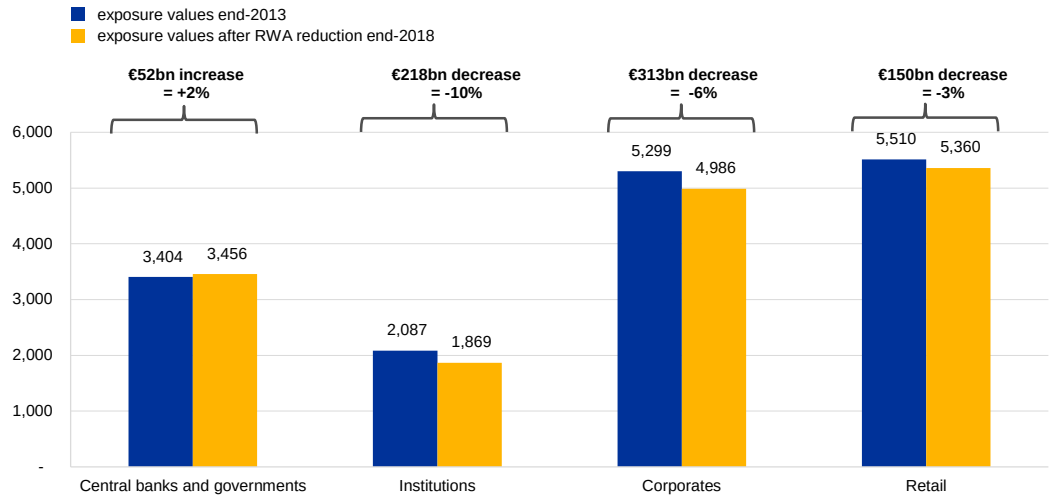
Source: ESRB and EBA.

Note: The figure shows the shares of asset classes in the expected RWA reduction based on the estimated exposure values (before risk weights are applied) using the average risk weight per asset class for each institution (as in Panel B of Figure 4-7). Historical data are taken from the 2014 EBA stress test disclosures.

Reductions in credit risk exposures are consistent with a reduction in credit supply to corporates. To gauge the effect of the planned reduction in credit risk exposures to the real economy, Figure 4-9 compares the change in exposure values with the stock of exposures outstanding. This shows that the greatest percentage reduction in exposure values would be expected to occur with respect to institutions (10%) and corporates (6%). These reductions compare with nominal GDP growth in the scenario of 8% over 2014-18. Taken together, these numbers imply reductions in credit-to-GDP ratios of 17% for credit to institutions and 13% for credit to corporates. This represents a substantial reduction in credit relative to GDP. By comparison, according to Bank for International Settlements (BIS) data, total credit to non-financial corporations in the euro area as a percentage of GDP declined by just 2.3%, from 102.9% to 100.5%, between 2009 and 2013.

Figure 4-9
Change in exposure values between end-2013 and end-2018

(€ billions)



Source: ESRB and EBA.
Note: The figure shows exposure values at the end of 2013 (from the 2014 EBA stress test disclosures) and at the end of 2018 (inferred from banks' replies to the survey as shown in Figure 4-7).

To assess the fire sale externality generated by these reductions in exposures, we implement an adaptation of the "vulnerable banks" framework of Greenwood et al. (2015). This framework provides for a quantification of the fire sale externality induced by bank deleveraging. When banks deleverage by selling assets and there is a shortage of buyers, prices fall. This reduces the net worth of banks holding the same or correlated assets. Applying this framework to our survey data implies aggregate exposure reductions of €313 billion for corporates, €218 billion for institutions, and €150 billion for retail (Figure 4-7, Panel B).

As an upper bound on fire sale externalities, we consider the case in which exposure reductions occur simultaneously. Under this assumption, the fire sale externality is assumed to be a 10 basis point (b.p.) price reduction per €10 billion of asset disposals, in line with Greenwood et al. (2015) and following empirical evidence summarised by Duffie (2010). In this case, the price

reduction owing to the fire sale would amount to approximately 7%, causing the mark-to-market value of commonly held assets to drop by €225 billion. If this price drop were to materialise, it would outweigh the €215 billion increase in CET1 over 2016-18. Deleveraging would therefore be self-defeating. By contrast, if banks had refrained from reducing exposures, and had instead relied only on increases in CET1 to improve their CET1/RWA ratio, their capital ratio would have stood 1.7 p.p. higher in 2018. Clearly, however, these results are only illustrative, and depend strongly upon the assumptions used. In practice, the strength of the fire sale externality would depend on other factors that may amplify or dampen the price impact of banks' liquidation of assets. For example, the fire sale externality would be milder if banks were to smooth their exposure reductions over time.

These calculations highlight how individual bank decisions can generate systemic externalities which outweigh private benefits. In the absence of an effective internalisation mechanism, banks may fail to take account of these externalities when faced with a deleveraging decision.

4.1.2 Excessive risk-taking

Banks claimed that profits would fill nearly half of the capital ratio gap; to achieve this, they would require exceptionally strong net earnings and increases in retention rates. Banks reported that profits would close €146 billion of the capital ratio gap following the adverse macroeconomic scenario. With a maximum retention rate of 100%, this implies average annual net earnings of €73 billion over 2017-18, which is only slightly below bank earnings in 2005 (Figure 4-10). With a more reasonable retention rate of 78%, which prevailed over 2010-12 (Cohen, 2013), banks would need to earn €94 billion per year, which is comparable to bank earnings in 2006.[3] Against a backdrop of a subdued macroeconomic recovery (real GDP growth from the end of 2016 to the end of 2018 was assumed to be 2% per annum) and an envisaged fall in RWAs of €865 billion (Figure 4-6), this would imply a 250% increase in return on assets, from 0.12% at the end of 2013 to 0.43% at the end of 2018.[4]

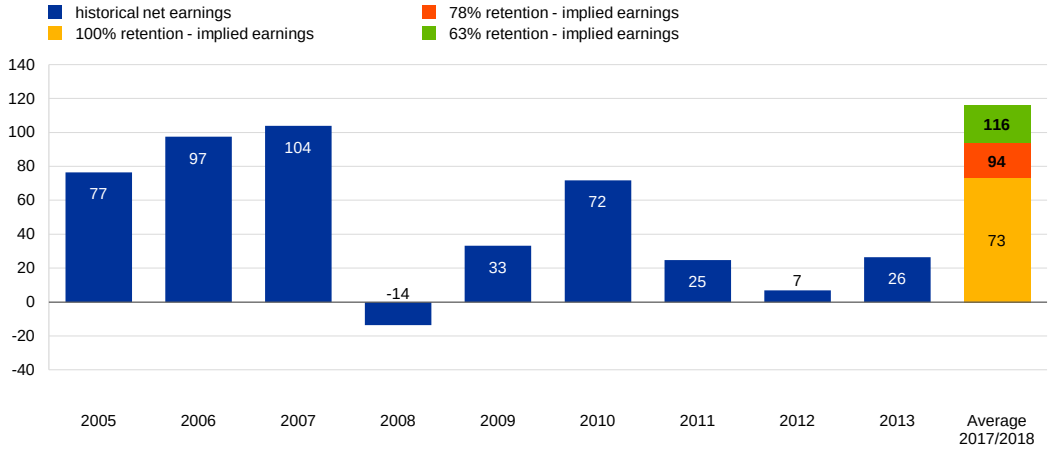
[3] A 63% retention rate, which was the average observed over 2005-07, would require annual earnings of as much as €116 billion in 2017 and 2018 – higher than the historical peak of €104 billion in 2007, and therefore only achievable with high levels of risk-taking.

[4] The return on assets is calculated as net earnings divided by total assets for the 28 sample banks. For the projection of the return on assets in 2018, we use net earnings of €94 billion (based on a retention rate of 78% as per Figure 4-10) as the numerator. For the denominator, we calculate the change in total assets between 2013 and 2018 according to banks' responses to the survey and assuming constant average risk weights by sector from 2013 onwards (as presented in Annex A).

Figure 4-10

Historical net earnings of the sample banks

(€ billions)



Source: ESRB and EBA.

Note: The figure shows historical net earnings of the 28 sample banks and net earnings over 2017-18 implied by the survey under different assumptions regarding retention rates.

Increased profitability would be achieved by cost reductions and increases in revenue in roughly equal proportions. To better understand the drivers of profitability, the survey asks banks how they would increase profitability. Table 4-2 summarises banks' responses. Regarding costs, several banks highlighted the scope for cost-cutting, with minimal detrimental effects on revenues. Banks also claimed that profitability would improve as high funding costs locked-in during the global financial crisis would be replaced by cheaper funding, particularly against a backdrop of low interest rates. Regarding revenue, banks expected the intensity of competition to decline, owing to future consolidation in the industry, coupled with a continued retreat of certain banks from non-core business areas. This reduction in competition would help banks to increase margins even during a period of low growth.

Strong net earnings against a backdrop of weak real GDP growth could imply that banks would engage in excessive risk-taking. Nevertheless, even if the above expectations are reasonable, the aggressiveness of banks' profit projections in a low-growth environment raises questions regarding their reliance on retained earnings to improve solvency positions. This sheds doubt on whether such results could be achieved without excessive risk-taking.

Table 4-2
Contributions to increased profitability

Measure	Average contribution to increased profitability
Reduction in costs	
funding costs:	9%
other costs	45%
Increase in revenue	
lending rates	35%
fees	6%
asset decomposition	5%

Notes: The table is based on answers to question Q2 of the banking sector survey (see Annex B). Percentages are simple (unweighted) means of the answers given by the 28 banks.

4.2 Measures affecting liquidity

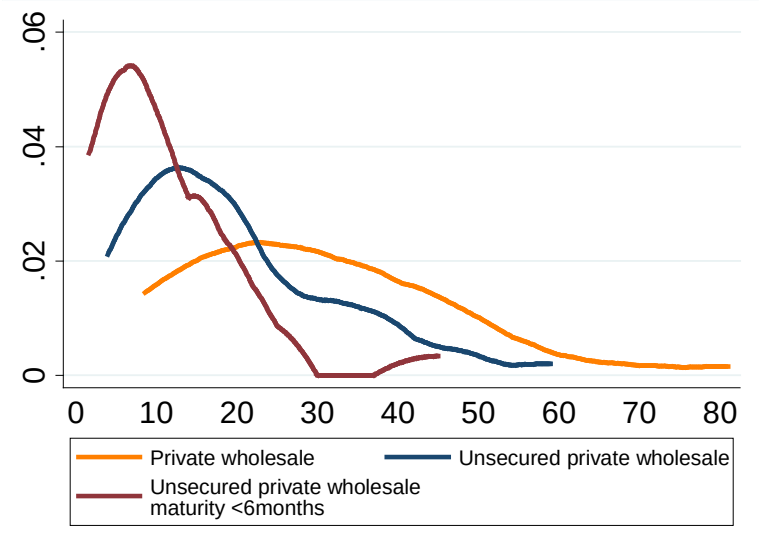
The survey asks banks how they would respond to distress in funding markets. This is distinct from the macroeconomic stress scenario used in the previous section to evaluate attempts by banks to restore their solvency positions. To isolate liquidity effects, the survey asks banks how they would respond to an extreme event in which wholesale funding markets close for six months (see Annex B, question Q3(b)).

For many banks, private wholesale funding markets constitute a substantial source of funding. The survey asks banks to report their private wholesale funding (defined as wholesale deposits and debt funding) relative to their total assets (see question Q3(a) in Annex B). At 28%, the median share of private wholesale funding in total assets is substantial. The median share of unsecured private wholesale funding in total assets is 15% and the median share of unsecured private wholesale funding with a maturity of less than six months in total assets is 9%. Figure 4-11 shows the distribution of banks' positions in these three categories.

A closure of unsecured private funding markets for a period of six months would represent a funding gap of about €2,000 billion. Reflecting the importance of private wholesale funding markets, the survey asks banks to report their actions if the unsecured private wholesale funding market were to close for six months. Given total assets for the sample banks of €21,565 billion, and that on average approximately 9% of total assets were funded by unsecured private wholesale instruments with a duration of less than six months, a six-month closure of these markets implies a funding gap of about €2,000 billion. To put this substantial sum in perspective, the ECB provided banks with €1,019 billion in three-year funding via refinancing operations in December 2011 and February 2012. On average, banks would close 60% (€1,236 billion) of the funding gap through a reduction in assets to fund and 40% (€766 billion) through increased funding from other sources (see Figure 4-12). We evaluate these two categories of response in Sections 4.2.1 and 4.2.2.

Figure 4-11

Distributions of percentage shares of private wholesale deposit funding in total assets



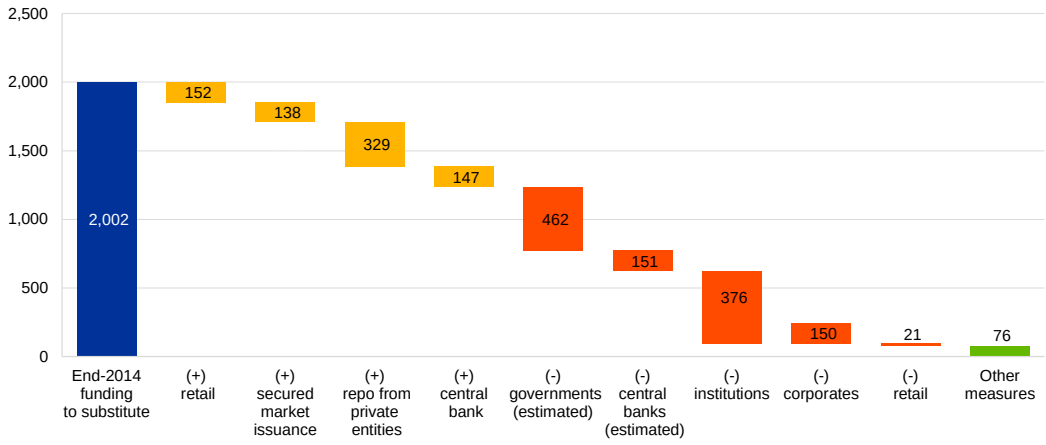
Source: ESRB and EBA.

Note: The figure shows the cross-bank distribution of wholesale funding as a percentage of total funding. The variable is calculated based on banks' answers to question Q3(a) of the banking sector survey (see Annex B). The distributions of banks' responses are approximated by a Kernel density estimation.

Figure 4-12

Reaction to a closure of all unsecured private wholesale funding markets for at least six months: aggregate actions to close the funding gap

(€ billions)



Source: ESRB and EBA.

Note: The figure shows the breakdown of banks' aggregate actions to close a hypothetical funding gap. Amounts were calculated using the share of unsecured private wholesale funding with a maturity of less than six months taken from banks' answers to question Q3(a) of the banking sector survey (see Annex B). "+" signs represent increases in funding, and "-" signs represent reductions in assets to fund.

4.2.1 Asset fire sales

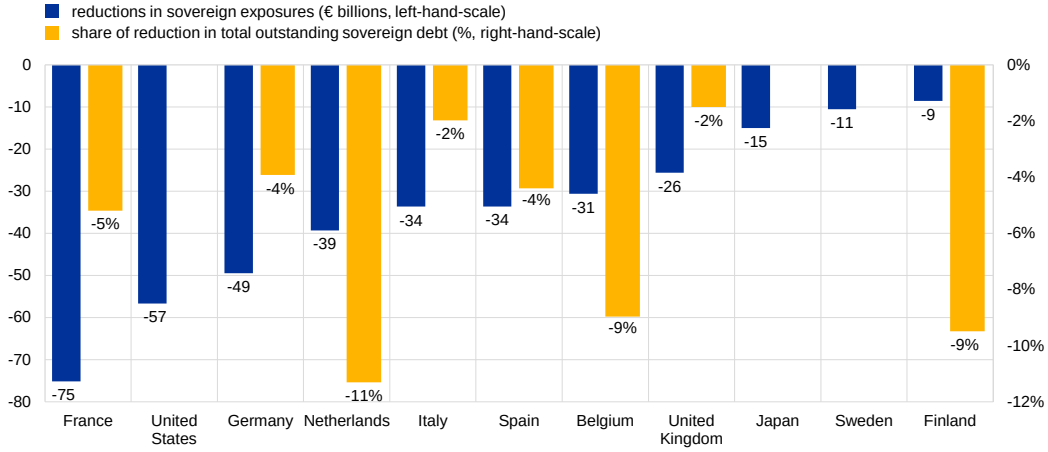
Banks reported that they would respond to a six-month closure of wholesale funding markets in large part by selling assets. In particular, banks would expect to dispose of approximately €610 billion of central government and central bank assets. Figure 4-12 shows the decomposition of this €610 billion into reductions in exposure to governments (€462 billion) and to central banks (€151 billion). The other main categories were reductions in exposure to institutions (€376 billion) and to corporates (€150 billion).

Prices and liquidity in certain sovereign bond markets could be affected by such actions. To assess this, we assume that banks reduce their exposure to each sovereign in proportion to their end-2013 holdings (cf. Alogoskoufis and Langfield, 2018). In this case, the most affected sovereigns in absolute terms would be France (€75 billion), Germany (€49 billion) and the Netherlands (€39 billion), as shown in Figure 4-13. Relative to outstanding central government debt, the most affected sovereigns would be the Netherlands, Belgium and Finland, since banks would sell 11%, 9% and 9%, respectively, of the total debt stocks of these countries.

Banks' reliance on disposals of sovereign debt to fill their funding gap has mixed implications for systemic risk. On one hand, sovereign debt markets are typically highly liquid and would therefore be less price-sensitive, mitigating the fire sale impact on CET1. On the other hand, the envisaged reductions in exposures to sovereigns are large, amounting to up to 11% of the debt stock. In the extreme, this could exacerbate sovereign risk and aggravate bank risk owing to the bank-sovereign nexus (Brunnermeier et al., 2017). However, given that debt dynamics in the most affected countries are stable, it is likely that non-bank institutions would be willing to increase their holdings such that the overall impact on bond yields would be relatively small.

Figure 4-13

Reductions in banks' exposures to central government (ten most affected countries)

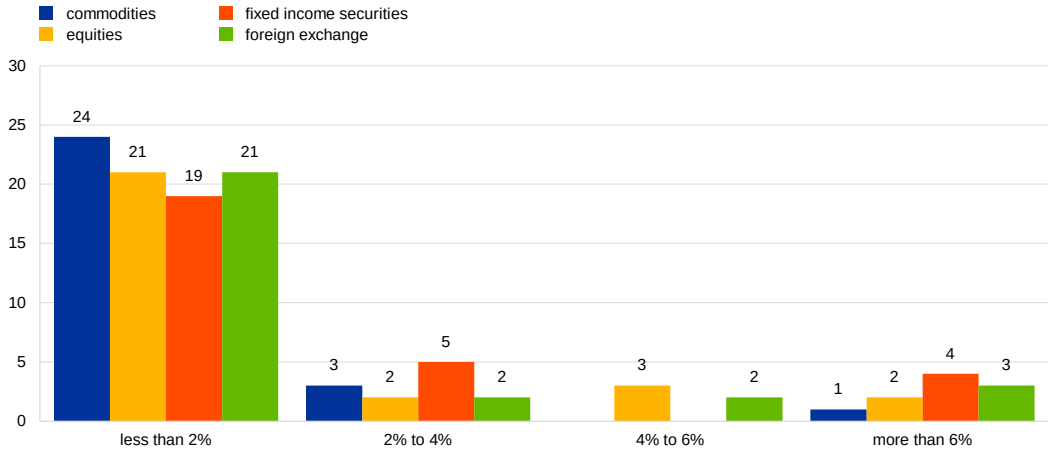


Source: EBA stress test 2014.
Note: The figure shows the reductions in banks' exposures to central government in a hypothetical stress scenario. Sample banks are assumed to reduce their sovereign exposures in proportion to their end-2013 holdings.

Individually, banks' presence in asset markets is small, but this does not rule out a potential asset price impact from common sales. To shed more light on the price impact of asset disposals, the survey asks banks to identify market segments in which they have a large presence. As shown in Figures 4-14 and 4-15, survey responses indicate that banks do not expect to see a significant impact on market prices if they were to liquidate some trading book positions within the space of two weeks. This might reflect the post-crisis reduction in the size of, and risk borne in, banks' trading books. Nevertheless, taken together, banks do have a significant presence, and simultaneous sales could move markets, as shown above in the case of sovereign debt.

Figure 4-14

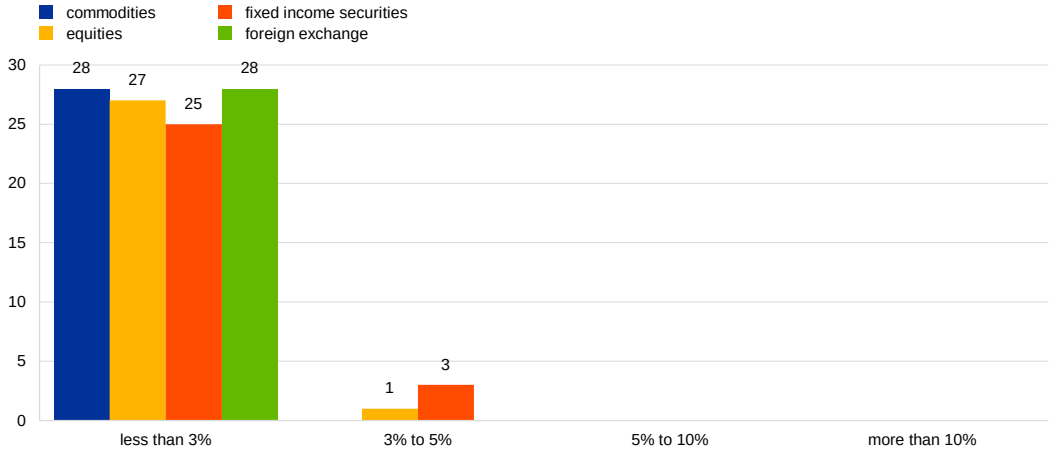
Number of banks reporting a given market share for exposures in the trading book



Source: ESRB and EBA.
Note: The figure shows the number of sample banks reporting a given market share for exposures in the trading book.

Figure 4-15

Number of banks reporting expected price movements due to unwinding of positions



Source: ESRB and EBA.
Note: The figure shows the number of banks reporting expected price movements due to an unwinding of their trading book positions.

4.2.2 Liquidity hoarding

In terms of funding increases, the banking sector in aggregate would try to fill the gap primarily through an increase in secured funding. Banks reported that, of the €766 billion in funding increases, €329 billion (43%) would reflect an increase in secured funding via private repo markets, and €138 billion (18%) would reflect an increase in secured market issuance (Figure 4-12). The remaining €437 billion (39%) is evenly spread between retail funding and central bank funding. Increasing retail funding could, however, be a zero sum game for the banking industry, unless additional savings could be mobilised through higher interest rates on retail deposits (at the expense of profitability).

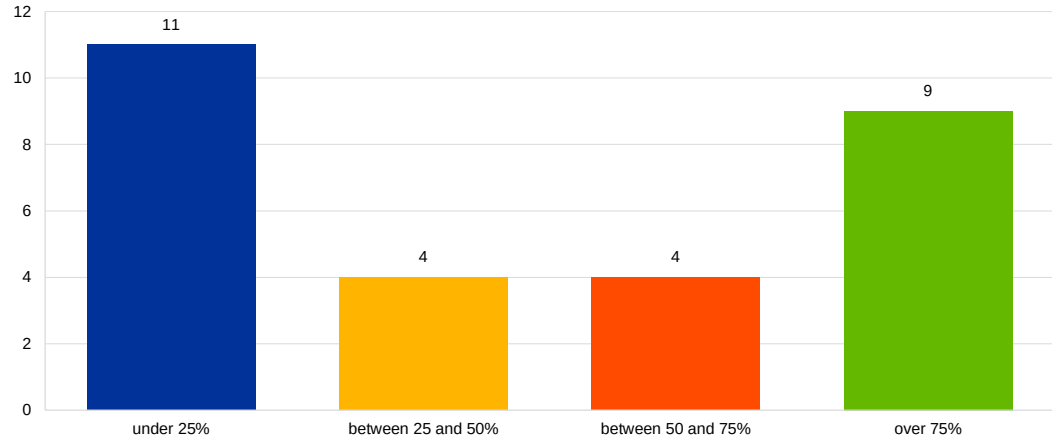
Banks' aggregate responses on their reductions in assets to fund cast doubt on whether a substantial increase in secured funding would be feasible. Banks reported that, of the €1,160 billion reduction in assets, one-third (€376 billion) would come from a reduction in exposures to other financial institutions. The survey results do not reveal to what extent banks' responses include any reduction in exposures to other banks that would arise from the assumed closure of unsecured funding markets. While it is thus not clear whether and to what extent banks would try to hoard liquidity, the result casts doubt on whether increases in secured funding of €329 billion via private repo markets and €138 billion via secured market issuance would be feasible in an environment in which banks are cutting exposures to other financial institutions.

The majority of banks would rely heavily on a single strategy, pointing to potential risks if that strategy proves more difficult to pursue than anticipated. Although aggregate results indicate a 40/60 split between increases in funding and reductions in assets to fund, this is not mirrored in the responses of individual banks. Panel A of Figure 4-16 depicts the frequency of banks relying to a given extent (from under 25% to over 75%) on increased funding to close the €2,000 billion funding gap. It shows that nine of the 28 participating banks expect to fill 75% or more of their individual funding gap through such increases, while 11 banks would expect to fill 25% or less of their individual funding gap through increases in funding, implying that they would rely instead on reductions in assets. Panels B and C of Figure 4-16 provide a similar breakdown within the two strategies. Four banks would fill 75% or more of their individual funding gap by reducing their exposure to central banks or governments. Such a heavy reliance on a single strategy poses risks if that strategy proves more difficult to pursue than anticipated.

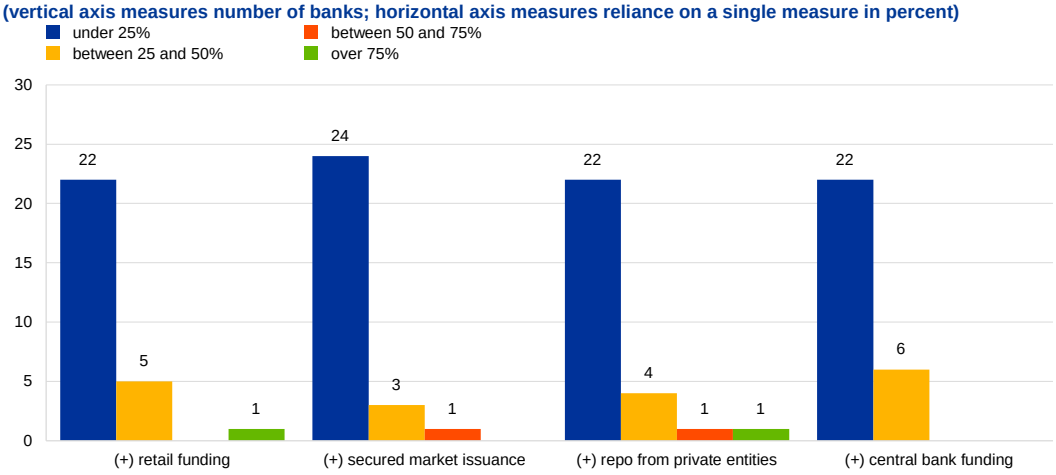
Figure 4-16

Reliance on a single strategy to close the funding gap

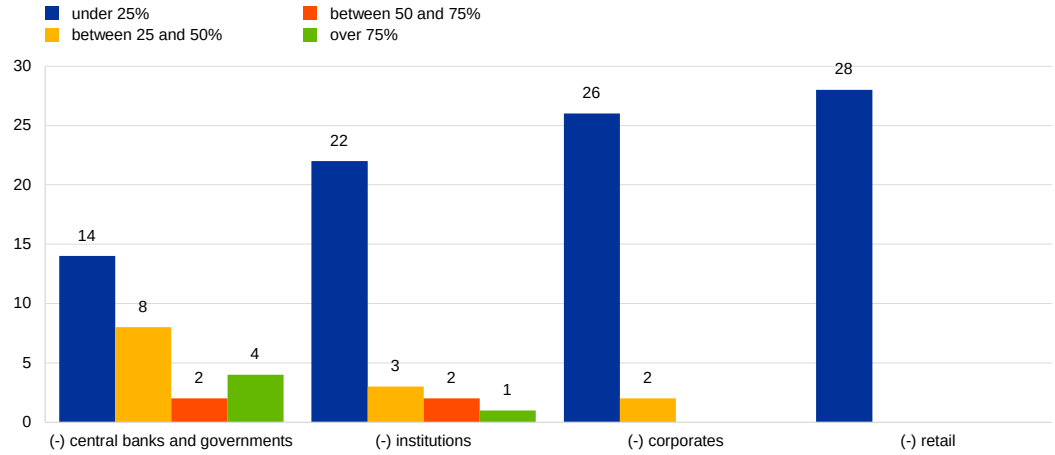
Panel A: Reliance on increases in funding to close the total funding gap
(vertical axis measures number of banks; horizontal axis measures reliance on a single measure in percent)



Panel B: Reliance on increasing various funding sources to close the total funding gap
(vertical axis measures number of banks; horizontal axis measures reliance on a single measure in percent)



Panel C: Reliance on reducing exposures to various asset classes to close the funding gap
(vertical axis measures number of banks; horizontal axis measures reliance on a single measure in percent)



Source: ESRB and EBA.
Note: The figure reports banks' strategies to close the funding gap. The extent to which banks rely on a particular strategy is inferred from their answers to question Q3(b) of the banking sector survey (see Annex B).

5 The insurance sector survey

This section describes the results of the macroprudential survey complementing the EIOPA 2014 insurance stress test. The EIOPA stress test was based on two adverse scenarios designed by the ESRB (ESRB, 2014b). The survey is based on one of those scenarios: shocks in corporate bond markets followed by adverse shocks in sovereign bond, equity, swap and real estate markets. The shocks in the scenarios were applied to balance sheets as at 31 December 2013. The insurance survey solicited reactions to the relevant scenario in the short term (i.e. within six months of the end of 2013) and over the medium term (beyond six months). The 166 insurers that responded to the survey held €6,100 billion of assets in 2013, equivalent to about 45% of EU GDP.

The survey provides several insights into potential second-round effects from insurers' collective response to the adverse scenario. First, insurers report that they would respond to the adverse scenario in different ways, assuaging concerns about herding and consequent feedback loops. Second, the survey results do not point to large-scale forced sales of one type of asset. But some insurers indicated that their presence in domestic corporate and sovereign bond markets was large enough for their actions to move these markets, thereby creating a risk of fire sale effects. Third, the survey provides little evidence that second-round effects were likely to arise through a retrenchment of credit supply, excessive risk-taking or liquidity hoarding. However, as insurers responded that they would react to a reduction in interest rates by extending the maturity of their assets, their collective action might further suppress long-term yields, thereby exacerbating their solvency positions.

A comparison with the potential second-round effects of banks' collective response should take into account the differences between the two exercises. The effects of insurers' responses to their stress scenario are mild compared with the effects of banks' responses to the banks' stress scenario. This is partly explained by the greater systemic relevance of the banking sector compared with the insurance sector. But it is also partly explained by two differences in the design of the scenarios and surveys. First, while insurers were tested under a solvency stress scenario only, banks were also tested under a funding stress scenario owing to their different business model. Second, in contrast to banks, insurers were not asked to report their internal capital targets. This made it impossible to quantify the impact of the reported actions to restore capital shortfalls to those internal targets.

5.1 Measures affecting solvency

Under the adverse scenario, the insurance industry would have faced a significant capital shortfall relative to regulatory requirements. Solvency II[5] requires insurers to have sufficient eligible own funds (EOF) to cover their Solvency Capital Requirement (SCR).[6] The adverse scenario caused eligible own funds of participating insurers to drop from nearly €700 billion to below €600 billion. Under the adverse scenario, 27% of the insurers (15% of the large insurers and 30% of the small and medium-sized insurers) would not have met their (pre-stress) SCR.[7] This implies a total capital shortfall of €21 billion.

Most insurers indicated that they would take action in response to the adverse scenario. In addition to the 27% of insurers that would be obliged to take short-term actions due to their capital shortfall under the adverse scenario, 40% of insurers responded that they would voluntarily take short-term actions to meet their internal capital targets. These insurers together represent €3,200 billion of assets. The remaining 33% of insurers, representing €3,000 billion of assets, replied that they would not take any short-term action. Over the medium-term, three-quarters of insurers would take action to support profitability. The remainder said that they would not take any action, mostly because they expected their profitability to be sufficiently robust under the adverse scenario to support their long-term strategy.

Insurers' reported short-term actions do not indicate systematic herding behaviour. Insurers were asked to decompose their short-term action into various categories, including capital measures (equity or subordinated debt issuance and dividend retention) and measures on the asset and liability sides of their balance sheets. Insurers reported three different types of action on average, indicating that most insurers would follow a range of strategies. Asset sales was the most frequently mentioned category (Figure 5-1). But insurers placed a lower weight on asset sales than, for example, equity or subordinated debt issuance and dividend retention. As a result, weighted short-term actions were more evenly split between asset sales, dividend retention, equity or subordinated debt issuance, and "other", while reduction of liabilities accounted for the smallest share.

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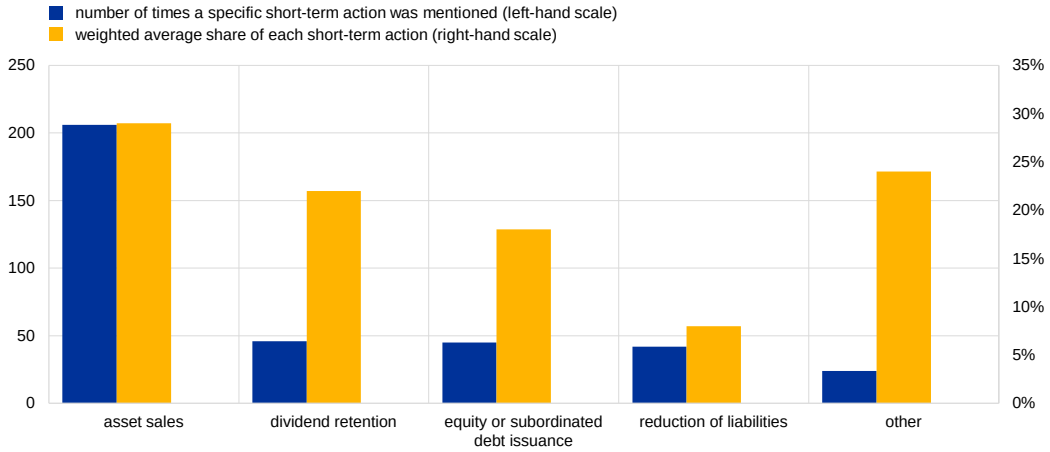
5 Directive 2009/138/EC of the European Parliament and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II) (OJ L 335, 17.12.2009, p. 1).

6 Solvency II contains two capital requirements: a Solvency Capital Requirement (SCR), and a Minimum Capital Requirement (MCR), which is lower than the SCR. Together they form a ladder of intervention: in the event of a breach of their SCR, insurance companies need to submit a recovery plan, which should enable them to close the gap with their SCR; in the event of a breach of their MCR, supervisory authorities may take more substantial measures, such as the withdrawal of the permit to write new insurance policies. The ESRB survey focused on the gap with the SCR of insurers.

7 See Figures 44 to 47 in EIOPA (2014a). In reality, insurers would recalculate their SCRs post-stress and this would result in a different shortfall, but this recalculation was not part of EIOPA's 2014 stress test.

Figure 5-1

Short-term actions taken by insurers in response to the stress scenario



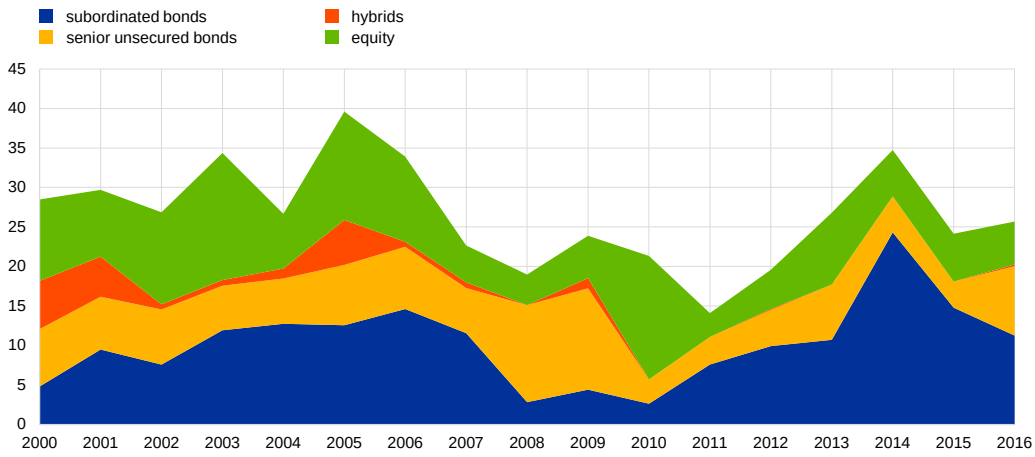
Sources: ESRB and EIOPA (2014a).
Note: The figure reports the short-term actions taken by insurers in response to the stress scenario. In total, 363 individual actions were mentioned by 111 insurers. In the survey, insurers were able to mention more than one action and had to give a weight to each action. The average shares of the actions were weighted using the total assets of each reporting insurer.

Estimates point to additional capital issuance by insurers of at least €5.5 billion. Because internal capital targets are unknown, it is difficult to assess the absolute amounts of capital issuance. Instead, the focus is on insurers with a capital shortfall relative to the regulatory solvency requirement. Those insurers reported that they would close a quarter of the shortfall by issuing capital or subordinated debt, i.e. total capital issuance of €5.5 billion in addition to their normal issuance in the absence of an adverse scenario. This seems feasible as it represents only a quarter of the average yearly capital issuance over 2000-16 (Figure 5-2).

Figure 5-2

Equity and debt issuance by European life and non-life insurers

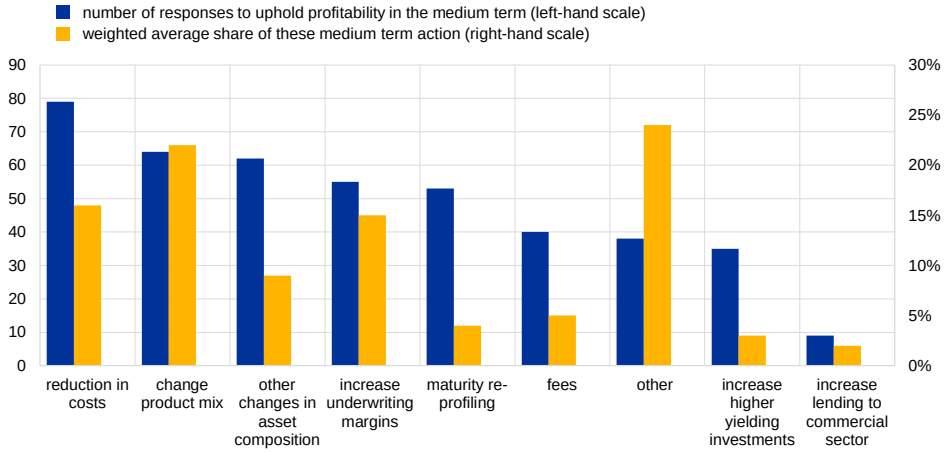
(in € billions)



Source: Dealogic Analytics.
Note: The figure shows a time series of the equity and debt issuance by European life and non-life insurers.

Responses do not indicate substantial medium-term herding behaviour to uphold profitability. Insurers were asked how they would maintain profitability over the medium term if the adverse scenario were to persist. On average, insurers reported that they would take four actions, of which “reduction of costs”, “change of product mix”, “change of asset portfolio” and “increase in underwriting margins” were the most prominent (Figure 5-3). There was little difference between the responses of small and large insurers, except that smaller insurers were more inclined to change their asset mix, whereas larger insurers, which tend to offer a broader range of products, were more inclined to change their product mix.

Figure 5-3
Medium-term actions taken by insurers in response to the stress scenario



Source: ESRB and EIOPA (2014a).
Note: The figure shows the medium-term actions taken by insurers in response to the stress scenario. In total, 435 individual actions were mentioned by 119 insurers. Insurers were able to mention more than one action and had to give a weight to each action. The average shares of the actions were weighted using the weight that each insurer attached to them and the weight of the total assets of that insurer.

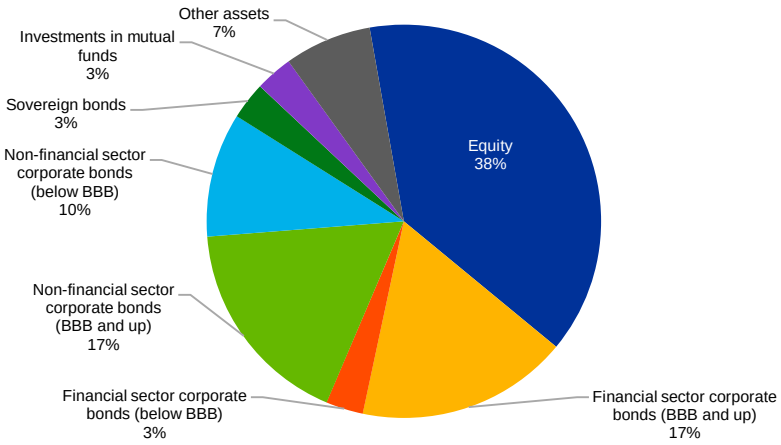
5.1.1 Retrenchment of credit supply

Insurers said that they would sell corporate bonds under the adverse scenario; such actions could contribute indirectly to a credit crunch. Figure 5-1 shows that 29% of all weighted short-term actions involved a change in the asset portfolio. Figure 5-4 depicts the distribution of sales by asset class. It shows that, of the asset portfolio changes indicated by insurers, 27% concerned the sale of non-financial corporate bonds and 20% financial corporate bonds. Such sales could indirectly contribute to a credit crunch by making it harder for non-financial corporates to finance themselves and for banks to fund their lending.

Figure 5-4

Distribution of short-term sales by asset class

(in percent)



Source: ESRB and EIOPA (2014a).
Note: The figure reports the distribution of insurers' short-term sales by asset class. The average shares of the actions were weighted using the weight that each insurer attached to them and the weight of the total assets of that insurer.

Estimates suggest that any indirect contribution to a possible credit crunch that might result from the adverse scenario materialising would be small. To ascertain whether the magnitudes of corporate bond sales are likely to matter in practice, we estimate the euro amounts of such sales.[8] In aggregate, insurers with a capital shortfall relative to their pre-stress SCR indicated that they would close 16% of their aggregate €21.1 billion shortfall (i.e. €3.4 billion) by selling financial and non-financial corporate bonds. Assuming that insurers would invest the proceeds of these sales in sovereign bonds (which have no capital charge in the Pillar 1 standard formula of Solvency II), the euro amounts of assets that need to be sold can be calculated by using the stand-alone capital charges of the different asset classes.[9] The indicated actions of insurers translate into a sell-off of €24 billion of non-financial corporate bonds and €17 billion of financial corporate bonds (Figure 5-5). This is less than 3% of the combined non-financial and financial corporate bonds held by this sample of insurers, and less than 0.5% of the entire EU corporate bond market. This suggests that the indirect contribution to a possible credit crunch under the adverse scenario would be small relative to the effects in the banking sector.

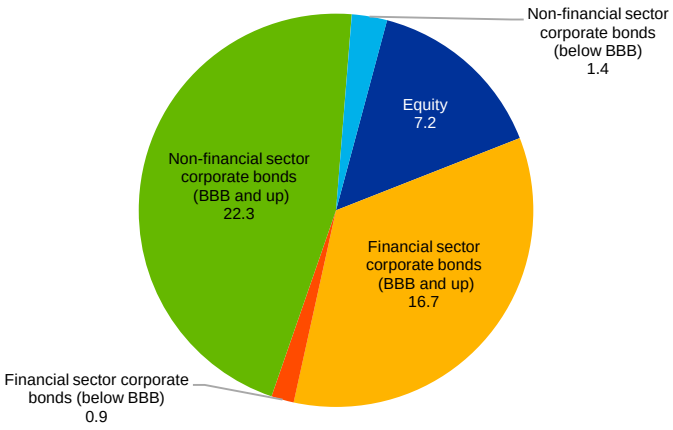
8 This estimate is a lower bound, because the data needed are only available for those insurers with a capital shortfall relative to their SCR. The estimate therefore excludes the sale of corporate bonds by insurers facing a shortfall relative to their internal solvency target.

9 This is a rough estimation, because the capital requirement change following marginal asset portfolio changes is also affected by factors other than the stand-alone capital requirement, such as diversification effects. This means that the estimated amount of assets to be sold should be regarded as a lower bound.

Figure 5-5

Estimates of amounts of asset sales

(in € billions)



Source: ESRB and EIOPA (2014a).

Note: The figure reports estimates of the amounts of asset sales by category. Only those insurers with a capital shortfall are included in this figure. Based on the ratings and durations of the corporate bonds held (EIOPA, 2014a) and the Solvency II capital requirements for market risk (Articles 169 and 176), the following stand-alone capital charges have been applied to the asset classes: 39% for equity, 8% for investment-grade corporate bonds and 16% for non-investment-grade corporate bonds.[10]

The survey did not reveal other contributions of insurers to a possible credit crunch in the adverse scenario. Because (securitised) loans and mortgages – the most direct form of credit provided by insurers – account for only a small part of insurers' assets, the survey did not ask insurers about changes in these holdings. Insurers rarely mentioned these categories in their explanations for the category "other assets", which accounts for only 7% of the short-term asset change (Figure 5-4). Moreover, only nine insurers (representing 2% of the weighted average actions) mentioned an increase in direct loans to the commercial sector as a medium-term action to bolster profitability. Insurers also provided no information on whether they would reduce the provision of certain types of insurance, such as trade credit insurance, that are closely related to credit provision.

[10] See Commission Delegated Regulation (EU) 2015/35 of 10 October 2014 supplementing Directive 2009/138/EC of the European Parliament and of the Council on the taking-up and pursuit of the business of Insurance and Reinsurance (Solvency II) (OJ L 12, 17.1.2015, p. 1).

5.1.2 Excessive risk-taking

Insurers seem hesitatnt to divest from high-yield bonds, perhaps indicating a willingness to take risks. Insurers reported that they would divest more investment-grade bonds than non-investment-grade bonds as an immediate response to the adverse scenario (Figure 5-4), even though the latter carry much higher capital charges and were subject to a severe shock in the adverse scenario of the stress test. This might indicate a tendency to search for yield as an immediate response or a hesitance to sell in the less liquid non-investment-grade bond markets.

However, there were few indications that insurers would take excessive risks through a large-scale search for yield or by expanding direct lending aggressively. Of the 106 reported changes in asset portfolios, 35 insurers indicated that they would increase their investments in higher-yielding assets, representing only 3% of the weighted average actions. Responses suggest even less inclination to increase direct lending (nine companies, representing 2% of the weighted average actions). Overall, the responses thus provide little indication that insurers would engage in excessive risk-taking to maintain profitability over the medium term.

Insurers' preference to match their assets with long-term liabilities could add to the downward pressure on long-term bond yields. Some insurers indicated that they would increase the duration of their assets to better match the duration of their liabilities. Changing the average maturity of assets was mentioned 38 times, representing 4% of all weighted medium-term actions. Adjusting maturities and thereby matching the duration of assets and liabilities is prudent practice. But if many insurers were to increase their investments in long-term bonds, then yields in this relatively illiquid market segment could be pushed below the already low levels assumed in the stress scenario. This in turn would put further pressure on insurers' solvency, as their long-term liabilities would be discounted at even lower rates. This possible behaviour is in line with the behaviour exhibited by German life insurers in 2014, which may have contributed to a flattening of the German yield curve (Domanski et al., 2017).

5.2 Measures affecting liquidity

Insurers do not expect lapses to increase, thereby avoiding any pressure on liquidity positions that might otherwise occur. Only 14% of the insurers foresee a significant increase in lapses. Most insurers that do not foresee a significant increase in lapses pointed to rigid insurance contracts and unfavourable consequences of lapses for policyholders and noted that, historically, lapse rates have been stable. As a significant increase in lapse rates under the adverse scenario would have been a factor that might have forced insurers to sell assets, its absence would tend to alleviate such pressure.

5.2.1 Forced asset sales

Responses do not point to a large-scale sale of a single type of asset in the adverse scenario. Figure 5-4 shows that, of the asset portfolio changes indicated by insurers, about one-third concerned the sale of equities, one-third concerned the sale of investment-grade corporate

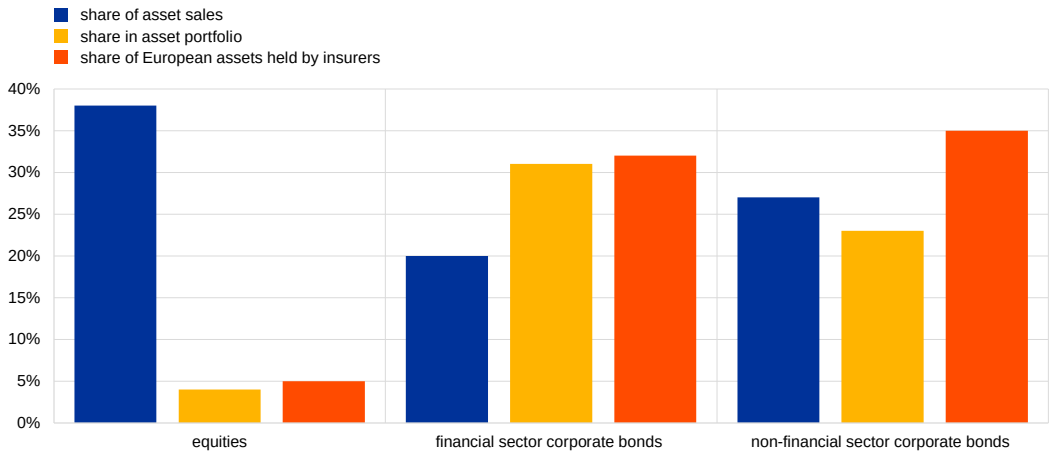
bonds (financial and non-financial), and the remaining third concerned the sale of non-investment-grade bonds, investments in mutual funds, sovereign bonds and other assets.

The sale of equity stands out, considering that insurers' equity holdings are small relative to their bond holdings. This result could reflect capital requirements in Solvency II, which are higher for equity holdings than for bonds (Figure 5-6). The outcome is consistent with an empirical study on asset portfolio changes following the dot-com crash (Bank of England, 2014b).

Figure 5-6

Shares of equities and financial and non-financial corporate bonds in asset divestments by insurers versus shares in asset portfolios and European market shares

(in percent)



Source: ESRB, EIOPA (2014a) and IMF (2015).
Note: The figure reports the shares of equities and financial and non-financial corporate bonds in asset divestments by insurers.

Corporate bond sales may have more of an impact than equity sales, given insurers' large presence in bond markets. Figure 5-6 compares the shares of asset sales in Figure 5-4 with insurers' presence in European asset markets (IMF, 2015). It shows that the impact of even large sales of equities is mitigated by the small share of insurers' equity holdings relative to the size of European equity markets. It also shows that the impact of a sell-off of financial and non-financial corporate bonds in these bond markets may be significant, given that insurers' holdings are large relative to the size of European bond markets.

Although insurers' responses suggest that they typically cannot move markets, there are some notable exceptions. Most insurers replied that, individually, they do not constitute a presence in any market that would be sufficiently large for their actions to move the market. Explanations given include the size of the asset portfolio relative to the various markets, the high degree of diversification within asset portfolios (both across sectors and across asset classes), and the above-average liquidity of the assets in which insurers tend to invest. A notable exception is sovereign bond markets, in which insurers have a large presence (ESRB, 2015). Examples mentioned include government bonds issued by smaller countries (e.g. Croatia, Latvia and Malta), some government bonds of medium-sized and larger countries (e.g. Belgium, France, Italy and Portugal), and bonds issued by municipalities and other non-central governments. Other exceptions

include UK corporate bonds, Danish mortgage and index bonds, the Nasdaq OMX Nordic market, Icelandic covered bonds, local commercial and rural real estate investments, and Norwegian securities markets. Certain derivatives, in particular long-term euro interest rate swaps and interest rate swaptions, were also mentioned, reflecting insurers' significant presence in these markets (Abad et al., 2016).

5.2.2 Liquidity hoarding

Insurers' funding needs in stress scenarios are unlikely to contribute to liquidity shortages elsewhere. Insurers run little funding risk thanks to their "inverted production cycle", and therefore have little incentive to hoard liquidity. The estimated €5.5 billion of capital issuance is small compared with the funding needs in the banking sector. The remaining channel through which insurers may affect liquidity is their investments in bank debt.

The amount of financial sector corporate bond sales by insurers does not suggest a funding liquidity risk for banks. Sales of financial sector corporate bonds make up 20% of short-term asset sales (Figure 5-4), which constitute 29% of total weighted short-term actions (Figure 5-1). In absolute terms, this sell-off is estimated to amount to at least €17 billion (Figure 5-5), which is less than 1% of outstanding amounts of debt securities issued by euro area banks. Thus, it is not expected that, in the adverse scenario, banks would encounter major funding restrictions as a result of the selling-off of financial sector corporate bonds by insurers.

6 Conclusion

The importance of feedback loops in an interconnected financial system requires a toolkit that allows stress tests to take them into account. The simplifying assumptions that large-scale microprudential stress tests need to make for operational reasons result in a loss of information about feedback loops. Top-down stress test models provide valuable insights, but they are based on ad hoc behavioural assumptions. A broader toolkit is therefore needed to complement existing bottom-up and top-down approaches.

This paper shows how surveys of financial institutions' responses to shocks can form part of a toolkit to shed light on feedback loops. Taken in isolation, measures taken by financial institutions to restore solvency positions and manage their liquidity can be optimal strategic responses. But they can be self-defeating if financial institutions herd into common strategies that can result in a broad retrenchment of credit supply, fire sales of assets, or liquidity hoarding. This paper describes how such herding behaviour can be revealed "from the horse's mouth" by asking financial institutions how they would respond to shocks. The surveys designed by the ESRB thus provide a macroprudential overlay to the large-scale microprudential stress tests that have become a cornerstone of post-crisis financial supervision.

The surveys relate to the 2014 stress tests of the EBA and EIOPA. Focusing on responses that would be of interest to policymakers during financial stress, the surveys reveal that banks would tend to herd into common strategies in response to adverse macroeconomic conditions. The consequences of this herding behaviour could be large, potentially undoing the effects of banks' remedial actions. In contrast, the surveys reveal little evidence of herding behaviour among insurance companies in response to the stress simulated in the stress scenario.

Although the surveys provide useful insights into the behaviour of banks and insurers, they have a number of limitations. In particular, the surveys are unable to capture the full set of interactions in the financial system and the economy. First, the surveys focus only on the initial reaction to stress within a sector. In equilibrium, second-round responses would interact with each other and the broader economy. This would include other parts of the financial system not considered in the surveys (e.g. pension funds and investment funds), the non-financial system (e.g. non-financial corporates) and responses by policymakers. During times of stress, some parts of the financial system might behave similarly, amplifying initial shocks. Other parts of the financial system might behave differently and have a dampening effect. Actions by policymakers would aim to stabilise the financial system and the economy.

Subsequent surveys complementing the stress tests of the EBA and EIOPA have tried to address some of these limitations. This paper provides a "proof of concept" by describing the design of the first generation of surveys and summarising the results from their pilot application to the banking and insurance stress tests in 2014. Since then, the surveys have continued to develop. Aggregate results have been discussed in workshops with participating institutions, and the surveys have become part of the discussion of the stress test results in the ESRB and ESAs. In addition to providing useful insights for policymakers, the surveys can help financial institutions and supervisors to better understand how recovery strategies and contingency plans might be vulnerable to herding by such institutions into similar strategies.

Annex A
Banks in the survey sample

Name of institution	Country	Total assets (€ billions, 2013)	Total risk exposure (€ billions, 2013)
HSBC Holdings plc	UK	1,938	880
BNP Paribas SA	FR	1,810	622
Crédit Agricole Group	FR	1,688	544
Barclays plc	UK	1,615	530
Deutsche Bank AG	DE	1,611	353
The Royal Bank of Scotland Group plc	UK	1,235	514
Société Générale SA	FR	1,214	343
Banco Santander SA	ES	1,115	540
Lloyds Banking Group plc	UK	1,012	328
UniCredit SpA	IT	825	408
ING Groep N.V.	NL	787	298
Groupe BPCE	FR	719	410
Nordea Bank – group	SE	630	163
Intesa Sanpaolo SpA	IT	624	284
Banco Bilbao Vizcaya Argentaria SA	ES	582	345
Commerzbank AG	DE	549	217
Coöperatieve Centrale Raiffeisen-Boerenleenbank B.A.	NL	479	210
Danske Bank	DK	432	120
Deutsche Zentral-Genossenschaftsbank AG	DE	385	99
Criteria Caixa Holding S.A.	ES	340	170
Skandinaviska Enskilda Banken – group	SE	280	68
Svenska Handelsbanken – group	SE	280	53
Landesbank Baden-Württemberg	DE	274	88
BFA Tenedora De Acciones S.A.	ES	269	105
Bayerische Landesbank	DE	255	93
KBC Group NV	BE	206	92
La Banque Postale	FR	201	57
Banca Monte dei Paschi di Siena SpA	IT	198	81
Total		21,565	8,029

Sources: EBA stress test 2014 and S&P Global Market Intelligence.
Note: Average risk weight is calculated by dividing total risk exposure by total assets.

Annex B
Template of the banking sector survey

Q1(a): What is your institution's fully loaded end-2016 CET1/RWA capital ratio under the adverse scenario of the EBA stress test? [11]

____%

Q1(b): Based on the same definition for the CET1/RWA capital ratio, what is your institution's internal target CET1/RWA capital ratio for end-2018?

____%

[11] This number should be the same as in the last column of Table 5 in the **EBA report on the results of the 2014 EU-wide stress test**.

Q1(c): Assuming that the adverse scenario materialises between the start of 2014 and end-2016, such that your institution's CET1/RWA capital ratio at end-2016 reaches the level indicated in your answer to question Q1(a), from this position at the end of 2016, how would you return to your institution's internal target CET1/RWA capital ratio indicated in your answer to question Q1(b) by end-2018?[12]

	Action	Change
1	**Change in capital levels**	**p.p.**
	of which:	
1i	Equity issuance net of buybacks	p.p.
1ii	Profitability	p.p.
1iii	Earnings retention rate	p.p.
2	**Change in risk-weighted assets for credit risk**	**p.p.**
	of which:	
2i	Owing to recalibration of internal models	p.p.
2ii	Owing to a change in credit exposures	p.p.
	of which:	
2ii(a)	Central banks and central governments	p.p.
2ii(b)	Institutions	p.p.
2ii(c)	Corporates	p.p.
	of which:	
2ii(c)i	SMEs	p.p.
2ii(c)ii	Specialised lending	p.p.
2ii(d)	Retail	p.p.
	of which:	
2ii(d)i	Qualifying revolving	p.p.
2ii(d)ii	Retail secured on real estate	p.p.
2ii(d)ii(1)	of which: SMEs	p.p.
2ii(d)iii	Other retail	p.p.
2ii(d)iii(1)	of which: SMEs	p.p.
3	**Change in risk-weighted assets for market risk**	**p.p.**
4	**Other** (please specify if applicable)	**p.p.**
5	**Sum of Items 1, 2, 3 and 4**	**p.p.**

Notes: Please provide percentage points (p.p.) reflecting the extent to which you would rely on those actions should the adverse scenario materialise. For example, if your institution's fully loaded end-2016 CET1/RWA capital ratio was 8% under the adverse scenario and your institution's fully loaded internal target CET1/RWA capital ratio by the end of 2018 was 13%, the entry under Item 5 would be 5 p.p. The sum of Items 1, 2, 3 and 4 should be the same as this entry of 5 p.p.

[12] Between end-2016 and end-2018, assuming that GDP grows at 2% per annum across the EU and that other macro-financial variables adjust accordingly.

Q1(d): Assuming that your institution is able to adjust its balance sheet in response to the adverse scenario already prior to end-2016, how much of the capital ratio adjustment to reach your institution's end-2018 target described under Q1(c) Item 5: (i) occurred before end-2014; (ii) would occur between end-2014 and end-2016; and (iii) would occur between end-2016 and end-2018?

(i)____p.p.

(ii)____p.p.

(iii)____p.p.

Note: The sum of the numbers provided should be the same as the figure provided under Q1(c) Item 5.

Q1(e): Of the total change in credit exposures (Q1(c) Item 2ii),

- **what would be the percentage point change in your institution's CET1/RWA capital ratio owing to a change in credit exposures to entities in your home country?**
- **what would be the percentage point change in your institution's CET1/RWA capital ratio owing to a change in credit exposures to entities outside of your home country?**

(i) ____p.p. owing to the change in credit exposures to entities in home country

(ii) ____p.p. owing to the change in credit exposures to entities outside of home country

Note: The sum of the numbers provided should be the same as the figure provided under Q1(c) Item 2ii.

Q1(f): Based on your answer to question Q1(e)ii (if applicable), what would be the percentage point change arising from the disinvestment of foreign subsidiaries?

Q1(g) Assuming that all institutions are able to adjust their balance sheets in response to the adverse scenario prior to end-2016, how do you expect aggregate credit exposures (i.e. credit exposures across the banking sector) to develop in your home country between end-2014 and end-2018?

(i) ___to fall by more than 5%

(ii) ___to fall by up to 5%

(iii) ___to stay unchanged

(iv) ___to rise by up to 5%

(v) ___to rise by more than 5%

Q2: Given your answer to Q1(c) Item 1ii, how would you increase profitability by end-2018?

	Action	
1	**Reduction in costs**	**p.p.**
	of which:	
1i	Funding costs	p.p.
1ii	Other costs	p.p.
2	**Increase in revenue**	**p.p.**
	of which:	
2i	Fees	p.p.
2ii	Lending rates	p.p.
	of which to:	
2ii(a)	Central banks and central governments	p.p.
2ii(b)	Institutions	p.p.
2ii(c)	Corporates	p.p.
2ii(c)i	of which: SMEs	p.p.
2ii(d)	Retail	p.p.
2iii	Asset composition	p.p.
	of which:	
2iii(a)	Central banks and central governments	p.p.
2iii(b)	Institutions	p.p.
2iii(c)	Corporates	p.p.
2iii(c)i	of which: SMEs	p.p.
2iii(d)	Retail	p.p.
2iv	Takeovers	p.p.
2v	Diversification into non-bank business	p.p.
3	**Other** (please specify if applicable)	**p.p.**
4	**Sum of Items 1, 2, and 3**	**p.p.**

Notes: Please provide percentage points (p.p.) reflecting the extent to which you would rely on those actions should the adverse scenario materialise. The sum of Items 1, 2 and 3 should be the same as your answer to Q1(c) Item 1ii.

Q3(a): At end-2014 what was your institution's:

(i) private wholesale funding[13] as a percentage of total assets?

(ii) private wholesale unsecured funding as a percentage of total assets?

[13] Private wholesale funding includes both wholesale deposits and debt funding.

(iii) private wholesale unsecured funding with a residual maturity of less than six months as a percentage of total assets?

(i) ___%

(ii) ___%

(iii) ___%

Q3(b): Starting from now, how would you adjust your funding strategy in response to a closure of all unsecured private wholesale debt funding markets that you expect to persist for at least six months?

	Action	Change
1	**Increase in funding**	**%**
	of which:	
1i	Retail funding	%
1ii	Secured market issuance	%
1iii	Repo funding from private entities	%
1iv	Central bank funding	%
1v	Other (please specify)	%
2	**Reduction in assets to fund**	**%**
	of which:	
2ii(a)	Central banks and central governments	%
2ii(b)	Institutions	%
2ii(c)	Corporates	%
	of which:	
2ii(c)i	SMEs	%
2ii(c)ii	Specialised lending	%
2ii(d)	Retail	%
	of which:	
2ii(d)i	Qualifying revolving	%
2ii(d)ii	Retail secured on real estate	%
2ii(d)ii(1)	of which: SMEs	%
2ii(d)iii	Other retail	%
2ii(d)iii(1)	of which: SMEs	%
3	**Other** (please specify if applicable)	**%**
4	**Sum of Items 1, 2 and 3**	**%**

Notes: Please provide percentages reflecting the extent to which you would rely on the actions should the shock materialise (e.g. if you would meet 30% of the funding needs resulting from a closure of unsecured wholesale debt funding markets through an increase in retail funding, the entry under Item 1i would be 30). Percentages should sum to 100%.

Q4(a): For exposures in the trading book, in which of the following market segments (equities, fixed income securities, commodities, foreign exchange) is the market share of your institution: (i) more than 2%; (ii) more than 4%; and (iii) more than 6%?

Q4(b): In which of these market segments is the market share of your institution so large that, if you had to unwind your positions within two weeks, you would expect to move the market by: (i) more than 3% but less than 5%; (ii) more than 5% but less than 10%; or (iii) more than 10%?

Note: Please provide details to Q4(a) in the comments box (for example, “equities, in particular emerging market equities”).

Comments

Annex C
Template of the insurance sector survey

Q1: Assuming the shocks in the adverse financial market scenario CORP[14] are sustained, how would you react in order to restore a capital shortfall relative to the SCR or to your own capital position target within six months?

	Action	Percentage
	Increase in capital levels, of which:	
1	Equity and/or subordinated debt issuance	%
2	Dividend retention	%
	Reduce risk on the asset side by the sale of:	
3	Sovereign bonds	%
	Financial sector bonds, of which	
4	Investment-grade financial sector bonds (BBB and up)	%
5	Non-investment-grade financial sector bonds (below BBB)	%
	Non-financial corporate bonds, of which	
6	Investment-grade corporate bonds (BBB and up)	%
7	Non-investment-grade corporate bonds (below BBB)	%
8	Investments in mutual funds	%
9	Equity	%
10	Other assets (e.g. real estate, participations; please specify)	%
	Reduce liabilities, of which:	
11	Increase reinsurance of in force business	%
12	Sale of in force business	%
13	Reduce new business	%
14	**Other (please specify)**	%
	Sum of rows 1-14	100%

Notes: Please provide percentages reflecting the extent to which you would rely on those actions should the adverse scenario materialise (e.g. if you would meet 30% of a capital shortfall through equity issuance, the entry in row 1 would be 30). Percentages should sum to 100%.

Please add clarifying comments in the box below. If your solvency position after the shocks does not require any action and you don't expect any substantial changes after the shock either, please clarify this in the box as well.

[14] To limit the complexity of the exercise, participants are only expected to answer the ESRB questions with regard to market scenario CORP (Annex 1).

Comments

Q2: Assuming the macroeconomic environment in the adverse financial market scenario CORP proves sustainable, how would you try to maintain profitability over the medium term?

	Action	Percentage
	Reduction in costs	%
	Increase revenue, of which	
1	Fees	%
2	Underwriting margins included in premiums	%
	Change of business model, of which	
3	Expand business outside EU	%
4	Change product mix	%
5	Corporate restructuring/acquisitions/mergers	%
	Change asset composition, of which	
6	Increased direct lending to commercial sector	%
7	Increased investment in higher-yielding securities	%
8	Other changes in asset composition	%
	Maturity re-profiling	
8	On the asset side	%
9	On the liability side	%
10	**Other**	%
	Sum of rows 1-10	**100%**

Notes: Please provide percentages reflecting the extent to which you would rely on those actions should the shocks materialise (e.g. if the contribution of a reduction in costs to meeting profitability targets is 30%, the entry in row 1 would be 30). Percentages should sum to 100%. Please add clarifying comments in the box below.

Comments

Q3: In which securities or security markets (type of security, country, etc.) is your presence so large that you would move the market (i.e. substantially move prices) if you had to unwind your positions within six months (e.g. if lapses force you to do so)? In which of these markets would you reduce your assets (as replied in Q1)?

Note: Please provide reply and additional details (like approximate market share) in the box.

Reply

Q4: Assuming the economic environment in the adverse financial market scenario CORP proves sustainable, what would be your expectations for policyholders' behaviour? Specifically:

- **What are your projections for the impact of the scenario on lapse rates?**
- **Would you expect demand for insurance products to change (both in terms of level and in terms of product mix)?**
- **How would you assess the competition among insurers within a stressed environment, and what strategies would you adopt to preserve your market share?**

Note: Please provide replies in the box.

Reply

Annex D
List of the members of the ESRB Task Force on Stress Testing

Mr	**John Fell (Chair)**	European Central Bank
Ms	**Niamh Hallissey (Secretary)**	ESRB Secretariat
Mr	**Olaf Weeken (Secretary)***	ESRB Secretariat
Ms	**Paula Antão**	Banco de Portugal
Ms	**Christine Balzan**	Central Bank of Malta
Mr	**Ádám Banai**	Magyar Nemzeti Bank
Mr	**Rasmus Barnechow Larsen**	Danish Financial Supervisory Authority
Ms	**Alina Birtoiu**	Banca Naţională a României
Mr	**Saša Cerovac**	Hrvatska narodna banka
Mr	**Mr Pavel Chichkanov***	Bank of England
Mr	**Tijmen Daniëls***	De Nederlandsche Bank
Mr	**Alessio de Vincenzo**	Banca d'Italia
Mr	**Knut Eeg**	Finanstilsynet
Ms	**Rand Fakhoury**	Bank of England
Mr	**Henri Fraisse**	Banque de France (ACPR)
Mr	**Benjamin Friedrich**	EBA
Mr	**Griksas Gintaras***	European Commission
Ms	**Katrine Godding Boye***	Norges Bank
Mr	**Mads Peter Pilkjær Harmsen***	Danmarks Nationalbank
Mr	**Jérôme Henry**	European Central Bank
Mr	**Ventsislav Hristev**	Българска народна банка (Bulgarian National Bank)
Mr	**Ulf Holmberg***	Sveriges Riksbank
Mr	**Petr Jakubik**	EIOPA
Mr	**Piotr Kasprzak***	Narodowy Bank Polski
Mr	**Stefan Kerbl**	Oesterreichische Nationalbank
Mr	**Søren Korsgaard**	Danmarks Nationalbank
Mr	**Oscar Krzesicki**	Narodowy Bank Polski
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Mr	**Sam Langfield***	ESRB Secretariat
Mr	**Henrik Larsson**	Finansinspektionen
Ms	**Nadia Lavín**	Banco de España
Mr	**Steffen Lind***	Danish Financial Supervisory Authority
Mr	**Pierlauro Lopez**	Banque de France
Mr	**Paul Lyons**	Central Bank of Ireland
Mr	**Krzysztof Maliszewski***	Narodowy Bank Polski
Ms	**Rønnaug Melle Johansen**	Norges Bank
Mr	**Christoph Memmel**	Deutsche Bundesbank
Ms	**Valeria Miceli**	European Commission
Mr	**Dimitris Mokas**	De Nederlandsche Bank

Mr	**Mateusz Mokrogulski***	Polish Financial Supervision Authority
Mr	**Bob Muller**	Commission de Surveillance du Secteur Financier (CSSF)
Mr	**Stavrianou Nikolaos**	Bank of Greece
Mr	**Jesper Nørgaard**	Danish Financial Supervisory Authority
Mr	**Peer Osthoff**	Bundesanstalt für Finanzdienstleistungsaufsicht
Mr	**Petr Polák**	Česká národní banka
Mr	**Miha Pucnik***	Banka Slovenije
Mr	**Claus Puhr***	Oesterreichische Nationalbank
Mr	**Mario Quagliariello***	EBA
Mr	**Abdelaziz Rouabah**	Banque centrale du Luxembourg
Mr	**Victor Savin***	European Commission
Ms	**Sophie Schiltz***	CSSF
Mr	**Christoph Siebenbrunner**	Oesterreichische Nationalbank
Ms	**Nadezda Sinenko**	Latvijas Banka
Mr	**Nikolaos Stavrianou**	Bank of Greece
Mr	**Carlos Trucharte***	Banco de España
Mr	**Patrick Van Roy**	Nationale Bank van België/Banque Nationale de Belgique
Mr	**Robert Vermeulen**	De Nederlandsche Bank
Mr	**Nikiforos Vidalis**	European Central Bank
Mr	**Matjaz Volk**	Banka Slovenije
Mr	**Christian Winkler**	ESMA
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** Former member involved in the design of the 2014 surveys.*
Note: The Task Force also benefited from contributions by Romain Calleja, Fabio Piamonte and Robert Maderitsch (all ESRB Secretariat).

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