



EUROPEAN CENTRAL BANK

EUROSYSTEM

# Financial Stability Review

November 2015



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# Foreword

The *Financial Stability Review* (FSR) assesses developments relevant for financial stability, in addition to identifying and prioritising main risks and vulnerabilities for the euro area financial sector. It does so to promote awareness of these risks among policy-makers, the financial industry and the public at large, with the ultimate goal of promoting financial stability. The ECB defines financial stability as a *condition* in which the financial system – intermediaries, markets and market infrastructures – can withstand shocks without major disruption in financial intermediation and in the general supply of financial services.

The FSR also plays an important role in the ECB's new macroprudential and microprudential tasks. With the establishment of the Single Supervisory Mechanism (SSM), the ECB was entrusted with the macroprudential tasks and tools provided for under EU law. The FSR, by providing a financial system-wide assessment of risks and vulnerabilities, provides key input to the ECB's macroprudential policy analysis. Such a euro area system-wide dimension is an important complement to microprudential banking supervision, which is more focused on the soundness of individual institutions. At the same time, whereas the ECB's new roles in the macroprudential and microprudential realms rely primarily on banking sector instruments, the FSR continues to focus on risks and vulnerabilities of the financial system at large, including – in addition to banks – shadow banking activities involving non-bank financial intermediaries, financial markets and market infrastructures.

In addition to its usual overview of current developments relevant for euro area financial stability, this Review includes seven boxes and four special features aimed at deepening the ECB's financial stability analysis and basis for macroprudential policy-making. A first special feature discusses the impact of the Basel III leverage ratio on risk-taking and bank stability. A second examines how a prolonged low-yield period might affect the profitability and solvency of euro area insurers. A third proposes an alternative measure of systemic risk: the percentage of banks going bust simultaneously over a given time horizon at a given confidence level. The fourth special feature provides some model-based illustrations of the strategic interactions between a single monetary policy and jurisdiction-specific macroprudential policies.

The Review has been prepared with the involvement of the ESCB Financial Stability Committee. This committee assists the decision-making bodies of the ECB, including the Supervisory Board, in the fulfilment of their tasks.



Vítor Constâncio  
Vice-President of the European Central Bank

# Overview

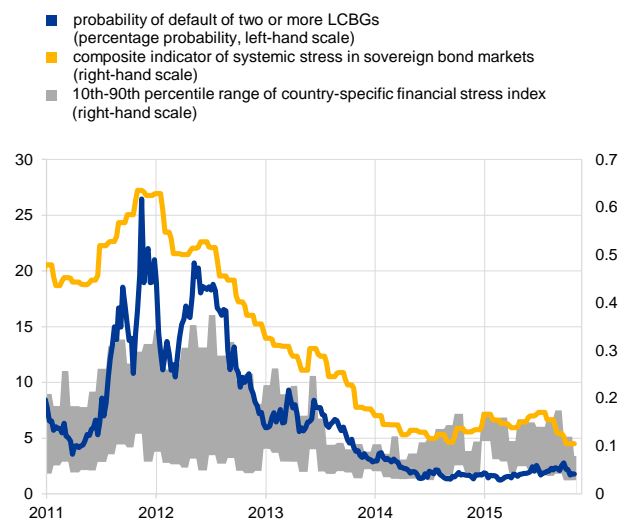
**The euro area financial system weathered challenges on several fronts in the second half of the year.** Most notably, higher political risks surfaced early in the summer surrounding negotiations about a new Greek financial assistance programme while, later in the summer, global and euro area stock markets suffered a spillover from a correction in Chinese stock prices. The impact on the euro area financial system of these developments has been relatively contained, with standard indicators of bank, fiscal and financial stress remaining at low levels (see **Chart 1**).

## Chart 1

Bank, fiscal and financial stress has remained contained in the euro area

**Financial stress index, composite indicator of sovereign systemic stress and the probability of default of two or more banking groups**

(Jan. 2011 – Nov. 2015)



Sources: Bloomberg and ECB calculations.

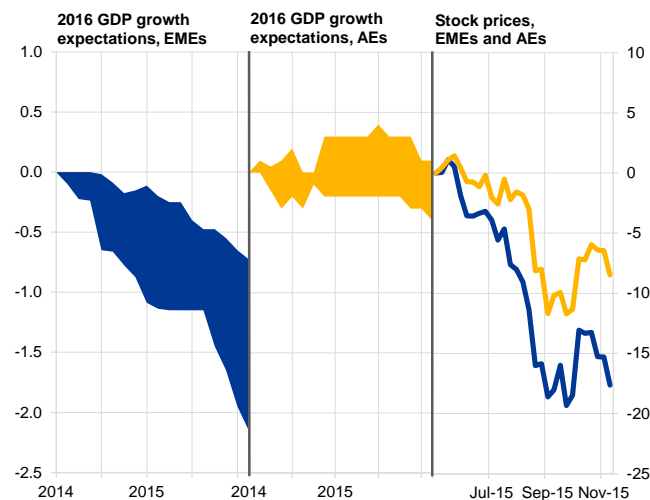
Notes: "Probability of default of two or more LCBGs" refers to the probability of simultaneous defaults in the sample of 15 large and complex banking groups (LCBGs) over a one-year horizon. The financial stress index measures stress in financial markets at the country level based on three market segments (equity, bond and foreign exchange) and the cross-correlation among them. For details, see Duprey, T., Klaus, B. and Peltonen, T., "Dating systemic financial stress episodes in the EU countries", *Working Paper Series*, ECB (forthcoming). For details of the composite indicator of sovereign systemic stress, see Section 1.2.

## Chart 2

Similarities in stock price movements across economic regions, despite a decoupling of economic growth expectations

**Changes in 2016 GDP growth expectations and stock price developments for emerging market and advanced economies**

(monthly data May 2014 – Oct. 2015 (for GDP expectations); weekly data May 2015 – Nov. 2015 (for stock prices); percentages per annum)



Sources: Thomson Reuters Datastream, Bloomberg and ECB.

Notes: Interquartile range for emerging market economies (EMEs), min.-max. for advanced economies (AEs). EMEs consist of China and the most significant oil-exporting EME economies (Russia, Chile, Argentina, Indonesia, Brazil, South Africa, India, Thailand, Mexico, Turkey and the Philippines). Advanced economies consist of the United States, the United Kingdom, the euro area and Japan.






**Occasional bouts of financial market volatility suggest that vulnerabilities stemming from emerging markets are increasing.** Of particular concern is the

outlook for China, given its growing role in the world economy. Turmoil in Chinese and other emerging market economies' equity markets in August led to a strong and broad spillover around the world, including to the euro area. This strong global co-movement of equity prices does not appear to have been solely driven by macroeconomic fundamentals. Indeed, there has been a notable divergence of real

economic growth prospects between the advanced and emerging economies (see [Chart 2](#)). This suggests that an important driver of the falls in advanced economy stock markets was a rise in the global equity risk premium, triggered by uncertainties about Chinese economic growth prospects.

**Financial stability concerns have been increasing generally across a number of emerging market economies.** In contrast to the Asian crisis in the late 1990s, most emerging market economies now have smaller macro-financial imbalances, stronger macroeconomic policy frameworks, more flexible exchange rate regimes and larger buffers (particularly substantial foreign exchange reserves). However, macroeconomic fragilities are still present and elevated growth in private sector credit (partly denominated in foreign currencies) in several economies signals increased risks for the financial system down the road. In particular, highly indebted foreign-currency borrowers may be vulnerable to a prospective normalisation of financial conditions in the United States and other advanced economies.

**Table 1**  
Key risks to euro area financial stability

 pronounced systemic risk medium-level systemic risk potential systemic risk	Current level (colour) and recent change (arrow)*
Abrupt reversal of compressed global risk premia amplified by low secondary market liquidity	
Weak profitability prospects for banks and insurers in a low nominal growth environment, amid incomplete balance sheet adjustments	
Rising debt sustainability concerns in the public and non-financial private sectors amid low nominal growth	
Prospective stress in a rapidly growing shadow banking sector, amplified by spillovers and liquidity risk	

\* The colour indicates the cumulated level of risk, which is a combination of the probability of materialisation and an estimate of the likely systemic impact of the identified risk over the next 24 months, based on the judgement of the ECB's staff. The arrows indicate whether the risk has increased since the previous FSR.

**Euro area banks have limited direct exposure to emerging market economies outside Europe.** This should temper spillovers across financial institutions stemming from deteriorating macro-financial conditions in these economies. At the same time, the rapidly growing euro area investment fund industry has been gradually broadening its exposure to emerging markets, while at the same time developments in China and other large emerging market economies have become important drivers of global confidence. Partly as a result of increased vulnerabilities stemming from emerging markets, the risk of an abrupt reversal of global risk premia is increasing (see [Table 1](#)).

**The domestic challenges which remain in the euro area are in many ways a legacy of the bank and sovereign debt crises.** The euro area banking system continues to be challenged by low profitability amid a weak economic recovery, while many banks' return on

equity continues to hover below their corresponding cost of equity. This, combined with a large stock of non-performing loans in a number of countries, is constraining banks' lending capacity and their ability to build up further capital buffers. In the first half of 2015, however, both the profitability and the solvency positions of banks have improved somewhat. Looking ahead, banks may need to further adjust their business models to cope with persistently weak economic conditions, along with an environment of historically low interest rates across the maturity spectrum.

**Increasingly, financial stability risks stretch beyond traditional entities such as banks and insurers.** The shadow banking sector continues to expand robustly at the global (and euro area) level. With the rapid growth and interconnectedness of this sector, in particular the investment fund industry, vulnerabilities are likely to be accumulating below the surface. The euro area investment fund industry has not only continued to grow, there are also signs that funds are taking on more risk on

their balance sheets. In addition, a more widespread use of synthetic leverage and the increasing prevalence of demandable equity imply that the potential for a systemic impact is increasing, should the investment fund industry come under stress.

**Beyond financial vulnerabilities, real economy risks also prevail.** High sovereign and private sector debt in several euro area countries remains a potential systemic risk. Debt sustainability challenges remain for euro area sovereigns, in particular on account of the downside risks to the economic outlook coming from higher macro-financial vulnerabilities in some emerging economies. Debt concerns also prevail within the private sector. Corporate sector debt remains particularly elevated in the euro area compared with other advanced economies.

**In this environment, there are four key sources of risk for euro area financial stability over the next two years.** These risks, while tied to distinct scenarios of prospective financial stability stress, are clearly intertwined and would, if they were to materialise, have the potential to be mutually reinforcing. Indeed, all risks could be aggravated by a materialisation of downside risks to nominal economic growth.

### **Risk 1: Abrupt reversal of compressed global risk premia amplified by low secondary market liquidity**

**Over the past few years, valuations have been pushed higher across a number of asset classes.** This has resulted from a combination of subdued nominal economic growth, an unusual confluence of exceptionally accommodative monetary policies around the world to support recovery from the global financial crisis, and investors' increased willingness to take on risk. Over the past six months, however, the favourable financial market sentiment in the euro area was temporarily interrupted by periods of rising risk aversion, which contributed to an increase in equity price volatility and a widening of corporate bond spreads.

**Misaligned asset prices are a key vulnerability in that they could potentially lead, at some point, to sharp adjustments of risk premia.** So far, however, signs of broad-based stretched valuations are not evident in the euro area. Low sovereign bond yields are consistent with the persistently subdued nominal growth environment and reflect measures taken by the Eurosystem in the wake of unparalleled risks of a protracted period of low inflation. As regards traditionally riskier asset classes, valuation metrics of euro area corporate bonds and equities appear to be broadly in line with or close to their respective norm. On the real estate side, valuation estimates for the euro area as a whole suggest that residential property prices are slightly below the average valuations of the last decades, but have departed further away from their long-term average for prime commercial property amid continued strong price increases. That said, there is significant country heterogeneity regarding deviations of real estate valuations from estimated equilibrium values in the euro area.

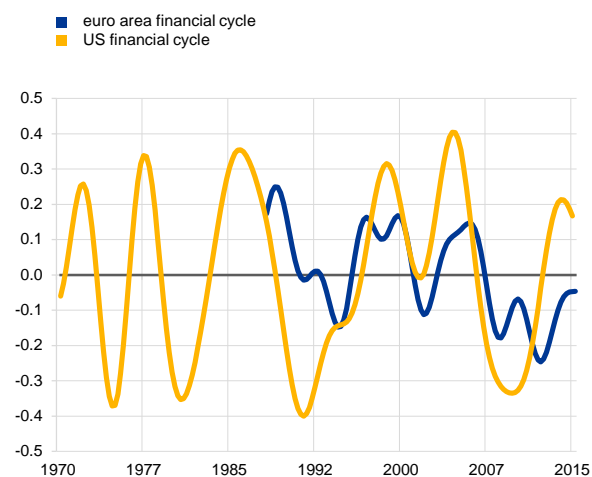
**Estimates of the state of the financial cycle for the euro area remain subdued** (see **Chart 3**). Such estimates – encompassing developments in private credit, as well as in main asset market segments – would not support the view of a credit-driven asset price boom in the euro area. Financial cycle estimates for the United States were more elevated through the middle of the year, partly as a result of slightly higher equity price valuations and stronger credit demand.

### Chart 3

Financial cycle estimates for the euro area do not signal a credit-driven asset price boom

#### Financial cycles in the euro area and the United States

(Q2 1970 – Q2 2015; normalised scale; euro area series starts in Q2 1988; y-axis: normalised deviation from historical median)



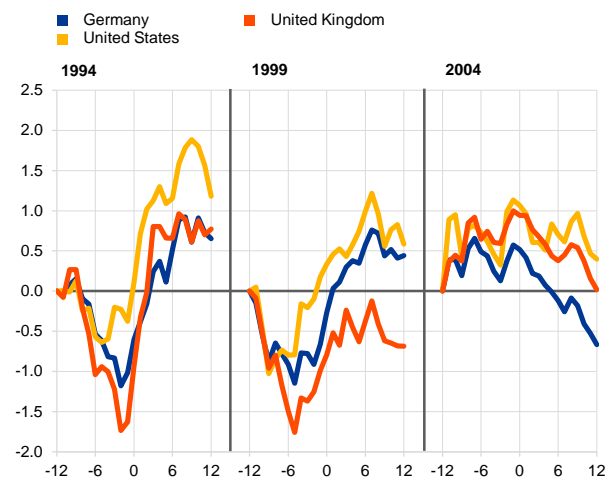
Sources: Bloomberg and ECB calculations.  
Notes: The financial cycle is a filtered time-varying linear combination emphasising similar developments in underlying indicators (total credit, residential property prices, equity prices and benchmark bond yields). See Schüler, Y., Hiebert, P. and Peltonen, T., “Characterising the financial cycle: a multivariate and time-varying approach”, *Working Paper Series*, No 1846, ECB, 2015. For the US, the last available data point is Q1 2015.

### Chart 4

Global long-term bond yields tend to rise during phases of tightened monetary policy – but exceptions exist

#### Changes in advanced economies’ long-term bond yields around periods of US monetary policy tightening

(percentage points; monthly observations; the x-axis represents the 12 months before and after the three tightening cycles started)



Sources: Bloomberg and ECB calculations.

### Developments in euro area bond markets are likely to continue to be influenced by policy settings around the globe.

In particular, the Eurosystem’s expanded asset purchase programme – intended to be carried out until at least September 2016 – will, beyond its support of price stability, probably dampen possible upward pressure on euro area bond yields. Nonetheless, a faster than expected withdrawal of monetary policy accommodation in other major advanced economies could trigger a reversal of global term premia, which may also spill over to the euro area. Experience from the three previous significant monetary policy tightening cycles in the United States, albeit with distinct structural driving factors, shows that bond yields increased strongly in advanced economies in 1994 and 1999, but fell in 2004 (see **Chart 4**).

### The impacts that China, in particular, had on advanced economies’ financial markets during the summer point to the need for close monitoring going forward.

The August turmoil can, to some extent, be compared with previous bouts of volatility observed over the last years, including the “taper tantrum” in the summer of 2013, the US Treasury “flash crash” in October 2014 and the recent Bund sell-off



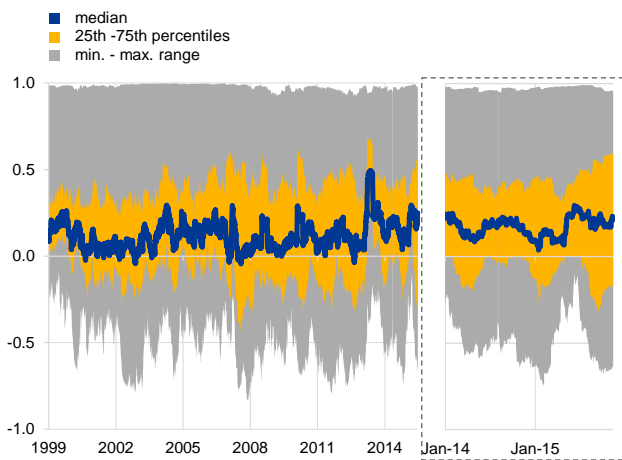
in May 2015. These events have some common denominators: market liquidity may be too low to absorb swift changes in market sentiment and higher levels of correlated trades may have amplified the magnitude of sell-offs. These two issues are tackled below.

### Chart 5

#### Stronger co-movement across financial asset classes – a symptom of herding and search-for-yield behaviour

##### Dispersion of pair-wise correlations between global asset classes over a 90-day rolling window

(Jan. 1999 – Nov. 2015; median and quartiles)



Sources: Bloomberg, Merrill Lynch and ECB calculations.

Notes: Calculations are based on pair-wise correlations between daily total returns of US, euro area and emerging market stock, sovereign bond, investment-grade corporate bond and high-yield corporate bond indices.

the part of investors. As a result, when a shock hits the system, too many investors try to sell the same assets simultaneously, resulting in elevated volatility. On the other hand, higher correlations between financial assets may be a cause of herding behaviour, as they make diversification less profitable and investors may thus be pushed to take on more risk, which at some point can become excessive. Looking at the pair-wise correlations across a broad set of global asset classes, one-directional moves in financial prices across asset classes have indeed become more common over the past two years (see [Chart 5](#)).

On the policy side, while monetary policy will continue to preserve price stability, possible country, sector and institution-specific challenges suggest a strong role for macroprudential policy in bolstering systemic resilience and curbing financial cycles.

### Risk 2: Weak profitability prospects for banks and insurers in a low nominal growth environment, amid incomplete balance sheet adjustments

#### The euro area banking system continues to struggle with low profitability, while euro area insurers also face challenges in a low-return environment.

Despite some increases observed in recent quarters, many banks' return on equity

#### While risk premia remain compressed, there is a concern that low market liquidity may amplify potential corrections in asset prices.

Indicators presented in the May 2015 Financial Stability Review suggested a significant deterioration of liquidity conditions in secondary fixed income markets. The strong increase in global equity market volatility over the past six months, coupled with a surge in the number of measures that had to be employed by major stock exchanges in late August to avoid substantial price movements, has raised questions about market functioning also for this segment. Furthermore, it remains unclear how evolving market microstructure, and in particular the trading venues with no pre-trade transparency requirements – so-called “dark pools” – have impacted equity market liquidity conditions (see [Box 4](#)).

#### Stronger co-movement across financial asset classes needs to be closely monitored as it may have repercussions on financial stability.

On the one hand, it may be a symptom of herding behaviour on

continues to hover below their corresponding cost of equity despite some recent narrowing of this gap. The profitability of the banking sector is being hampered by a number of challenges, two of which predominate. First, the low nominal growth and low interest rate environment makes traditional banking activities such as retail lending using maturity transformation less profitable. Likewise, insurers in some countries face challenges, in a low-return environment, especially in the life insurance business where there are pressures to ensure that returns are sufficient to maintain guaranteed returns to policyholders. A second challenge specific to banks relates to the large stock of legacy problem assets, particularly in the countries that were most affected by the financial crisis. These problem assets remain an important obstacle for banks to provide new credit to the real economy. In some countries, improvements have been made in the legal framework for resolving non-performing loans. That said, progress in writing off and/or disposing of non-performing loans remains moderate when measured against the stock of such loans.

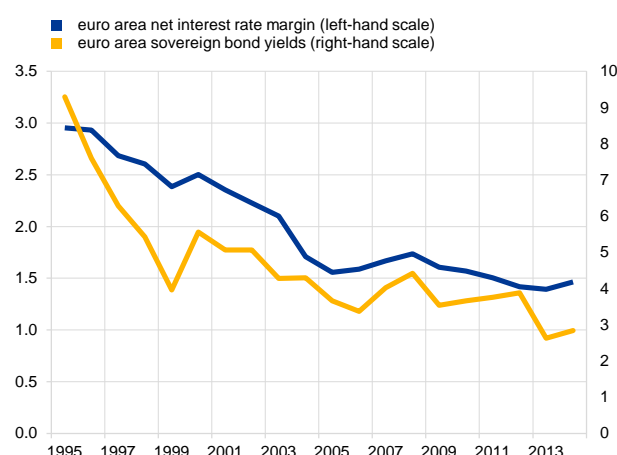
**While remaining subdued, a recent moderate improvement in profitability (combined with continued improvements in solvency positions) has been evident.** The slightly higher profitability reported by banks in the first half of 2015 reflected an increase in non-interest income, a decline of loan loss provisions from historically high levels, as well as decreasing funding costs which outweighed the negative impact of asset yield compression and higher operating costs. The improvement in bank profitability was broad-based, also extending to banks in countries most affected by the financial crisis.

### Chart 6

The low interest rate environment over the past two decades has contributed to lower interest income

**Euro area ten-year sovereign bond yields and the net interest rate margin for large euro area banks**

(1995-2014; percentage points)



Sources: Thomson Reuters Datastream and ECB calculations.  
Notes: The net interest margin is defined as the net interest income over total assets. Weighted average (using total assets) of 66 euro area banks.

**Over the past two decades, interest rates in most advanced economies have fallen with strong implications for banks' interest revenues.** Looking back, part of the fall in interest rates was a reflection of the "Great Moderation" where the volatility of business cycle fluctuations was reduced starting in the mid-1980s. In the past few years, the downward trend in interest rates has accelerated as an unprecedented level of support by central banks for the real economy was needed in the aftermath of the severe crisis. As for the euro area, in parallel with a low interest rate environment, banks' net interest income has also fallen (see **Chart 6**). Indeed, interest revenues are typically more interest rate sensitive than expenses, particularly in a low interest rate environment where bank deposit rates tend to be constrained by the zero lower bound (see **Box 5**).

**While nominal growth prospects are expected to remain subdued over the next years, euro area interest rates will probably remain low and yield curves relatively flat.** This could challenge banks'

traditional source of profitability in the maturity transformation business. While some banks may be flexible enough to cope with this environment, a number of banks may

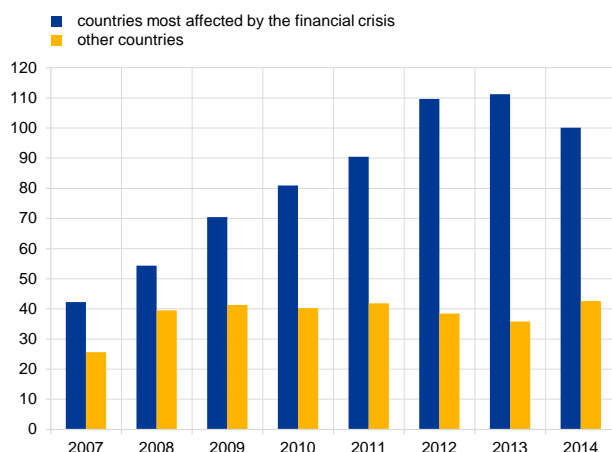
need to adjust their business mix towards activities that rely less on traditional interest income-generating business.

### Chart 7

Banks with high non-performing loans have limited buffers against further credit losses

#### Ratio of non-performing loans to tangible equity and loan loss reserves for euro area significant banking groups

(2007-2014; percentages; median values)



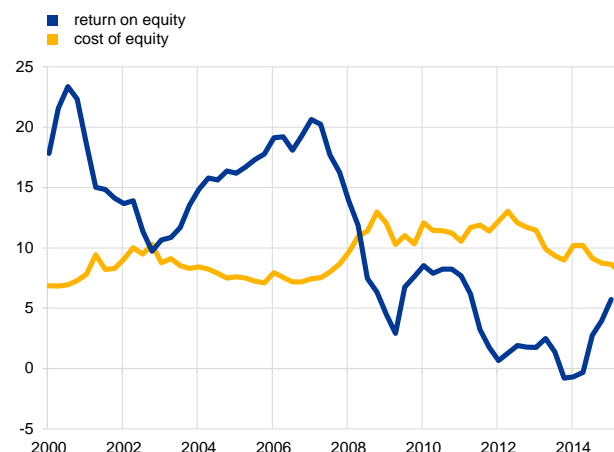
Source: SNL Financial.  
Notes: Based on publicly available data for a sample of significant banking groups. Countries most affected by the financial crisis are Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain.

### Chart 8

Albeit declining, the gap between euro area banks' cost of equity and return on equity is considerable

#### Cost of equity and return on equity for a large sample of listed euro area banks

(Q1 2000 – Q3 2015; percentage points)



Sources: Bloomberg, Thomson Reuters Datastream, Consensus Economics and ECB calculations.  
Notes: Based on the weighted portfolio of 33 euro area banks in the EURO STOXX index. For further details, see Box 5 in *Financial Stability Review*, ECB, May 2015.

**Apart from the flat yield curve environment, banks also face legacy problems from the sovereign debt crisis, mainly in the form of a large stock of non-performing loans in several countries.** A high level of non-performing loans in countries strongly affected by the euro area strains (such as Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain) has dampened profitability prospects.

Such a constellation could hinder banks' ability to provide new credit to the real economy. Furthermore, banks with high levels of non-performing loans and moderate coverage ratios are more vulnerable to negative shocks affecting the credit quality of borrowers (see [Chart 7](#)). In addition, euro area banks' cost of equity still exceeds their return on equity. This negative gap is not sustainable in the long run since it implies that equity investors in banks require a higher return than the return banks are able to deliver. Over time, this will make it difficult for banks to attract capital and finance growth. In recent quarters, the gap has narrowed somewhat owing to the marginal improvement in banks' earnings and the favourable equity market conditions in the first half of the year (see [Chart 8](#)).

**Similarly to banks, the profitability prospects for the insurance sector also remain a risk to financial stability.** Although current profitability and capital positions remain solid, the low-return environment coupled with the forthcoming Solvency II regime will induce changes in some insurers' business models. Some insurers are taking on more risks so as to maintain returns. In particular, there is evidence of portfolio shifts towards infrastructure financing, equities and lower-quality

bonds. On the liabilities side, life insurers are looking towards unit-linked policies and fee-based products for new business.

**Several triggers could lead to sharp downward adjustments to banks' already-weak profitability.** For instance, negative revisions to the economic growth path could weigh on borrowers' debt servicing ability, especially in countries currently experiencing benign market sentiment. In addition, further deterioration in some vulnerable emerging market economies also has the potential to weaken euro area banks' profitability – probably mainly via confidence channels.

**From a policy perspective, some progress has been made recently in improving the legal framework, which should facilitate more effective resolution of non-performing loans.** This could also contribute to better loss recognition by banks, as well as faster foreclosure of collateral underlying impaired loan portfolios. Banks should use the current environment to clean up their balance sheets so that the constraints on the supply of new credit are reduced. The efforts to resolve the stocks of non-performing loans in parts of the euro area should be carefully designed so as to avoid an undue negative impact on bank capitalisation and to minimise moral hazard.

### Risk 3: Rising debt sustainability concerns in the public and non-financial private sectors amid low nominal growth

**Debt sustainability concerns in the euro area public and non-financial private sectors remain, given still elevated debt levels and insufficient progress made in terms of deleveraging in several countries.** Debt sustainability challenges are most relevant in the sovereign sector in the aftermath of the global financial crisis, but a debt overhang is also prevalent in the private sector. Corporate sector debt remains particularly elevated in the euro area compared with other advanced economies. While household indebtedness remains contained on aggregate in the euro area, in some countries additional vulnerabilities stem from high indebtedness in this sector too – thereby serving as a brake on economic growth.

**Debt sustainability indicators for the sovereign sector paint a mixed picture.** On the positive side, indicators of sovereign stress have remained relatively contained despite renewed sovereign tensions in Greece. The turmoil in China mainly affected equity markets in the euro area, while sovereign bond markets were hardly affected, partly as a result of the ECB's asset purchase programme. Headline fiscal imbalances are expected to improve in almost all euro area countries over the next years, with a temporary deterioration expected to materialise only in Greece. The public sector has gradually increased the average debt maturity and a large amount of short-term liquid assets are available to cushion possible sudden increases in sovereign financing needs. On the negative side, challenges in safeguarding public debt sustainability across the euro area relate to complacency concerning fiscal adjustment and structural reforms, as well as a prolonged period of low nominal growth. In the long run, these challenges are accentuated by vulnerabilities related to slower than expected potential GDP growth and population

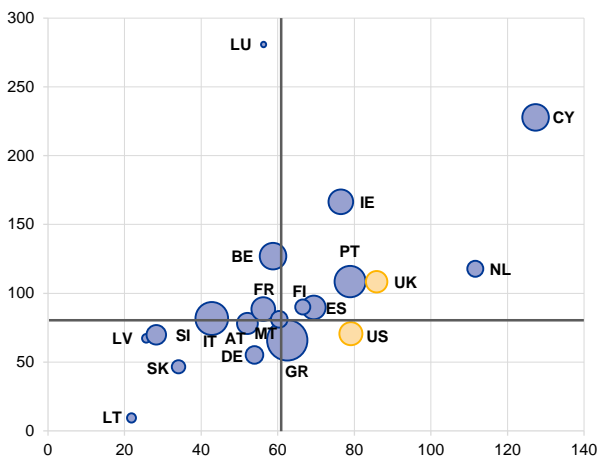
ageing-related costs. Lastly, failure to meaningfully tackle the growth challenge, with the related consequences in terms of social inclusion, could create political and economic policy uncertainty. Such a situation may contribute to a deterioration in investor sentiment, pushing financing costs higher – and possibly resulting in renewed debt sustainability concerns.

### Chart 9

High indebtedness across sectors in some economies remains a cause for concern

Non-financial corporate indebtedness (y-axis) and household indebtedness (x-axis)

(Q2 2015; percentage of GDP)



Sources: European Commission and ECB.

Notes: The size of the bubble reflects the indebtedness of the general government. Data on non-financial corporations are consolidated. The horizontal and vertical lines represent the euro area averages.

### Debt sustainability concerns also prevail in the non-financial private sector.

The aggregated euro area picture conceals strong differences among countries (see Chart 9). The non-financial corporate debt-to-GDP ratio remains high in a number of euro area countries, by both historical and international standards. In addition, there are a number of countries which have high indebtedness across all main economic sectors – households, corporates and the sovereign. There are risks that an intensification of vulnerabilities in one sector could spill over to other sectors, with negative repercussions for the banking system.

### There are several triggers which could cause debt sustainability concerns to materialise.

This could happen via deteriorating global and euro area economic growth prospects, mainly driven by the possibility of renewed bouts of volatility in major emerging markets. Further delays in key fiscal and structural reforms may lead to a reassessment of the sentiment towards vulnerable sovereigns which, in turn, could also create

debt sustainability challenges for non-financial firms.

Going forward, challenges to debt sustainability would in many ways be best addressed by sound macroeconomic policies.

### Risk 4: Prospective stress in a rapidly growing shadow banking sector, amplified by spillovers and liquidity risk

**The shadow banking sector continues to grow at a rapid pace.** At the same time it is becoming more central in the financial system, amid limited standardised data collection for adequate monitoring and oversight. All these factors – size, interconnectedness and opacity – suggest that the potential for systemic impacts emanating from this sector is increasing. The bulk of the increase in total assets in the shadow banking sector stems from the investment fund sector. From a financial stability perspective, concerns about the risks posed by investment funds relate to the implications for the wider financial system and the real economy arising from the sector's increasing role in credit intermediation and capital markets.

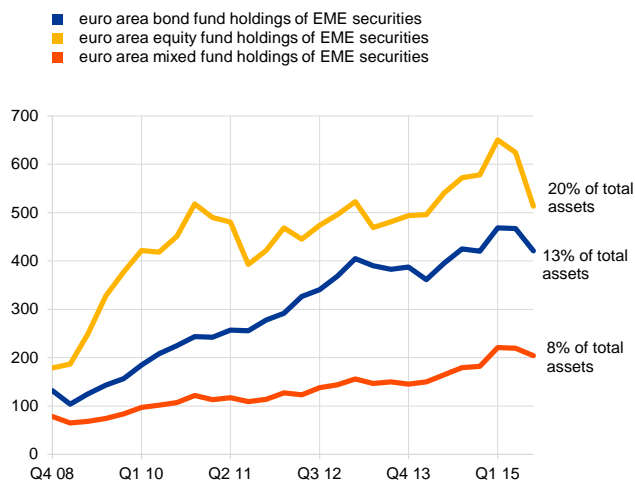
Available data gathered from various sources suggest that risk-taking activities undertaken by the euro area investment fund sector have increased over the past year. The funds have shifted their asset allocation from higher to lower-rated debt securities, while the average residual maturities have increased by almost one year (see [Box 7](#)). In terms of country allocation, euro area investment funds have continued to increase their exposure to emerging markets over the few past years, although a decline in valuations and some outflows led to a reduction in exposures in the recent past (see [Chart 10](#)). It is crucial that investors in those funds are aware of the risks they take and have sufficient buffers to withstand any strong reversal of global risk premia.

**Chart 10**

Euro area investment funds have gradually increased their exposure to emerging markets...

**Euro area bond and equity funds' exposure to emerging markets**

(Q4 2008 – Q3 2015; EUR billions)



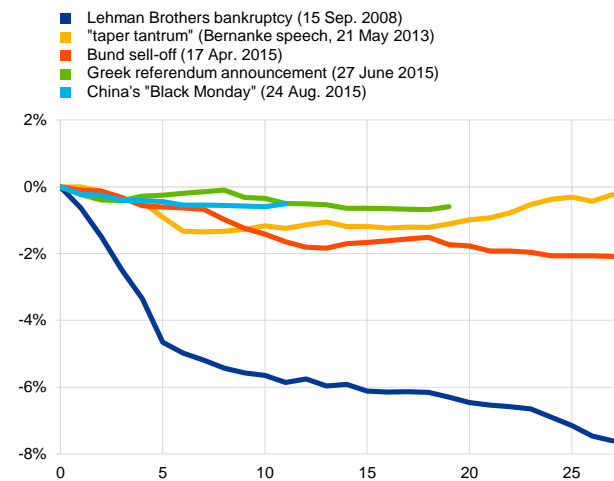
Source: ECB and ECB calculations.  
Note: EME debt securities and shares are proxied by debt securities and shares issued in countries outside the European Union, the United States and Japan.

**Chart 11**

... and the recent turmoil did not push investors to significantly revise their asset allocations

**Cumulative investment fund outflows of euro area assets following sharp changes in investor sentiment**

(in weeks; percentages of investment funds' assets)



Sources: EPFR country flow data and ECB calculations.  
Note: The cumulative outflows are for retail investors who are usually more active in their asset allocation decisions.

**With regard to investment funds, “liquidity spirals” remain a risk.** Such spirals, not dissimilar to those witnessed in the US in the global financial crisis of 2008, could be triggered if funds were to be confronted with high redemptions or increased margin requirements, as these could result in forced selling on markets with low liquidity. With such liquidity conditions, initial asset price adjustments would be amplified, triggering further redemptions and margin calls, thereby fuelling such negative liquidity spirals. Mitigating factors in the form of liquidity buffers and low leverage would dampen such effects.

**Until now, various episodes of bond market volatility have been temporary.** The sell-off in the German Bund market earlier this year did not lead to immediate stability concerns. Looking at more recent events, neither the difficulties surrounding the negotiations in Greece nor the turmoil in global stock markets in August led to significant outflows from euro area investment funds on the whole (see [Chart 11](#)).

**The continued growth of the investment fund sector nonetheless raises concerns that investors in those funds could be part of any prospective global repricing.** Growing exposures both in nominal and value terms, in addition to signs of increased risk-taking, underline the need for close monitoring.

**On the policy side, more information and enhanced disclosure are clearly needed as a starting point in tackling this growing source of risk.** While individual firms report selected liquidity and leverage metrics for their own risk management, the crisis of the last years has vividly illustrated that risks for financial stability are not additive. Indeed, the paucity of information on measures of liquidity in stressed circumstances and of leverage (both traditional and synthetic) at the aggregate level outside traditional banking remains a key issue in fully understanding the nature and extent of such a risk.

## Policy considerations

**For what concerns macroprudential matters, since November last year, the ECB has had prudential responsibilities for the SSM area – shared with national authorities.** In this vein, measures announced by euro area countries since the last FSR have mostly focused on mitigating country-specific structural systemic risks, i.e. risks originating from significant size, high concentration and interconnectedness in the banking sector. Buffers for systemically important institutions and the systemic risk buffer have been applied or recommended for this purpose (e.g. in Austria, Belgium, Finland, Germany and Slovakia). Some euro area countries (including Finland, Latvia, Lithuania and Slovakia) have already started taking regular quarterly decisions on counter-cyclical capital buffer rates. However, reflecting the subdued credit growth, no additional counter-cyclical capital requirements have been set as yet in this regard. A few countries have also taken or issued more forward-looking measures or recommendations regarding potential risks and the availability of instruments related to borrowers and real estate markets (e.g. Germany, Lithuania and the Netherlands).

**Beyond this newly acquired macroprudential mandate, work continues to complete the regulatory foundations serving to increase the resilience of not only individual institutions but also the financial system as a whole.** Most importantly, the substantial capital increase above pre-crisis levels, primarily triggered by the introduction of the CRR/CRD IV package and various supervisory actions (e.g. stress tests, Pillar 2 measures) and market pressure, should contribute to a healthy and resilient banking system. This, in turn, should help the financial sector facilitate economic growth over the whole financial cycle.

**Beyond capital requirements, ongoing initiatives are helping to complete a comprehensive regulatory overhaul of the banking sector globally and in the EU in the wake of the global financial crisis.** Most importantly, on 9 November the Financial Stability Board issued the total loss-absorbing capacity standard for global systemically important banks which will increase the resolvability of such institutions without recourse to public funds and the associated moral hazard. Further key

elements of the ongoing regulatory initiatives that will be finalised in the short term include rules on liquidity (e.g. on the net stable funding ratio), the leverage ratio and securitisation. Finally, work at the international and European levels is proceeding on reducing excessive variability in banks' regulatory capital ratios arising from the use of internal models and on revising the regulatory treatment of sovereign exposures. These measures, along with complementary parallel regulatory initiatives for non-bank financial entities, should help bolster the resilience of the broader euro area financial system and benefit financial stability in the medium term.



# 1 Macro-financial and credit environment

***Macro-financial conditions** have strengthened gradually further in the euro area, amid a more pronounced shift in global growth dynamics from emerging to advanced economies. Still, euro area growth prospects remain muted, with the risks surrounding the economic outlook tilted to the downside given heightened macro-financial vulnerabilities in major emerging economies. Within the euro area, generally favourable financial conditions contrast with continued real fragmentation at the country level, despite some further progress made in terms of rebalancing. At the global level, the prospect of diverging monetary policy trends in major advanced economies, ongoing geopolitical tensions and continued bouts of volatility in emerging economies and global commodity markets have the potential to unearth underlying vulnerabilities, reignite risk aversion vis-à-vis certain countries, markets and asset classes, and trigger a broad-based adjustment in global capital flows.*

*Against this backdrop, euro area **sovereign stress** has remained contained, despite some tensions in selected countries. In general, sovereign financing conditions have remained relatively benign in terms of pricing, while the trend towards longer durations has continued in the current low interest rate environment. However, underlying sovereign vulnerabilities remain elevated amid continuing challenges along the path to durably restoring the sustainability of public finances. The main risk relates to a possible prolonged period of low nominal growth, in particular, in the absence of meaningful enough structural reform efforts in several countries.*

*As with euro area sovereigns, financing conditions remain favourable for the euro area **non-financial private sector**, as unconventional measures by the Eurosystem translate into improved availability and a low cost of funding and help reduce persistent financial fragmentation across countries and firm sizes. The gradual economic recovery should underpin improving income and earnings prospects for households and non-financial corporations, which together with the low interest rate environment should help mitigate the risks associated with elevated levels of non-financial private sector debt in several euro area countries. The recovery of euro area **property markets** has gained some momentum over recent quarters, while becoming more broad-based across countries and market segments. This broadening recovery notwithstanding, heterogeneity in terms of price movements and valuations remains at the country and regional levels in both the residential and commercial property realms. Continued favourable financing conditions and gradually improving economic prospects should underpin the sustainability of the ongoing recovery, but buoyant developments in some countries and asset classes need to be carefully monitored in the context of the current low-yield environment.*

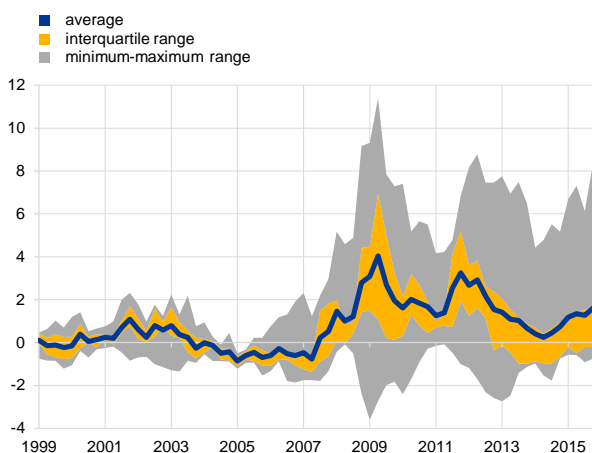
## 1.1 Ongoing euro area recovery amid rising external risks

The economic recovery in the **euro area** has gained further momentum in the first three quarters of 2015. Domestic demand has benefited, in particular, from

**Chart 1.1**  
Overall uncertainty has remained relatively low in the euro area

**Macroeconomic uncertainty in the euro area**

(Q1 1999 – Q4 2015; standard deviations from mean)



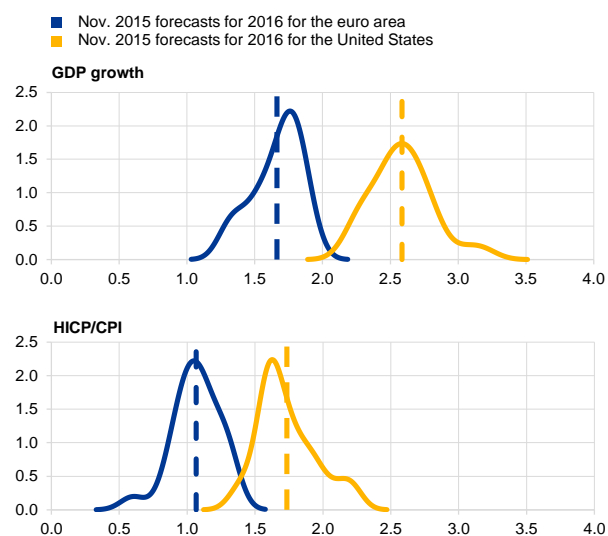
Sources: Consensus Economics, Baker, Bloom and Davis (2013), European Commission, ECB and ECB calculations.

Notes: Mean for the period Q1 1999 – Q4 2007. Macroeconomic uncertainty is captured by examining a number of measures of uncertainty compiled from various sources, namely: (i) measures of economic agents' perceived uncertainty about the future economic situation based on surveys; (ii) measures of uncertainty or of risk aversion based on financial market indicators; and (iii) measures of economic policy uncertainty. Measures of economic policy uncertainty are taken from Baker, S., Bloom, N. and Davis, S., "Measuring Economic Policy Uncertainty", Chicago Booth Research Paper No 13/02, January 2013. For further details on the methodology, see Box 4 entitled "How has macroeconomic uncertainty in the euro area evolved recently?", *Monthly Bulletin*, ECB, October 2013.

**Chart 1.2**  
Low nominal growth in the euro area contrasts with more benign conditions in the United States

**Distribution of the 2016 real GDP growth and HICP/CPI forecasts for the euro area and the United States**

(probability density)



Sources: Consensus Economics and ECB calculations.  
Note: The dashed lines represent the average forecast values.

strengthened private consumption, in line with higher labour income and lower energy prices. At the same time, euro area exports remained buoyant, reflecting gains in euro area export market shares on the back of the past depreciation of the euro. The recovery is being chiefly supported by the very accommodative monetary policy stance, with the effects of recent non-standard Eurosystem measures gradually finding their way through the economy. Against this backdrop, overall uncertainty in the euro area has remained relatively low (see [Chart 1.1](#)), although political and financial market uncertainty have increased somewhat in the context of renewed political and sovereign tensions in some euro area countries and heightened financial market volatility stemming from developments in major emerging economies. Despite the ongoing recovery, economic conditions remain weak in the euro area, while the level of economic output remains on average below pre-crisis levels, albeit to varying degrees across euro area countries. That said, a low nominal growth environment in the euro area contrasts with more buoyant developments in other major international peers, notably the United States, highlighting the prospect of increasingly divergent underlying monetary policies. Still, uncertainty regarding the strength and pace of economic expansion as well as inflation prospects remains high not only in the euro area, but also in the United States (see [Chart 1.2](#)).

The euro area economic recovery is projected to continue over the next two years, although at a somewhat slower pace than anticipated earlier this year given the slowdown in emerging economies. Still, a very accommodative monetary policy stance, the past depreciation of the effective exchange rate of the euro, improvements in the labour market, lower energy prices and a waning fiscal drag will underpin economic activity in the near and medium term, in particular by boosting domestic demand. By contrast, the ongoing process of balance sheet adjustment in the financial and non-financial private sectors, sluggish structural reform implementation and still high (albeit declining) unemployment rates in several countries will continue to weigh on the pace of recovery. Against this backdrop, the September 2015 ECB staff macroeconomic projections for the euro area envisage real GDP growth of 1.4% for 2015, which is expected to

accelerate moderately to 1.7% in 2016 and 1.8% in 2017.

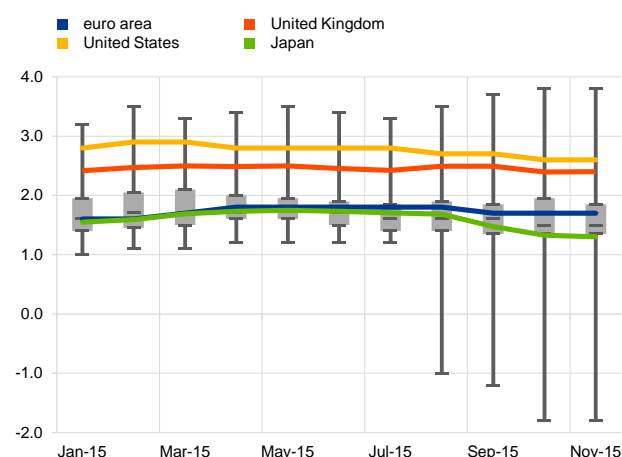
The risks surrounding this outlook are tilted to the downside and relate mainly to the external environment, notably rising uncertainty stemming from developments in emerging economies. In particular, a further slowdown of the Chinese economy has the potential to affect the euro area economy via the trade and confidence channels, albeit to varying degrees across the individual countries (see Box 1). Additional headwinds may relate to a further rise in geopolitical tensions, a reintensification of sovereign stress at the euro area country level, as well as an adverse global interest rate shock and increased global risk aversion. These risks may be accentuated by concerns about the euro area's long-term growth potential, with both crisis-related factors (e.g. slow capital stock growth) and non-crisis-related forces (e.g. demography) weighing on the underlying trend.

### Chart 1.3

#### Overall economic prospects diverge considerably across the euro area

##### Evolution of forecasts for real GDP growth in the euro area and selected advanced economies for 2016

(Jan. 2015 – Nov. 2015; percentage change per annum)



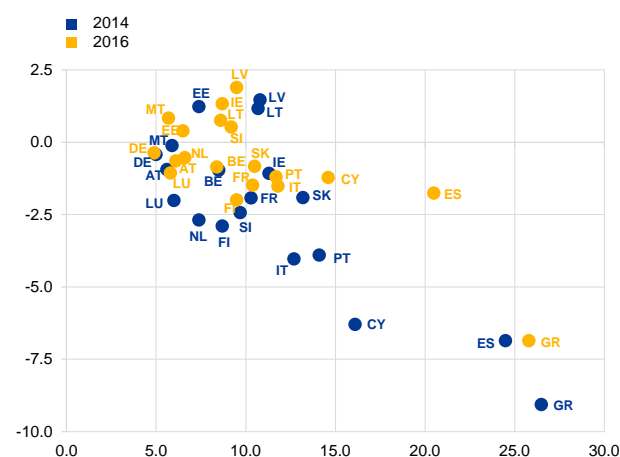
Sources: Consensus Economics and ECB calculations.  
Note: The chart shows the minimum, maximum, average, median and interquartile distribution across the 11 euro area countries surveyed by Consensus Economics (Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal and Spain).

### Chart 1.4

#### Negative output gaps and high unemployment rates remain a challenge in several countries

##### Output gaps and unemployment rates across the euro area

(2014; 2016; percentages; x-axis: unemployment rate; y-axis: output gap)



Sources: Eurostat and European Commission.  
Note: 2016 data are projections.

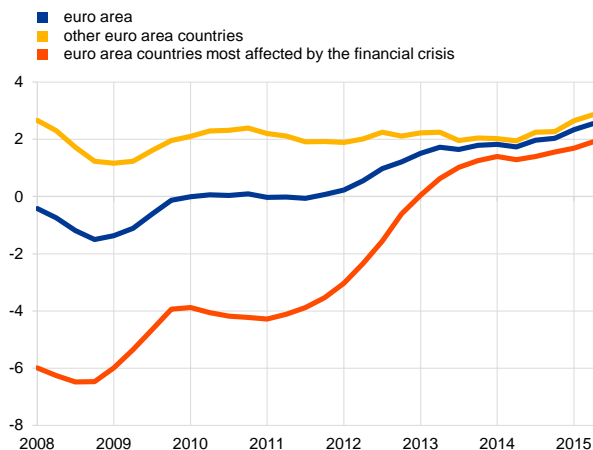
Despite the ongoing gradual economic recovery in the euro area, real fragmentation across countries – albeit lower than at the height of the euro area sovereign debt crisis – remains a challenge. In particular, there are signs of a renewed widening in cross-country divergence of projected growth rates (see [Chart 1.3](#)), with Greece and Ireland at the lower and upper end of the distribution. Similarly, labour market conditions show signs of improvement, with the aggregate euro area unemployment rate falling to 10.8% in September 2015, the lowest level since early 2012. However, developments continue to diverge in the euro area (see [Chart 1.4](#)), as continued labour market slack in countries such as Cyprus, Greece and Spain contrasts with relatively tight labour market conditions in other countries like Austria, Germany and Luxembourg. This heterogeneity continues to highlight the need for employment-

### Chart 1.5

#### Sustained current account improvements underpin the ongoing process of rebalancing within the euro area

##### Current account balances in the euro area

(Q1 2008 – Q2 2015; percentage of GDP)



Sources: Eurostat and ECB calculations.

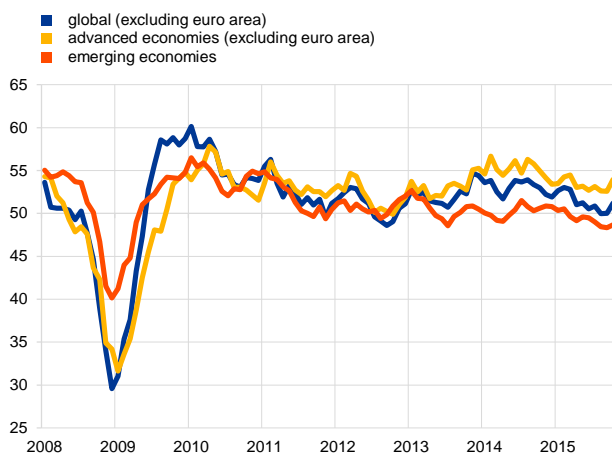
Note: Euro area countries most affected by the crisis include Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain.

### Chart 1.6

#### Economic prospects continue to diverge in advanced and emerging economies

##### Manufacturing Purchasing Managers' Indices across the globe

(Jan. 2008 – Oct. 2015; diffusion indices: 50+ = expansion; seasonally adjusted)



Sources: Markit and Institute for Supply Management.

Notes: Advanced economies cover Japan, the United Kingdom and the United States, while emerging economies include Brazil, China, India, Russia and Turkey. Values are aggregated with GDP PPP weights.

boosting structural reforms with a view to fostering an inclusive economic recovery and enhancing the euro area's medium-term growth potential. In fact, negative output gaps are expected to remain sizeable over the 2014-16 period in many euro area countries (see [Chart 1.4](#)), even if markedly lower than during the crisis-ridden years.

Efforts to restore price and non-price competitiveness within the euro area are ongoing, as reflected by the marked improvement of the external balances of euro area countries most affected by the financial crisis in recent years (see [Chart 1.5](#)). A large part of the underlying current account adjustment has been of a non-cyclical nature, reflecting competitiveness gains and adjustments in potential output, and is therefore likely to be sustained. Looking ahead, the near-term outlook for external rebalancing will be shaped by two conflicting forces. On the one hand, the gradual upturn in economic activity is likely to exert downward pressure on current account balances, while, on the other hand, temporary factors – in particular a weaker euro and lower oil prices – should support external rebalancing. The longer-term prospects will depend on a number of determinants, such as the reallocation of resources towards high-productivity firms and the continuation of structural product and labour market reforms which have the potential to reinvigorate growth and competitiveness in the euro area.

The **global economy** remained on a muted growth path with uneven developments across major economic areas (see [Chart 1.6](#)). While economic activity in advanced economies has continued to firm gradually, the growth prospects for emerging markets have deteriorated further amid heightened political uncertainty and tighter external financing conditions. While global growth is expected to recover gradually on the back of lower oil prices and continued policy support, risks to the global outlook remain tilted to the downside. In particular, a sharp repricing of risk with ensuing corrections in asset prices, a potential disorderly reversal of capital flows and sharp exchange rate movements in the context of the prospective

unwinding of monetary accommodation in the United States remain causes for concern. Moreover, heightened geopolitical tensions and possible financial market stress accompanying the ongoing rebalancing to a more moderate growth path in

major emerging economies, notably China, may harbour the potential for an adverse growth shock.

Economic activity in **advanced economies** outside the euro area continued to firm gradually. The recovery is being supported by lower oil prices, improving labour market conditions, as well as gradually receding headwinds from private sector deleveraging and fiscal consolidation in several countries, while highly accommodative monetary policies have continued to underpin favourable financing conditions. However, the pace of progress varies across countries, with a multi-speed economic recovery increasingly translating into divergent monetary policies. That said, the uncertainties related to the timing and specific profile of monetary policy normalisation across advanced economies represent a key source of risk, having the potential to spark volatility and trigger abrupt adjustments in financial markets, and, eventually, weigh on global growth.

In the **United States**, after strong growth in the second quarter of 2015, real GDP growth slowed in the third quarter, mostly due to a negative contribution from inventories. Meanwhile, the recovery in domestic demand continued to be robust, supported by the strength in private consumption on account of income windfalls from low oil prices, a falling propensity to save and past gains in net wealth. Looking ahead, the recovery is expected to continue at a relatively robust pace, as – despite a prospective turn in the interest rate cycle – still very accommodative monetary policies and a lower fiscal drag are supporting growth, together with continued improvements in labour and housing markets. Risks to the growth outlook remain slightly on the downside and relate to a faster than expected normalisation of interest rates and a further appreciation of the US dollar. Moreover, a negative impact of low oil prices on energy-related investment spending may prove more persistent than previously anticipated, while underlying fiscal imbalances, if unaddressed, highlight the risk of a potential reassessment of sovereign creditworthiness.

In **Japan**, following a strong start to the year, economic activity contracted in the second and third quarters of 2015. However, the recent weakness in the third quarter was driven mainly by the large negative contribution of inventories, while both private consumption and exports rebounded. Looking ahead, the recovery is expected to proceed at a modest pace on the back of improving domestic demand, which is being supported inter alia by accommodative monetary policies. In addition, higher real incomes due to lower oil prices and stronger wage growth should boost private consumption, while continued increases in corporate profits bode well for investment. Risks to the economic outlook remain tilted to the downside amid rising external risks, in particular those related to a further slowdown of the Chinese economy, and major challenges in ensuring the long-term sustainability of public finances. Domestic banks' sovereign exposure and related risks to financial stability remain elevated, although they have been gradually declining since the launch of the quantitative and qualitative monetary easing in April 2013 and its further expansion in October 2014.

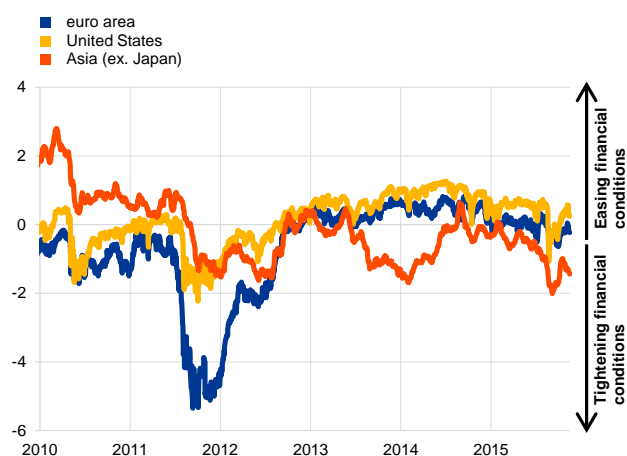
Economic activity in the **United Kingdom** has lost some of its momentum in the first three quarters of 2015, following the robust growth recorded last year. Still, economic conditions have remained relatively buoyant, with a low inflation environment, an

accommodative monetary policy stance and improving labour market conditions underpinning domestic demand. Looking ahead, the economy is expected to continue to expand at a relatively robust pace close to potential, with risks to economic activity being broadly balanced. On the upside, low energy prices and accelerating wage growth should support private consumption, while easing credit conditions should spur business investment. On the downside, continued balance sheet repair in the private and public sectors as well as the lagged effect of the appreciation of the pound sterling could weigh on economic activity. Also, the planned referendum on EU membership could heighten political uncertainty and dampen investment, while buoyant housing market developments may add risks to household balance sheets via further rising indebtedness.

**Chart 1.7**  
Financial conditions in emerging economies remained less benign than those in advanced economies

**Financial conditions in selected advanced and emerging market economies**

(Jan. 2010 – Nov. 2015; number of standard deviations)



Source: Bloomberg.

Notes: Bloomberg's financial conditions index tracks the overall stress in money, bond and equity markets. Yield spreads and indices are combined and normalised. The values of this index are Z-scores, which represent the number of standard deviations by which financial conditions are above or below the average level of financial conditions observed during the pre-crisis period, covering 1994 – June 2008 for the United States, 1999 – June 2008 for the euro area and 2000 – June 2008 for Asia (excl. Japan).

**Emerging markets** have lost further momentum on the back of unwinding domestic and/or external macro-financial imbalances, continued geopolitical tensions, heightened political uncertainty and lower commodity prices which adversely affected commodity (in particular oil) exporters across the emerging market universe. Economic dynamics continued to vary across regions, with rather upbeat sentiment in central and eastern Europe contrasting with further deteriorating economic confidence in emerging Asia and Latin America. Despite positive stimuli for oil-importing emerging economies, future growth prospects in a number of countries continue to be restrained by the limited monetary and fiscal room for manoeuvre as well as prevalent infrastructure bottlenecks and capacity constraints that weigh on potential output. Tighter financial conditions (see [Chart 1.7](#)) and the expected monetary policy adjustment in the United States are likely to further constrain economic activity in emerging economies which are highly dependent on capital inflows. That said, concerns regarding potential currency mismatches on sovereign and corporate balance sheets across emerging markets remain, albeit declining in recent years, inter alia given the increased

issuance of domestic currency-denominated debt and the build-up of substantial foreign currency asset positions in many emerging economies. This may render emerging markets overall less vulnerable to major downward exchange rate pressures vis-à-vis the US dollar, even if aggregate figures may hide pockets of risk at the country and/or sector levels.

The economic recovery across **emerging Europe**, notably the non-euro area EU countries in central and eastern Europe, is under way, with the recent increase in volatility in global financial markets having had only a limited impact on the region given rather healthy macroeconomic fundamentals. Economic growth is predominantly being driven by robust domestic demand, as very low inflation underpins the purchasing power of consumers, while investment activity is benefiting

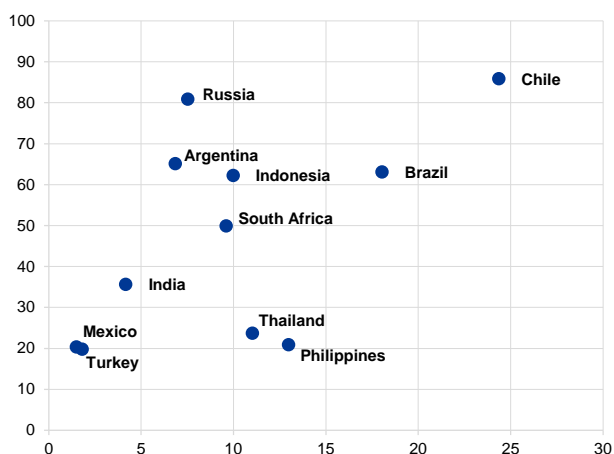
from EU structural fund inflows. Looking forward, an improving economic outlook for the euro area is expected to further stimulate economic growth in the region, but a possible re-escalation of the conflict in Ukraine and the deepening recession in Russia as a result of a commodity price shock and international sanctions continue to represent a potential downside risk to economic activity for some countries. In spite of the ongoing economic recovery, credit growth has remained muted across the region given legacy asset quality problems and the ongoing balance sheet repair in the non-financial private sector, which is constraining loan demand in some countries. Banks in the region continue to reshuffle their funding structure by mobilising local deposits and reducing cross-border funding sources. The implementation of new legislative initiatives aiming to reduce currency mismatches on household and corporate balance sheets (e.g. in Croatia, Hungary and Poland) may entail considerable financial costs for the banking sector and affect the profitability and future lending capacity of banks which are mostly subsidiaries of major euro area banking groups.

### Chart 1.8

Some emerging economies are highly exposed to the twin risk of lower commodity prices and a slowdown in economic activity in China

Share of commodity exports (y-axis) and exports to China (x-axis) in total exports

(2014; percentage of total merchandise exports)



Sources: IMF and World Bank.

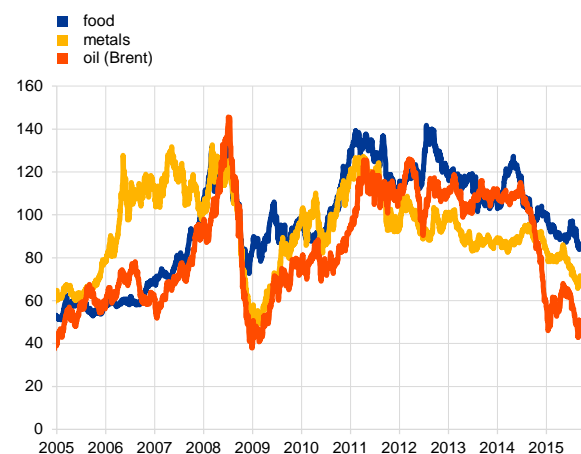
Notes: Commodities cover agricultural raw materials, food, fuels, ores and metals. Data for Indonesia and Russia are for 2013.

### Chart 1.9

Commodity markets have remained under pressure in all major market segments

Selected commodity price developments

(Jan. 2005 – Nov. 2015; index: 2010 = 100; USD per barrel)



Source: Bloomberg.

Economic conditions remained subdued in **emerging Asia**, in particular driven by developments in China where decelerating growth prospects coupled with previously overly high valuations triggered major corrections in local (and global) stock markets (see Box 1), prompting Chinese authorities to take supportive measures to stabilise sentiment. Looking ahead, regional growth dynamics are expected to fall short of the momentum seen in previous years, despite supportive factors such as the overall positive impact of lower oil prices, stronger foreign demand from key advanced economies as well as available room for further monetary and/or fiscal easing in several countries. In fact, risks to activity in the region are tilted mainly to the

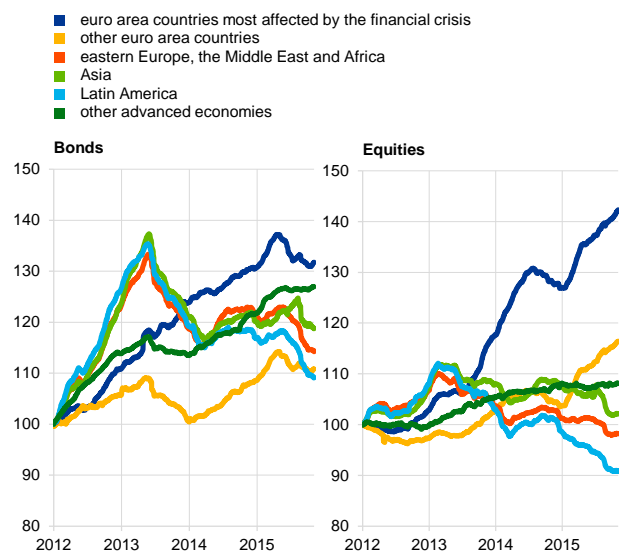
downside and relate to possible stronger than expected exchange rate adjustments linked to divergent monetary policies in advanced economies, as well as the uncertainty surrounding the monetary policy normalisation in the United States. Moreover, the slowdown of the Chinese economy may trigger additional knock-on effects for other Asian economies with close trade and financial links to China (see [Chart 1.8](#)) where increasing leverage, a large shadow banking sector, an accelerated liberalisation of capital flows and potential further corrections in the housing market indicate rising risks to financial stability.

Economic activity in [Latin America](#) remained weak, while growth became more uneven across countries. Several countries have lost further momentum or are experiencing an outright recession, in particular commodity exporters which saw their terms of trade deteriorate sharply as a result of lower commodity prices (e.g. Brazil and Venezuela). In other countries (e.g. Mexico), activity has remained relatively solid, buttressed by strong foreign (i.e. US) demand. Overall, risks remain skewed to the downside and mainly relate to a further tightening of external financing conditions and to a potential disorderly rebalancing of the Chinese economy, on which commodity exporters in the region are highly dependent (see [Chart 1.8](#)). Also, fiscal challenges in oil-exporting economies, coupled with heightened political risks and underlying structural vulnerabilities in some countries, may act as a drag on growth.

**Chart 1.10**  
Prospective changes in the US monetary policy stance and economic weakness in China have triggered capital outflows from emerging economies

**Equity and bond flows to advanced and emerging economies**

(Jan. 2012 – Nov. 2015; index: Jan. 2012 = 100)



Source: EPFR.

Notes: Bonds include both sovereign and corporate bonds. Indices are constructed based on relative flows over total net assets in order to control for the fact that the number of funds is not constant over time.

In sum, the global economy should continue on a moderate growth path, but developments will remain uneven across countries and regions. Risks to the outlook remain tilted to the downside as long-standing and newly emerging underlying vulnerabilities pose a threat to the global recovery, with inherent fragilities being partly masked by benign financial market conditions. Geopolitical tensions continue to represent a cause for concern, in particular the ongoing Ukraine-Russia tensions, but also those prevalent in other parts of the world (e.g. the Middle East). Moreover, after a short-lived recovery, global commodity markets have continued to adjust (see [Chart 1.9](#)) against the backdrop of abundant supply conditions and slowing global demand, while the related slowdown in emerging economies has caused oil price volatility to rise again. While low oil prices are likely to have a net positive impact on the global economy, they may challenge the macro-fiscal stability of oil-exporting emerging economies, thereby potentially triggering shifts in investor sentiment and negative spillovers across emerging economies. In addition, in comparison with the mainly supply-driven oil price decline observed so far, a fall in oil prices caused by lower growth in emerging economies is likely to be less positive for the

global economy on aggregate as it would be accompanied by weaker global trade.



Lastly, developments in China and more general concerns about the macro-financial health of major emerging economies have triggered portfolio investment outflows from emerging markets (see **Chart 1.10** and Section 2.1), highlighting the potential risk of a disorderly and broad-based reversal of global search-for-yield flows.

All in all, the main macro-financial risks to euro area financial stability currently relate to external factors, such as the ongoing adjustment in emerging economies towards a more moderate growth path, continued heightened geopolitical tensions and diverging monetary policies in major advanced economies. In addition to raising uncertainties regarding the pace and sustainability of the economic recovery at both the euro area and global levels, these factors also have the potential to trigger renewed tensions in global financial markets and prompt a potential reversal of global search-for-yield flows. Against the background of a low nominal growth environment, macro-financial risks also continue to originate from within the euro area. In particular, the ongoing balance sheet repair in both the private and public sectors in several countries, as well as the sluggish pace of structural reforms, continue to weigh on the underlying euro area growth momentum.

## Box 1

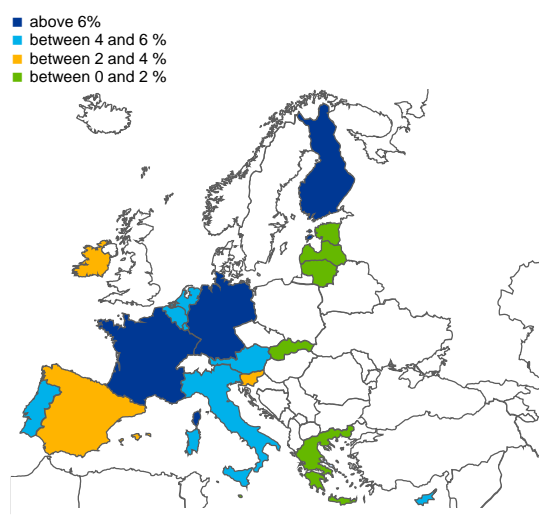
### Understanding the links between China and the euro area

#### Chart A

##### Trade linkages with China are limited

##### Exports to China across the euro area

(Q2 2015; percentage share of total extra-euro area exports of goods)



Source: IMF Direction of Trade Statistics.

A reassessment of global economic growth prospects has been under way since late 2014, as economic activity in emerging markets has receded from the strong growth seen over the last years. A key focus in this regard has been China, not only given its sheer size and growing role in international trade and finance, but also given the uncertainties related to the country's ongoing rebalancing from an investment and export-driven to a consumption-led growth model. The correction in Chinese stock markets in the third quarter of this year sparked a pronounced rise in uncertainty which was pervasive enough to have significant global effects, including on euro area financial markets. Indeed, developments in China could affect the euro area in multiple ways from a financial stability perspective, including via trade, commodity and financial channels, which may work either directly or indirectly.

Starting with the trade channel, trade between the euro area and China has increased substantially over the past decade, reflecting China's rapid pace of growth, its accession to the World Trade Organization and the growth of global value chains (GVCs) in which China is a key player. China's share in world GDP rose to 13% in 2014, which is more than half the size of that of the United States at 23% (using market exchange rate weights). Despite China's size, euro area exports to China remain limited at around 6% of total extra-euro area exports of goods. At the country level,

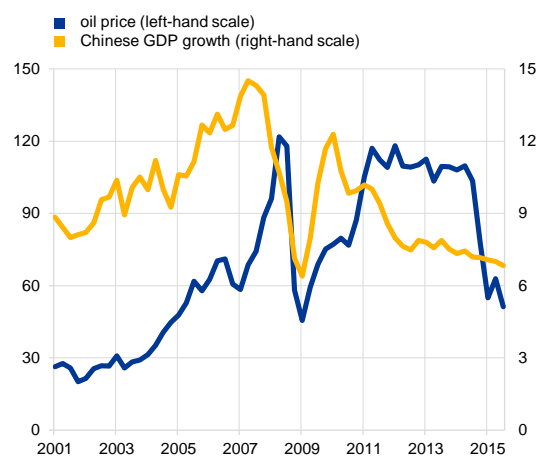
Germany has the largest share, with some 9% of its total extra-euro area exports of goods targeting China, while for other euro area countries the importance of China as an export destination ranges from around 1% (Lithuania) to 8% (Finland) of their total extra-euro area exports of goods (see Chart A). The majority of exports to China consist of manufactured goods, reflecting the relatively high share of investment in GDP. However, a growing share of euro area exports also relates to intermediate goods, which is due in part to China's prominent role in GVCs, suggesting that the demand for euro area exports partially depends on foreign demand rather than domestic demand in China.

## Chart B

China has been an important driver of oil prices

### Oil prices and Chinese GDP growth

(Q1 2001 – Q3 2015; USD per barrel; annual percentage change)



Sources: Bloomberg and OECD.

Note: Oil prices are nominal Brent crude oil prices.

Turning to the commodity channel, given the size of the economy, a slowdown in Chinese economic activity would also clearly affect global commodity markets (see Chart B), with subsequent repercussions for the euro area.

China is an important driver of oil prices, accounting for 12% of total world demand for oil (compared with 21% for the United States).<sup>1</sup>

While the oil price decline since mid-2014 has been largely driven by supply-side factors, such as robust US shale oil production, a decline in commodity prices induced by lower demand from China would dampen adverse growth spillovers from lower foreign demand. The commodity price channel could also affect euro area banks with direct linkages to commodity producers through debt or equity financing. The related risks appear to be limited though, as euro area bank exposures to oil-exporting

economies and the energy sector are relatively small.<sup>2</sup>

Beyond the oil sector, financial linkages between China and the euro area relate to direct bank exposures to Chinese counterparties, indirect exposures to third countries, mutual fund exposures (see Section 2) and asset price co-movements which may be partly driven by confidence effects. As regards direct bank exposures, aggregated banking supervision data suggest that cross-border claims of euro area banks on China are relatively small, accounting for less than 1% of home-country assets (see Chart C).<sup>3</sup> However, euro area banks could also be affected indirectly via exposures to third countries which are exposed to China. However, simulations factoring in such effects via network analyses find that only major financial centres can have large effects on the euro area.<sup>4</sup>

<sup>1</sup> Compared with the situation for oil, China plays a larger role in total demand for various metal commodities. For example, China's share in total world demand for aluminium and copper is around 50%.

<sup>2</sup> For further details, see Box 2 in *Financial Stability Review*, ECB, May 2015.

<sup>3</sup> These exposures to China mainly comprise traditional loans, while debt, equity and derivative exposures play a less significant role.

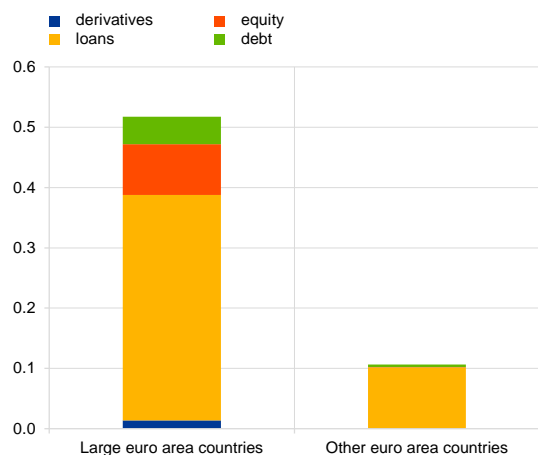
<sup>4</sup> See, for example, Espinosa-Vega, M. A. and Solé, J. (2010), "Cross-Border Financial Surveillance: A Network Perspective", IMF Working Paper No 10/105, April.

### Chart C

Euro area bank exposures to China are relatively small

#### Euro area bank exposures to China

(Q4 2014; percentage of home-country banking sector assets)



Source: ECB.

Note: Large euro area countries cover France, Germany, Italy, Spain and the Netherlands.

### Chart D

Chinese shocks can have a large impact on the VIX index

#### The Shanghai stock index and the VIX index

(Nov. 2014 – Nov. 2015; index points)



Source: Bloomberg.

Despite limited direct financial sector exposures to China, shocks emanating from China during the third quarter of this year spilled over to global equity markets, with daily declines comparable to those seen in the context of the Lehman Brothers default and significantly larger than in earlier corrections in China or in the Fed tapering episode in 2013. The market reaction differed across countries, yielding a significant degree of heterogeneity in market responses. An empirical analysis of the determinants of cross-country heterogeneity in local stock market responses shows that these differences cannot be explained by traditional spillover channels including trade linkages, commodity prices and country risk.<sup>5</sup> This indirectly lends support to the notion that global confidence shocks which would affect all risky assets irrespective of country-specific risk factors could be triggered by developments in China. This finding is consistent with an increase in the VIX index during China-related shocks (see Chart D).

To conclude, direct trade and financial linkages between the euro area and China, while having increased rapidly over the past decade, appear to be limited, and thus are rather unlikely to induce major spillovers with negative implications for euro area financial stability. The commodity channel tends to dampen adverse spillovers, as the effect of lower foreign demand is partially offset by the positive impact of lower commodity prices on euro area growth. However, despite limited financial linkages with the rest of the world, developments in China may trigger significant volatility in global stock markets and more generally adversely affect global confidence. To the extent that such confidence effects may lead to significant global portfolio adjustments, spillovers from China to global growth and thus euro area financial stability can be more powerful than direct exposures suggest.

<sup>5</sup> In a sample of 30 countries, changes in domestic stock market indices are regressed in country-specific settings on specific Chinese events and macroeconomic news in those countries, the United States and the euro area. The marginal effects of the Chinese event on exchange rates and stock markets are regressed on a set of explanatory variables, including standard gravity-type variables and proxies for the trade, commodity and country risk channels.

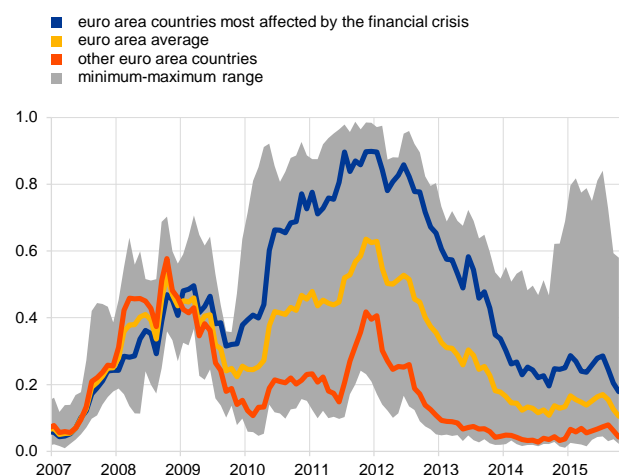
## 1.2 Sovereign debt sustainability risks remain elevated amid continued favourable financing conditions

**Sovereign stress** conditions have remained contained in the euro area despite higher volatility triggered by renewed sovereign tensions in Greece. In fact, spillovers from the Greek events across the euro area were minimal, also cushioned by ECB action, including the expanded asset purchase programme. The composite indicator of systemic stress in euro area sovereign bond markets has remained close to the levels seen before the eruption of the global financial crisis in 2008 (see [Chart 1.11](#)). However, the aggregate indicator conceals substantial divergence in sovereign stress across countries. In particular, default risk expectations had increased in Greece amid high political uncertainty until July 2015 and, even though decreasing since then, they remain at heightened levels due to concerns about the prompt and full implementation of the third Greek financing programme.

**Chart 1.11**  
Sovereign tensions contained in most (but not all) euro area countries

Composite indicator of systemic stress in euro area sovereign bond markets (SovCISS)

(Jan. 2007 – Oct. 2015)



Sources: ECB and ECB calculations.

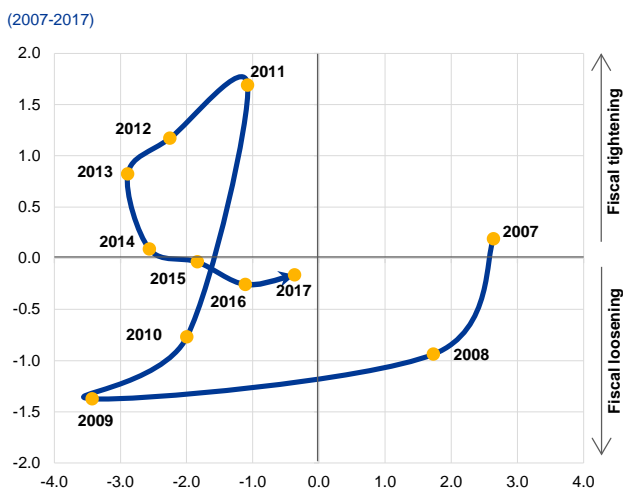
Notes: The SovCISS aims to measure the level of stress in euro area sovereign bond markets. It is available for the euro area as a whole and for 11 individual euro area countries (Austria, Belgium, Germany, Finland, France, Greece, Ireland, Italy, the Netherlands, Portugal and Spain). Countries most affected by the financial crisis comprise Greece, Ireland, Italy, Portugal and Spain, while other euro area countries include Austria, Belgium, Germany, Finland, France and the Netherlands. The SovCISS combines data from the short end and the long-end of the yield curve (two-year and ten-year maturity bonds) for each country, i.e. two spreads between the sovereign yield and the euro swap interest rate (absolute spreads), two realised yield volatilities (the weekly average of absolute daily changes) and two bid-ask bond price spreads (as a percentage of the mid-price). The aggregation into country-specific and euro area aggregate SovCISS is based on time-varying cross-correlations between all homogenised individual stress indicators pertaining to each SovCISS variant following the CISS methodology developed in Hollo, D., Kremer, M. and Lo Duca, M., "CISS – a composite indicator of systemic stress in the financial system", *Working Paper Series*, No 1426, ECB, March 2012.

In terms of fiscal fundamentals, flows are showing signs of continued (albeit gradual) improvement. **Fiscal deficits** in the euro area are expected to decline further in 2015-17, although at a slower pace than in previous years. According to the European Commission's autumn 2015 economic forecast, the aggregate euro area fiscal deficit is projected to fall from 2.6% of GDP in 2014 to 2.0% in 2015, 1.8% in 2016 and 1.5% in 2017, entirely driven by cyclical factors and lower interest expenditure. Headline fiscal balances are expected to improve in almost all euro area countries over the forecast horizon. Despite the overall improvement in fiscal conditions in the euro area in recent years, sovereign risks remain elevated given high debt ratios. Consolidation efforts appear to have lost momentum, while proceeding at an uneven pace across countries. Following major largely pro-cyclical adjustments in 2011-13, the underlying fiscal stance is expected to be broadly neutral for the euro area as a whole in 2015-17, as reflected by the flat profile of the euro area cyclically adjusted primary budget balance (see [Chart 1.12](#)). In the absence of further reform efforts, structural budget balances are expected to deteriorate in some countries, in many cases also moving further away from the medium-term objective set by individual euro area countries in their stability programmes (see [Chart 1.13](#)). In addition, several countries (e.g. Belgium, France, Spain, Slovakia and Slovenia) have postponed the targeted deadline for

achieving their medium-term objectives, compared with the ones set in the 2013 calendars of convergence, into the distant future.<sup>6</sup> In these cases, further progress with fiscal adjustment and reform implementation is needed to ensure long-term government debt sustainability and to restore fiscal buffers. As long as large structural fiscal vulnerabilities remain at the country level, fiscal expansion would risk generating an adverse reaction in both sovereign and private funding markets.

**Chart 1.12**  
Implementation of reform and consolidation commitments appears to have dwindled...

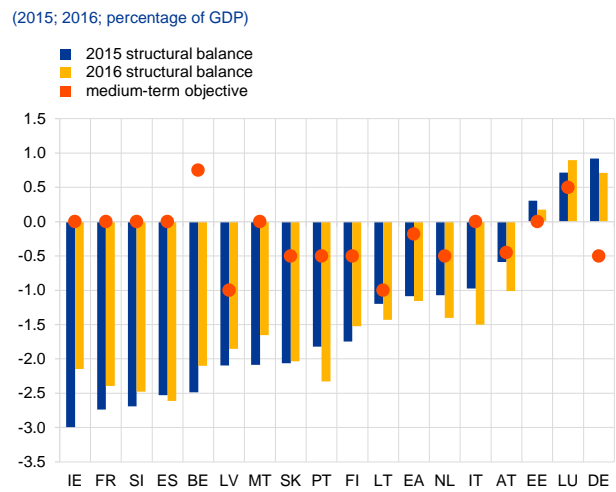
Output gap (x-axis) and changes in the cyclically adjusted primary budget balance (y-axis) in the euro area



Sources: European Commission and ECB calculations.

**Chart 1.13**  
... highlighting the need for continued reform efforts at the national level

Structural budget balances and medium-term fiscal objectives across the euro area



Source: European Commission's autumn 2015 economic forecast.  
Note: The programme countries Cyprus and Greece are excluded as they are not covered by the European Semester.

From the stock perspective, risks to **government debt** sustainability remain sizeable despite the deficit reduction observed over recent years. In fact, on average, the euro area government debt-to-GDP ratio appears to have reached a peak of 94.5% of GDP in 2014, but it is projected by the European Commission to fall only gradually to 91.3% of GDP by 2017. In terms of the evolution of government debt levels, the outlook at the aggregate euro area level has improved slightly since the adoption of the expanded asset purchase programme, thanks to lower interest payments and higher expected nominal growth. Still, the picture remains fairly heterogeneous at the country level, with seven euro area countries forecasted to see an increase in their government debt ratios over the 2014-17 period, in particular on account of positive debt-deficit adjustments, but in some cases also driven by primary deficits and/or positive interest rate-growth differentials (see [Chart 1.14](#)).

In the short term, the main challenges to sovereign debt sustainability across the euro area relate to heightened political uncertainty in several countries in the context of upcoming elections, complacency concerning fiscal adjustment and structural

<sup>6</sup> For further details, see Box 8 on "The effectiveness of the medium-term budgetary objective as an anchor of fiscal policies", *Economic Bulletin*, Issue 4, ECB, 2015.

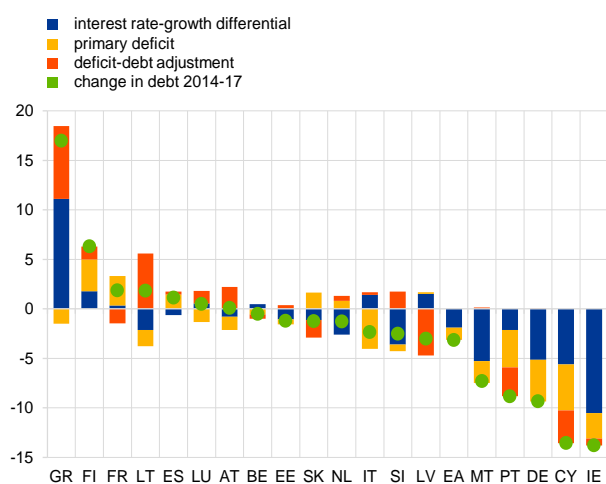
reforms as well as a prolonged period of low nominal growth. In the long run, these challenges are accentuated by vulnerabilities related to slow potential GDP growth and ageing-related costs<sup>7</sup>.

**Chart 1.14**

Government debt levels are projected to increase further in several euro area countries in 2014-17

**Changes in government debt levels across the euro area**

(2014-2017; percentage points of GDP; percentage point contributions)



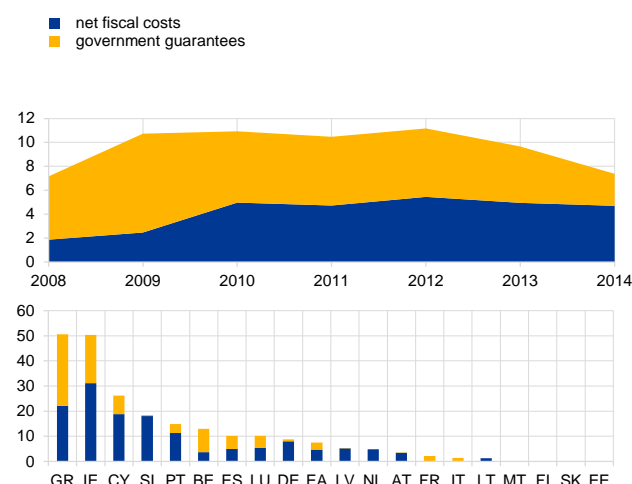
Sources: European Commission's autumn 2015 economic forecast.  
Note: For more details on the deficit-debt adjustment, see the article entitled "From government deficit to debt: bridging the gap", *Monthly Bulletin*, ECB, April 2007.

**Chart 1.15**

Financial exposure of euro area governments arising from interventions in financial institutions is falling, but remains high in some euro area countries

**Net fiscal costs of financial assistance measures and outstanding government guarantees**

(2008-2014; percentage of GDP)



Source: ESCB.  
Notes: Net fiscal costs equal gross fiscal costs minus realised sales/repayments of acquired assets. Government guarantees do not include deposit insurance schemes. Country-level data as at end-2014. For more details, see the article entitled "The fiscal impact of financial sector support during the crisis", *Economic Bulletin*, Issue 6, ECB, 2015.

While the Eurosystem's expanded asset purchase programme addresses the risk of a prolonged period of low inflation and thereby provides support for economic growth, governments may see reduced incentives to undertake the necessary structural reforms or fiscal adjustments. Credible compliance with the commitments made under the Stability and Growth Pact together with continued reform efforts would clearly help to build resiliency to adverse shocks. In terms of the sovereign-bank nexus, the unwinding of financial sector support has continued, with most countries having already recovered part of the liquidity and/or capital support provided to financial institutions since the onset of the global financial crisis in 2008.<sup>8</sup> Still, the financial exposure of governments arising from interventions in financial institutions remains high in some euro area countries (see **Chart 1.15**). Recent steps towards a genuine European banking union, including bail-in and bank resolution arrangements based on the provisions of the Bank Recovery and Resolution Directive and the establishment of the Single Resolution Mechanism, should,

<sup>7</sup> For an overview and assessment of the latest ageing cost estimates, see Box 7 entitled "The 2015 Ageing Report: how costly will ageing in Europe be?", *Economic Bulletin*, Issue 4, ECB, 2015.  
<sup>8</sup> For further details, see the article entitled "The fiscal impact of financial sector support during the crisis", *Economic Bulletin*, Issue 6, ECB, 2015.

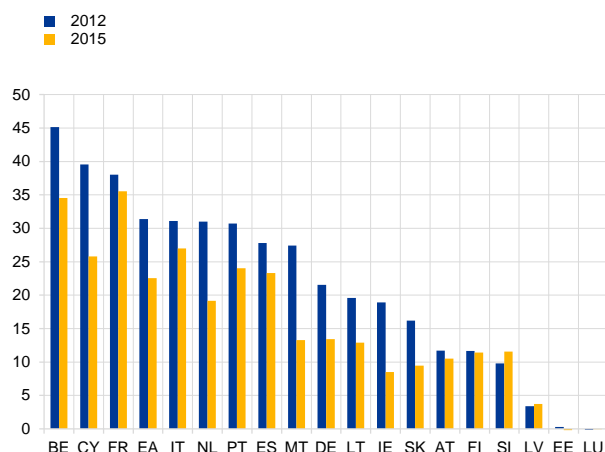
however, limit the future potential for contingent liabilities of any given country vis-à-vis its banking sector.

**Chart 1.16**

Government financing needs have fallen considerably in several euro area countries...

**Gross general government financing needs in the euro area**

(2012; 2015; percentage of GDP)



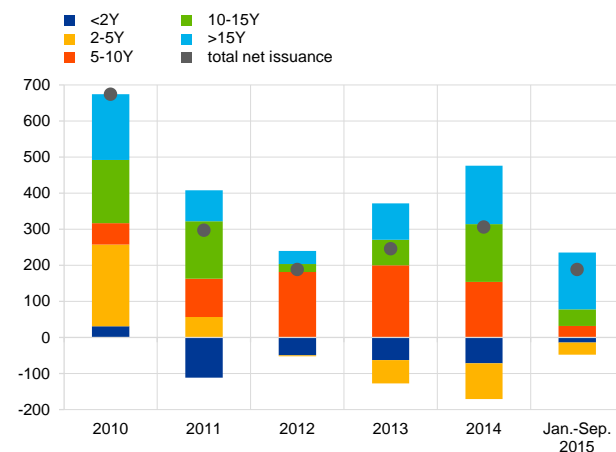
Sources: ECB CSDB database and ECB calculations.  
 Note: The financing need is calculated as the sum of the budget deficit and the gross redemption of outstanding government debt for a given year. For more details on the CSDB database, see "New and timely statistical indicators on government debt securities", *Statistics Paper Series*, No 8, ECB, June 2015.

**Chart 1.17**

... partly driven by a shift of issuance activity towards the long end of the maturity spectrum...

**Issuance of government debt securities by original maturity**

(2010-2014; Jan. – Sep. 2015; EUR billions)



Source: ECB Government Finance Statistics.

While **sovereign financing** conditions became more volatile in the context of the Greek events, overall financing conditions have remained favourable inter alia thanks to increased demand for government bonds against the backdrop of the Eurosystem's ongoing expanded asset purchase programme. Even if still substantial, government liquidity needs are forecast to drop to about 22.5% of GDP for the euro area aggregate in 2015, down from approximately 31.5% of GDP in 2012 (see **Chart 1.16**), and are projected to decrease further in 2016. The drop in refinancing needs is driven by the end of the borrowing cycle that started in 2009 and consisted predominantly of short- and medium-term financing, as well as by the ongoing shift in issuance activity towards the long end of the maturity spectrum. Net issuance of government securities with maturities below five years remains negative and contrasts with strong increases in issuance activity beyond the 15-year horizon (see **Chart 1.17**). As a result, the average residual maturity of outstanding euro area government debt securities continued to increase, reaching 6.6 years in September 2015, with the average residual maturities ranging from 3.1 years in Cyprus to 11.9 years in Ireland (see **Chart 1.18**).<sup>9</sup> Given the current environment of low and further declining (or even negative) government bond yields at short maturities, this trend is likely to continue in the near term, as investors search for higher returns by increasing the duration of purchased assets, while governments aim to lock in long-

<sup>9</sup> Note that the average residual maturity of outstanding Cypriot government securities increased markedly after the issuance of a €1 billion ten-year bond on 4 November 2015.

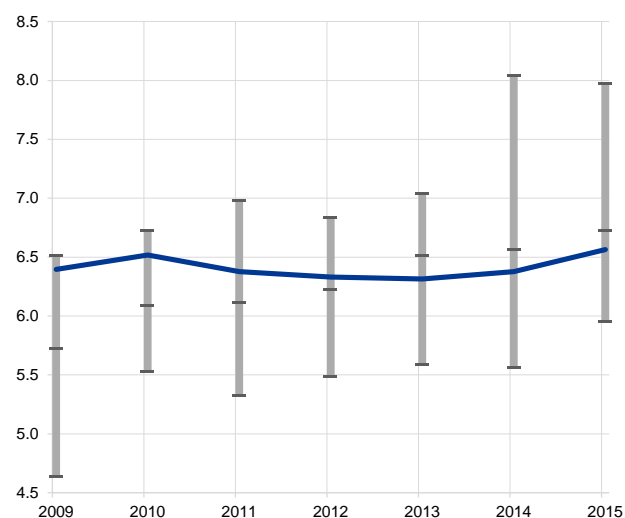
term financing at low costs. Looking at the country level, 2015 refinancing needs remain substantial for several countries, while gradually declining towards levels seen prior to the financial crisis, as lower interest rates pass through into reduced debt servicing costs.

**Chart 1.18**

... leading to a gradual increase in the average government debt maturity across the euro area

**Average residual maturity of government debt securities**

(Dec. 2009 – Sep. 2015; years)



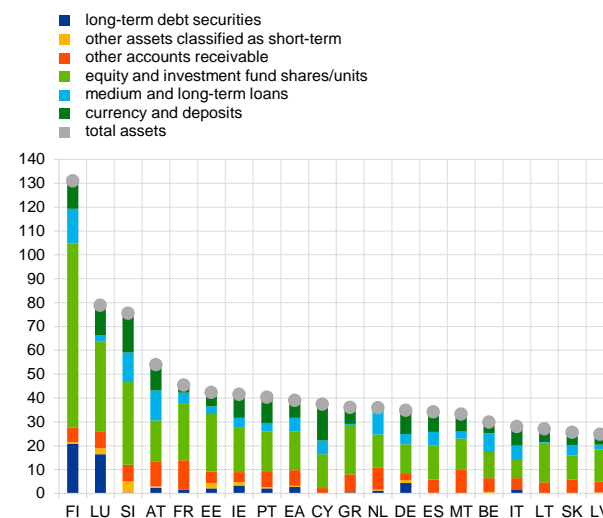
Source: ECB Government Finance Statistics.  
Note: The chart shows the interquartile distribution as well as the average and median values across euro area countries.

**Chart 1.19**

Available short-term liquid financial assets may help cushion possible sudden financing needs

**Structure of euro area governments' financial assets**

(Q2 2015; percentage of GDP)



Sources: Eurostat, national sources and ECB calculations.  
Note: Other assets classified as short-term include short-term debt securities, short-term loans and monetary gold.

Turning to the asset side of sovereign balance sheets, the **financial assets** of governments represent an important element in the assessment of sovereign liquidity and debt sustainability prospects as they may cushion possible sudden increases in sovereign financing needs. In fact, financial assets held by euro area sovereigns are substantial, amounting to some 40% of GDP at the end of the second quarter of 2015 on average, with a considerable degree of cross-country variation. However, the value of highly liquid assets that can be effectively used as a buffer to finance the rollover of government liabilities (i.e. currency and deposits) varies across countries, ranging from 1.5% of GDP in the Netherlands to some 16.3% of GDP in Slovenia (see **Chart 1.19**). Equity and investment fund shares/units accounted for the largest part of financial assets in most euro area countries, suggesting that privatisation of state-owned assets could play an important role in mitigating debt sustainability concerns – provided that privatisation proceeds are used to retire government debt.



## 1.3 Decreasing country fragmentation in the non-financial private sector

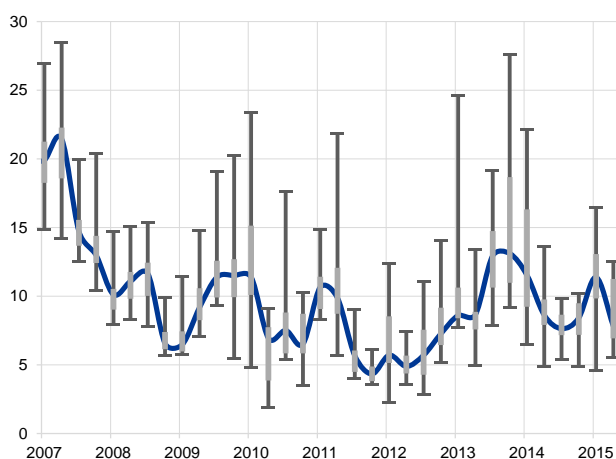
Mirroring the euro area macroeconomic environment, the **income and earnings** position of the euro area non-financial private sector has shown further signs of improvement, though it remains weak. The distance-to-distress indicator indicates that overall credit risks related to household balance sheets in the euro area are much less pronounced than at the height of the euro area sovereign debt crisis at the turn of 2011-12 (see [Chart 1.20](#)). A similar picture can be observed in terms of risks related to corporate balance sheets (see [Chart 1.21](#)), with the positive impact of gradually improving economic fundamentals and very low funding costs more recently being largely offset by the negative impact of heightened market volatility.

**Chart 1.20**

Risks related to euro area household balance sheets prevail, but are...

### Households' distance to distress in the euro area

(Q1 2007 – Q2 2015; number of standard deviations from estimated default point)



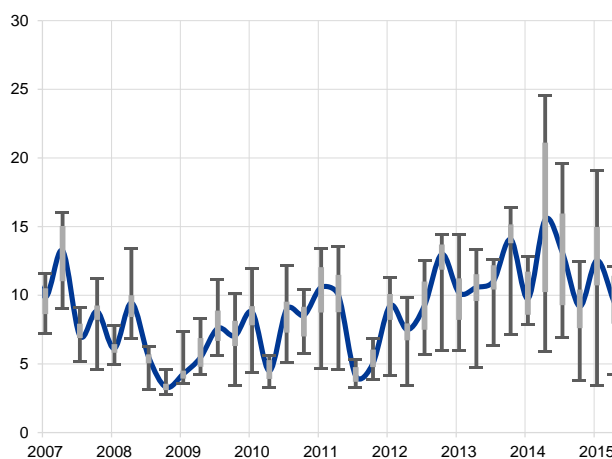
Sources: ECB, Bloomberg, Thomson Reuters Datastream and ECB calculations.  
Notes: A lower reading for distance to distress indicates higher credit risk. The chart shows the median, minimum, maximum and interquartile distribution across 11 euro area countries for which historical time series cover more than one business cycle. For details on the indicator, see Box 7 in *Financial Stability Review*, ECB, December 2009.

**Chart 1.21**

... similarly to corporate balance sheet risks lower than during the euro area sovereign debt crisis

### Non-financial firms' distance to distress in the euro area

(Q1 2007 – Q2 2015; number of standard deviations from estimated default point)



Sources: ECB, Bloomberg, Thomson Reuters Datastream and ECB calculations.  
Notes: A lower reading for distance to distress indicates higher credit risk. The chart shows the median, minimum, maximum and interquartile distribution across 11 euro area countries for which historical time series cover more than one business cycle. For details on the indicator, see Box 7 in *Financial Stability Review*, ECB, December 2009.

Risks to corporate and household balance sheets are expected to continue to diminish gradually. The euro area household sector is expected to recover further, buttressed by overall improving labour market conditions, even if high unemployment still weighs on households' income prospects in some euro area countries. In fact, euro area households have seen accelerating real disposable income growth (see [Chart 1.22](#)) amid low inflation outturns that, coupled with continued improvements in household net worth on the back of gradually strengthening housing market dynamics across the euro area, should help bolster households' balance sheets and counterbalance the negative impact of recent declines in financial asset prices on household wealth. Similarly, the earnings-generating capacity of euro area non-financial corporations has improved somewhat on the back of the ongoing economic recovery. Still, corporate profitability has remained muted in the aftermath of the

crisis, inter alia reflecting the limited possibilities of non-financial firms to pass on cost increases to output prices in an environment of weak demand and needed competitiveness gains. Looking ahead, corporate profitability is expected to improve as the recovery gathers pace, thereby alleviating balance sheet pressures of stressed firms.

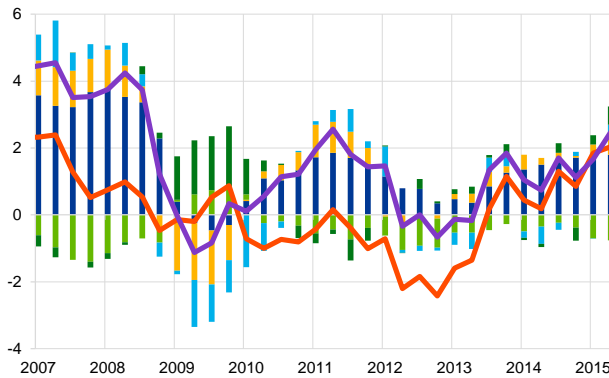
**Chart 1.22**

A gradually improving income position underpins households' debt servicing capabilities

**Euro area households' real and nominal gross disposable income**

(Q1 2007 – Q2 2015; annual percentage changes; percentage point contributions)

- compensation of employees
- gross operating surplus and mixed income
- real gross disposable income
- direct taxes
- net property income
- net social benefits and contributions
- gross disposable income



Sources: Eurostat and ECB.

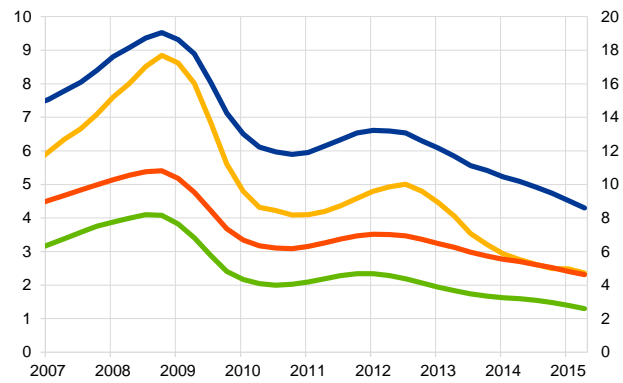
**Chart 1.23**

Interest payment burden of households and non-financial corporations has reached record lows

**Interest payment burden of the euro area non-financial private sector**

(Q1 2007 – Q2 2015; four-quarter moving sums; percentages)

- gross interest payments-to-gross operating surplus ratio of non-financial corporations (right-hand scale)
- net interest payments-to-gross operating surplus ratio of non-financial corporations (left-hand scale)
- households' interest income as a percentage of gross disposable income (left-hand scale)
- households' interest expenditures as a percentage of gross disposable income (left-hand scale)



Sources: ECB and Eurostat.

Improving income and earnings prospects in tandem with record low interest payment burdens (see [Chart 1.23](#)) should support borrowers' debt servicing capabilities. The sensitivity to any prospective rise in interest rates depends fundamentally on the predominance of loans with floating rates or rates with short fixation periods. A higher debt service burden for borrowers in a rising interest rate environment is, however, likely to be partly offset by the positive impact of accelerating economic growth on households' and firms' income and earnings situation.

Notwithstanding these improvements in income and earnings prospects, legacy balance sheet concerns continue to constrain the non-financial private sector in the euro area. On average, euro area household **indebtedness** stood slightly above 60% of GDP in mid-2015. Although this figure is not remarkable by international standards, it remains high by historical standards. The level of non-financial corporate debt was more elevated, at 107% of GDP on an unconsolidated basis (excluding trade credit) or 83% of GDP on a fully consolidated basis, by both historical and international standards (see [Chart 1.24](#)). Balance sheet repair in the household and non-financial corporate sectors has been gradual at the aggregate euro area level, with debt levels declining only marginally since the peak at end-2009

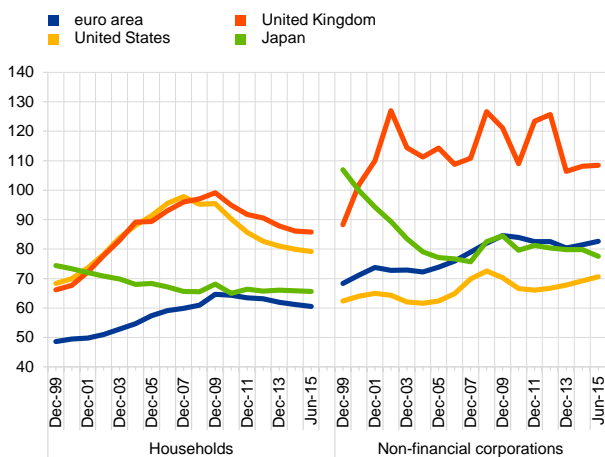
or even increasing somewhat when compared with the pre-crisis period (see [Chart 1.25](#)). In fact, a weak nominal growth environment, legal impediments in several countries and non-financial firms' increased recourse to market-based funding in recent years have tended to inhibit a swift deleveraging in the non-financial private sector.

**Chart 1.24**

Euro area household and non-financial corporate debt levels remain high by historical standards...

Development of household and consolidated corporate debt levels in the euro area and other currency areas over time

(Q4 1999 – Q2 2015; percentage of nominal GDP)



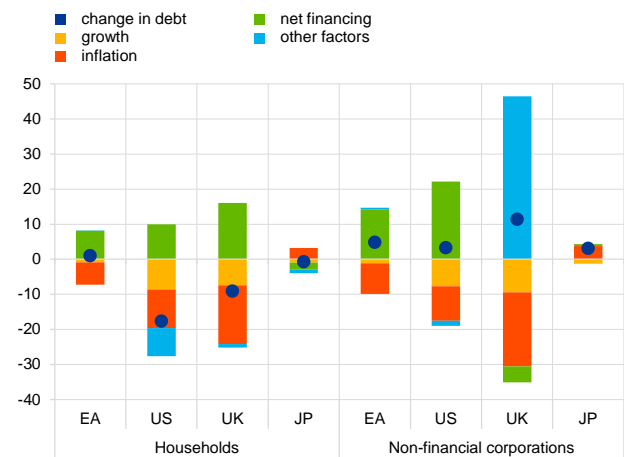
Sources: Eurostat, Federal Reserve, Office for National Statistics, Bank of Japan, ECB and ECB calculations.  
Notes: Household debt includes total loans granted to households. Consolidated corporate debt is defined as the sum of total loans granted to non-financial corporations net of inter-company loans, debt securities issued and pension liabilities.

**Chart 1.25**

... with a weak economic growth environment being one obstacle to household and corporate deleveraging

Decomposition of the change in household and consolidated corporate debt in the euro area and other currency areas since mid-2007

(Q2 2007 – Q2 2015; percentage of nominal GDP; percentage point contributions)



Sources: Eurostat, Federal Reserve, Office for National Statistics, Bank of Japan, ECB and ECB calculations.  
Notes: Household debt includes total loans granted to households. Consolidated corporate debt is defined as the sum of total loans granted to non-financial corporations net of inter-company loans, debt securities issued and pension liabilities. Other factors include possible debt write-offs, valuation effects and reclassifications.

Significant heterogeneity across countries underlies the aggregate euro area household and corporate debt figures. In some countries continued deleveraging needs clearly imply a potential drag on economic growth. Particularly in terms of corporate deleveraging, the pace of adjustment differed markedly across the euro area, with deleveraging being more forceful in countries which had accumulated large amounts of debt prior to the crisis, e.g. Ireland and Spain. The same is true for deleveraging at the sector level, where arguably overindebted sectors, such as construction and real estate services, continue to deleverage more strongly than less-indebted ones such as industry or trade. That said, in the context of a low opportunity cost of holding liquid assets, non-financial corporations retain historically high cash balances, which could make an important contribution to reducing leverage or financing the economic recovery.

**Bank lending flows** to the non-financial private sector have continued to recover. The underlying short-term dynamics of bank lending gathered further momentum (see [Chart 1.26](#)), in particular in the household sector, on the back of strengthening credit demand – which is supported by higher economic and housing market activity and further declines in the cost of bank lending – and receding supply-side

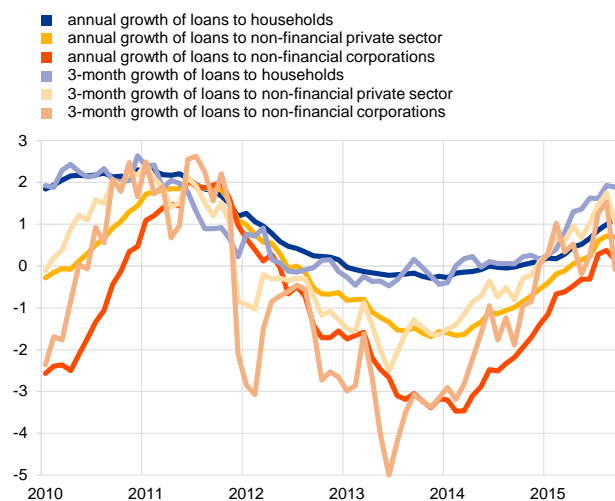
constraints. On average, bank lending to euro area households has remained weak though (albeit stronger than lending to the non-financial corporate sector), mirroring continued high levels of unemployment, remaining deleveraging needs and housing market weakness in euro area countries which have been more affected by the crisis. This aggregate picture also masks diverging developments at the country level, with annual growth rates ranging from -6% in Ireland to +10% in Slovakia. Turning to the sub-components of bank lending by purpose, modest annual growth in loans for house purchase and consumer loans has been offset by a continued drop in other types of lending.

Looking ahead, the October 2015 euro area bank lending survey suggests a mixed picture regarding households' financing conditions. Supply-side constraints have continued to ease for consumer loans and other lending to households, mainly driven by increased competitive pressures. Credit standards have tightened for loans for house purchase, largely driven by other factors, in particular those relating to national regulation. At the same time, competition continued to contribute most to an easing in credit standards on housing loans. On the demand side, improving consumer confidence, the low general level of interest rates, more favourable housing market prospects and increased financing needs for spending on durable consumer goods have translated into an increase in demand for housing loans as well as consumer credit and other lending.

**Chart 1.26**  
Bank lending to the euro area non-financial private sector has shown further signs of recovery over the course of 2015

**Bank lending to the euro area non-financial private sector**

(Jan. 2010 – Sep. 2015; annual percentage changes; percentages)

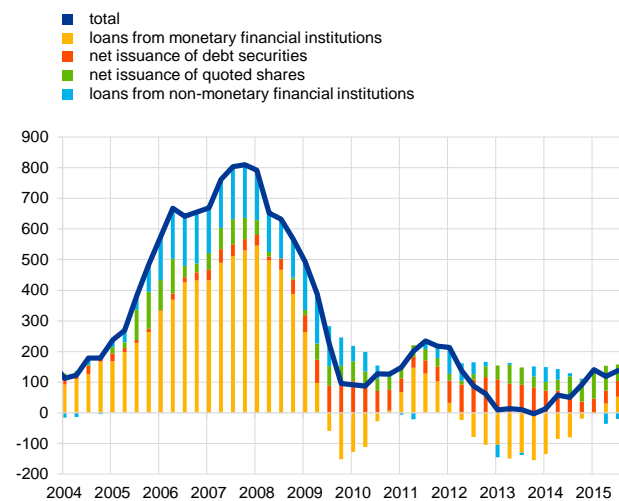


Sources: ECB.  
Note: Data have been adjusted for loan sales and securitisation.

**Chart 1.27**  
External financing flows for euro area non-financial corporations have stabilised

**External financing of euro area non-financial corporations**

(Q1 2004 – Q3 2015; EUR billions; four-quarter moving flows)



Sources: Eurostat, ECB, Dealogic and ECB calculations.  
Note: Loans from monetary financial institutions to non-financial corporations are corrected for loan sales and securitisations, while loans from non-monetary financial institutions exclude loan securitisations.

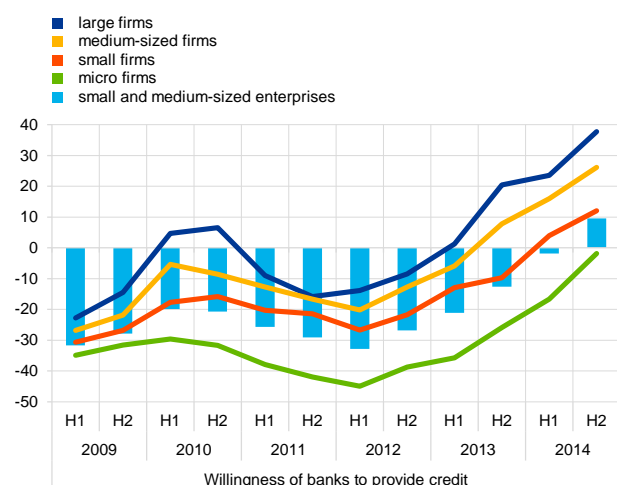
Following a strong recovery over the course of 2014 and early 2015, the net external financing of euro area non-financial corporations has stabilised, now standing at

levels similar to those observed in the first half of 2012 and in 2004 before the strong credit expansion took place (see [Chart 1.27](#)). Having declined for three consecutive years, bank loans to non-financial firms turned positive at the beginning of 2015, but loan dynamics have remained subdued, despite some strengthening during the year. Monthly data show that the net issuance of debt securities moderated towards the autumn, after the temporary rebound in mid-summer. This development was most likely driven by the recent increases in the cost of market-based debt financing and possibly also by a further strengthening of retained earnings (which reduces the need for external finance). This suggests that the strong issuance of debt securities by non-financial corporations and their conduits observed during the first months of 2015 was temporary, possibly relating to the launch of the Eurosystem's public sector purchase programme and the exceptionally low level of corporate bond yields. The issuance of quoted shares has slowed markedly in recent months amid unfolding corrections in global (including euro area) stock markets. Going forward, alongside improving supply and demand-side conditions, targeted Eurosystem measures to revive lending, i.e. the targeted longer-term refinancing operations or the asset-backed securities and covered bond purchase programmes, should promote the recovery of bank credit, while also lowering funding costs for non-financial firms in the euro area. At the same time, the recent repricing in bond markets and heightened stock market volatility may constrain the recourse to market financing by firms and dampen issuance activity further.

**Chart 1.28**  
Financing conditions continued to improve for non-financial corporations irrespective of firm size

**Financing conditions of euro area non-financial corporations across firm sizes**

(H1 2009 – H2 2014; net percentages of respondents; changes over the past six months)



Source: ECB survey on the access to finance of enterprises (SAFE).

The results of the latest euro area bank lending survey suggest that underwriting terms for corporate loans have continued to improve, mainly on the back of increased competitive pressures and banks' lower risk perceptions. Looking at maturities, banks have eased their credit standards for short- and long-term loans to the same extent. Across firm sizes, credit standards have eased in particular on loans to SMEs and to a lesser extent also to large firms. Still, according to the ECB's latest survey on the access to finance of enterprises in the euro area, financing conditions continued to improve for non-financial corporations irrespective of firm size, but banks' willingness to grant a loan continues to be still somewhat higher for large firms (see [Chart 1.28](#)). Demand for corporate loans in the euro area has improved further amid continued divergence across countries. Alongside the low general level of interest rates, financing needs related to fixed investment as well as inventories and working capital have contributed positively to the demand for loans to enterprises. At the same time, the issuance of debt securities by non-financial firms and their internal

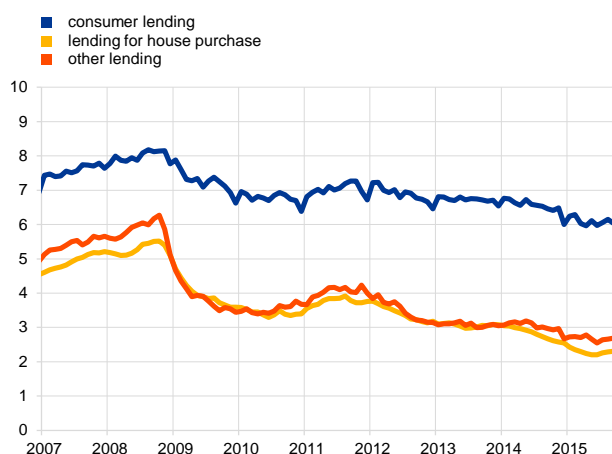
financing capacity have contributed negatively to loan demand.

**Chart 1.29**

Nominal funding costs for euro area households have remained close to record lows in all lending categories...

**Euro area nominal bank lending rates on new loans to households**

(Jan. 2007 – Sep. 2015; percentages)



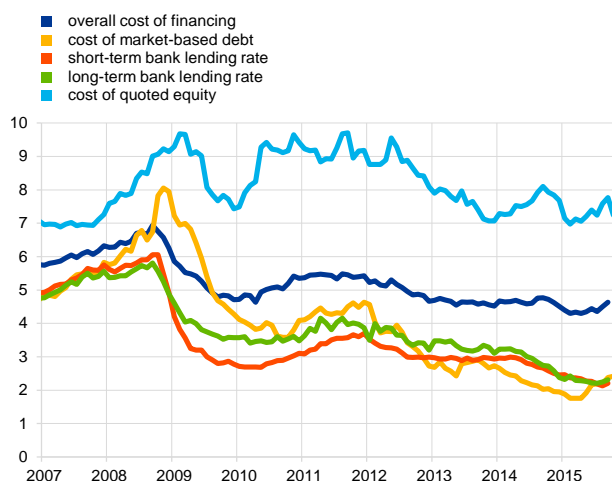
Source: ECB.

**Chart 1.30**

... as have the overall funding costs of euro area non-financial firms, despite a pick-up in the cost of market-based debt

**Nominal cost of external financing of euro area non-financial corporations**

(Jan. 2007 – Oct. 2015; percentages)



Sources: ECB, Merrill Lynch, Thomson Reuters Datastream and ECB calculations. Notes: The overall cost of financing for non-financial corporations is calculated as a weighted average of the cost of bank lending, the cost of market-based debt and the cost of equity, based on their respective amounts outstanding derived from the euro area accounts. The cost of equity estimates are based on a three-stage dividend discount model.

**Funding costs** of the euro area non-financial private sector remain at low levels across most business lines, maturities and funding sources. Still, fragmentation in financing conditions persists across countries and firm sizes, albeit further declining as the impacts of the latest standard and non-standard monetary policy measures gradually feed through to the economy. More specifically, nominal financing costs for euro area households have increased somewhat, but remained very close to the record lows touched in mid-2015 in all lending categories (see **Chart 1.29**). The financing conditions of non-financial firms remain favourable and supportive to financing investment, even though the overall nominal cost of external financing for non-financial firms has increased slightly since mid-2015. This development was mainly driven by a correction in financial asset prices after significant increases in the early months of the year, translating into a pick-up of both the cost of market-based debt and equity. However, these increases were partly offset by the continued fall in bank lending rates across the maturity spectrum (see **Chart 1.30**), as the full transmission of monetary policy measures taken by the Eurosystem since June 2014 takes hold and banks progressively pass on the improvement in funding costs in the form of reduced bank lending rates. SMEs continued to face somewhat less favourable financing conditions than large firms. However, as evidenced, for example, by the declining spread between bank lending rates for very small loans (likely to be taken out by SMEs) and large loans, the pass-through of monetary policy measures to corporate lending was more pronounced for SMEs than large firms, in particular in countries which have been more affected by the crisis. Looking ahead, favourable lending conditions should provide continued support to a further recovery in lending to both households and non-financial corporations. However, remaining political uncertainty in the euro area, heightened stock market volatility and expectations regarding the prospective monetary policy normalisation in the United States may dampen the positive effects of very accommodative policies on the cost of financing for non-financial firms in the euro area.

## Box 2

### The relationship between business and financial cycles

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Boom-bust cycles in financial variables such as credit volumes and residential property prices play an important role in the build-up of financial instability and subsequent financial crises.<sup>10</sup> Against this background, one of the key goals of macroprudential policy is to attenuate such boom-bust cycles, often termed the financial cycle. To inform such policies, various recent studies have presented estimates of cyclical fluctuations in financial indicators for major advanced economies.<sup>11</sup>

Notwithstanding the expansion of the literature to date, the evidence on the co-movement of financial cycles with the business cycle and differences in cyclical characteristics across countries is still limited. The relationship between business and financial cycles has implications for the policy mix at the aggregate euro area level, while differences in the properties of financial cycles provide a case for country-specific policies.

Multivariate structural time series (STS) models are a powerful tool to gain an insight into the interplay of series associated with financial and business cycles.<sup>12</sup> These models are designed to decompose multiple series into trend and cyclical components. They have several advantages compared with the non-parametric univariate filters that have been used in most earlier studies. Non-parametric filters require a priori assumptions about the dynamic properties of cycles and are applied separately to each individual series, while multivariate STS models permit researchers to estimate the dynamic properties of both trend and cyclical components jointly for all series. This has the advantage of estimation accuracy by reducing the risk of extracting spurious cycles.

Chart A shows estimates of the cyclical fluctuations in GDP, total credit volumes and residential property prices for the United States and three major European economies (Germany, France and the United Kingdom). In line with earlier studies, the multivariate STS model finds large medium-term cyclical components in the two financial series. However, there are also substantial differences in cyclical characteristics across countries. Germany stands out with very small cycles with a length of about seven years. For the remaining countries, the average cycle length in both financial series is estimated at 13 to 15 years, compared with 8 to 13 years for GDP cycles. Another notable feature is the large amplitude of credit and residential property price cycles in the United Kingdom, a country with a high rate of private home ownership.

Generally, differences in the cyclical characteristics of residential property prices correspond quite closely to differences in the rates of private home ownership: cycles are larger and longer for countries with high home-ownership rates (see Chart B). The same finding holds for credit volumes.

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<sup>10</sup> See for example Jordà, Ò., Schularick M. and Taylor A., "The Great Mortgaging: Housing Finance, Crises, and Business Cycles", *Working Paper Series*, No 20501, NBER, 2014.

<sup>11</sup> Composite financial cycle indicators for euro area countries are found in Schüller, Y., Hiebert, P. and Peltonen, T., "Characterising the financial cycle: a multivariate time-varying approach", *Working Paper Series*, No 1846, ECB, 2015; see also Drehmann, M. et al., "Characterising the Financial Cycle: Don't Lose Sight of the Medium Term", *Working Paper Series*, No 380, BIS, 2012, and Special Feature B, "Capturing the financial cycles in euro area countries", *Financial Stability Review*, ECB, November 2014.

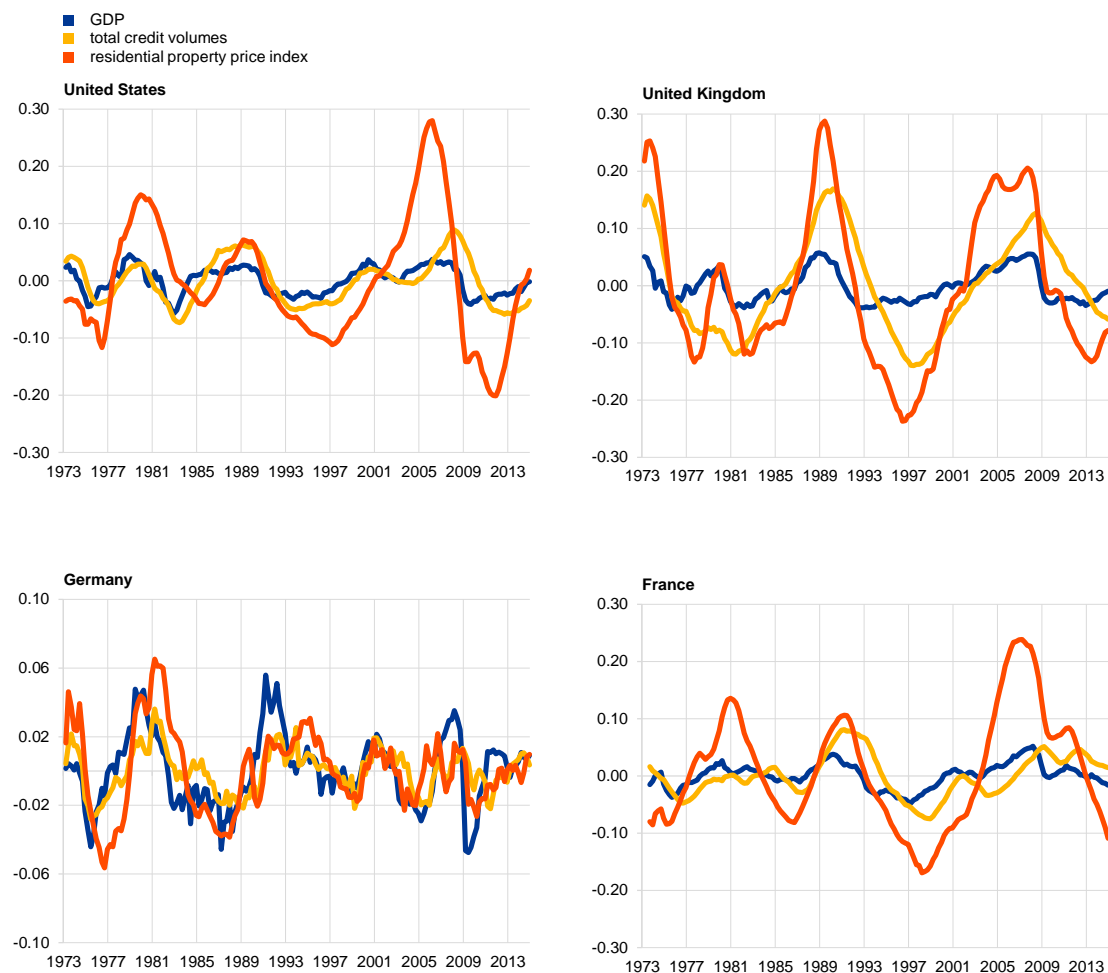
<sup>12</sup> Rünstler, G. and Vlekke, M., "Business and financial cycles: an unobserved components models perspective", mimeo, ECB, 2015. The study includes the United States, the United Kingdom, Germany, France, Italy and Spain. The model is an extended version of Rünstler, G., "Modelling Phase Shifts Among Stochastic Cycles", *Econometrics Journal*, Vol. 7, 2004, pp. 232-248.

## Chart A

Cycles in credit volumes and residential property prices are closely aligned with a medium-term component in GDP cycles

### Cycles in GDP, real total credit volumes and residential property prices

(1973-2014; percentage deviations from trend (\*100))



Source: Rünstler and Vlekke (2015).

Notes: Data on GDP were obtained from the OECD Main Economic Indicators. Data on total credit volumes and residential property price indices were taken from two BIS databases. All variables are deflated with the GDP deflator.

Furthermore, medium-term fluctuations in credit, residential property prices and GDP cycles are closely aligned (see Chart A). Cross-correlations are in a range of 0.5 to 0.9. The cycles in residential property prices move contemporaneously with GDP cycles, while credit cycles tend to lag the latter by about one to three years. With the exception of Germany, booms arise in the late 1970s, the early 1990s and the period before the recent financial crisis. At the same time, the estimates show some de-synchronisation of fluctuations between the series at business cycle



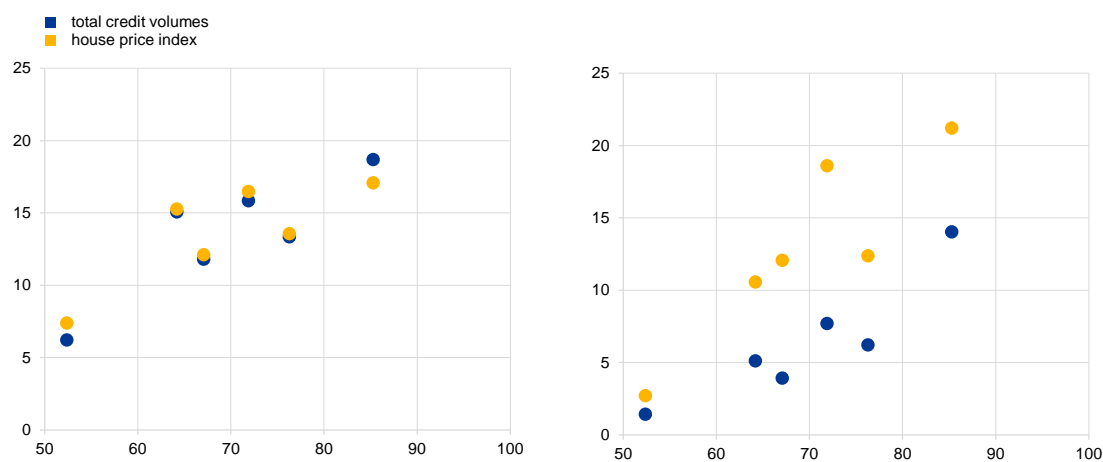
frequencies: shorter-term fluctuations in economic activity are reflected in the financial series – in particular in residential property prices – only to a limited extent.<sup>13</sup>

### Chart B

Differences in the length and size of cycles in credit volumes and residential property prices correspond to private home-ownership rates

Private home-ownership rate (x-axes), cycle length (y-axis left-hand chart) and standard deviations (y-axis right-hand chart)

(years; percentages)



Source: Rünstler and Vlekke (2015).

Note: Data on private home-ownership rates are from the FRED database for the United States, and from Eurostat for the United Kingdom, Germany, France, Italy and Spain.

All in all, while the estimates suggest that credit, house prices and real activity are closely linked over the medium term, there are important divergences between financial cycles (i.e. in credit volumes and a broad set of asset prices) and cycles in real economic activity at the shorter business cycle frequencies. This, along with the presence of country-specific factors, suggests a need for a country-specific application of macroprudential policies moving beyond system resilience, aimed not only at stemming financial cycles but also limiting economic booms and busts.

In line with overall trends in the economy, a gradual recovery of euro area **property markets** has continued in the first half of 2015. Having returned to a moderate growth path in mid-2014, residential property markets have gained some further momentum at the aggregate euro area level. Similarly, euro area commercial property markets have continued their recovery, with a somewhat larger amplitude than their residential counterpart in line with historical patterns (see **Chart 1.31** and Box 2).

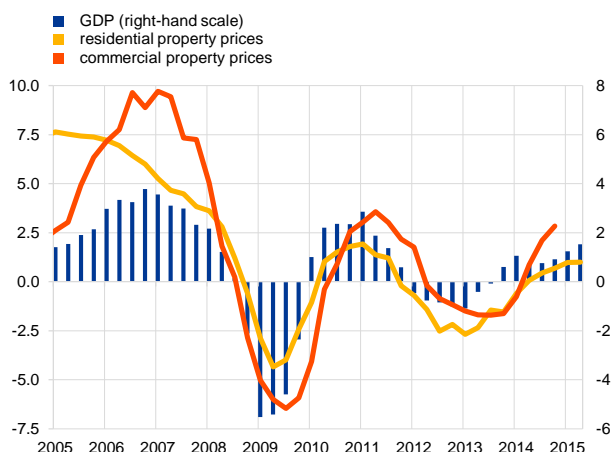
<sup>13</sup> This finding is also supported by Schüler et al (2015), who find concordance of financial and business cycles only for two-thirds of turning points. On the coincidence of troughs in credit and house price cycles with deep recessions, see Claessens, S., Kose, M. and Terrones, M., "How Do Business and Financial Cycles Interact?", *Journal of International Economics*, Vol. 87(1), 2012, pp. 178-190.

**Chart 1.31**

Euro area residential and commercial property markets continued to recover, mirroring overall economic developments

**Euro area commercial and residential property prices and the economic cycle**

(Q1 2005 – Q2 2015; percentage change per annum)



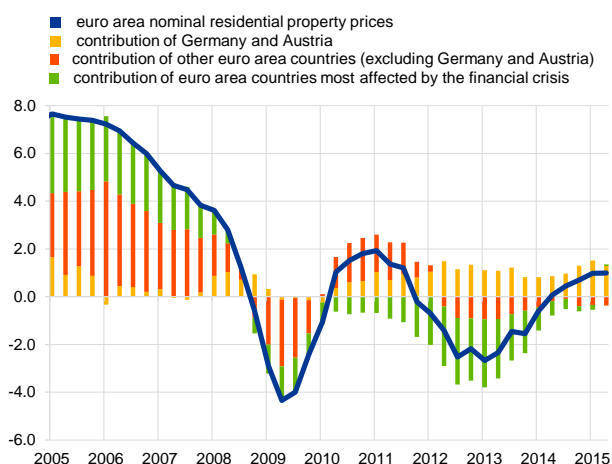
Sources: Eurostat, ECB and experimental ECB estimates based on MSCI and national data.  
Note: Latest available data for commercial property price developments are for Q4 2014.

**Chart 1.32**

The ongoing recovery in euro area residential property markets is becoming more broad-based across countries...

**Decomposition of euro area residential property price growth by groups of countries**

(Q1 2005 – Q2 2015; percentage change per annum, percentage point contributions)



Source: ECB calculations based on national data.  
Notes: The countries most affected by the financial crisis are Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain. Last observation is Q2 2015 for all countries but Belgium (Q4 2014).

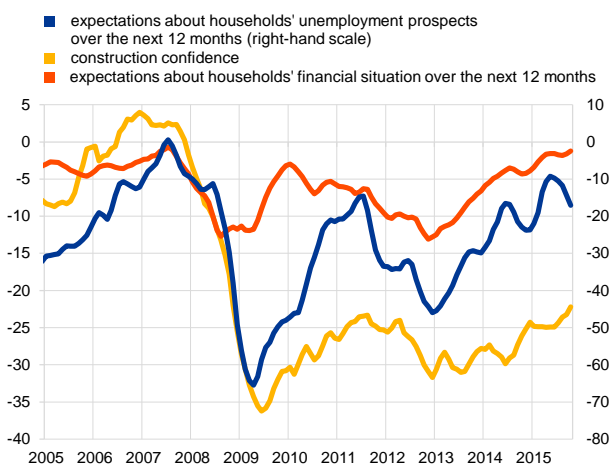
There are growing signs that the recovery is becoming more broad-based across countries, as major multi-year corrections in residential and commercial property markets in the aftermath of the global financial crisis abate. This is also evidenced by the gradually decreasing negative contribution of euro area countries most affected by the financial crisis to euro area house price growth (see [Chart 1.32](#)). Indeed, there has been a rebound in residential property prices in many countries since the troughs observed in 2012-13, notably Ireland and – to a lesser extent – Spain, where property price corrections were particularly pronounced. Cross-country heterogeneity has declined further also in the commercial property sector amid signs of a firming recovery in a number of countries, encompassing not only Ireland and Spain, but also Portugal. As valuations return towards historical norms, continued favourable financing conditions, households' improving expectations regarding their financial situation and employment prospects, and increasing confidence in the construction sector, even if only from low levels, are likely to underpin the sustainability of the ongoing recovery in residential and commercial property markets going forward (see [Chart 1.33](#)).

**Chart 1.33**

... and is underpinned by favourable employment and income prospects for households as well as gradually increasing confidence in the construction sector

**Construction confidence as well as households' financial situation and unemployment expectations in the euro area**

(Jan. 2005 – Oct. 2015; percentage balances; three-month moving averages)



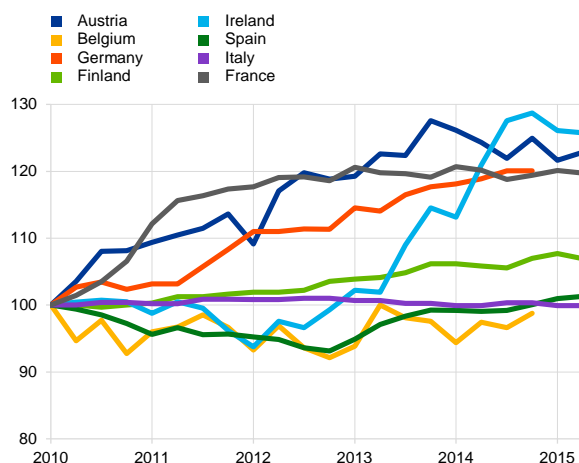
Source: European Commission.  
Note: Unemployment expectations are presented using an inverted scale, i.e. an increase (decrease) of this indicator corresponds to more (less) optimistic expectations.

### Chart 1.34

#### Country-level developments often mask underlying regional disparities

##### Residential property prices in the capital city/big cities vis-à-vis the national aggregate

(Q1 2010 – Q2 2015; index: Q1 2010 = 100)



Sources: BIS, national sources and ECB calculations.

Note: Last observation is Q2 2015 for all countries but Belgium and Germany (Q4 2014).

As property price developments have an inherently regional component, country-level aggregates can mask divergent underlying regional price trends – in particular in metropolitan areas, where strong demand amid supply constraints may lead to stronger price pressures than in other regions. Price growth in the capital city/largest cities has continued to exceed the corresponding price changes at the national level in many countries, such as Austria, France, Germany and Ireland (see [Chart 1.34](#)), which could potentially ripple out to surrounding areas. The related risks are likely to be limited at the current juncture, as the ongoing housing market recovery or the regional buoyancy of euro area residential property markets has so far shown no signs of translating into rapid credit growth, while the new macroprudential toolkit equips authorities with instruments to mitigate possible risks to financial stability at the country level in a targeted and granular way (see Section 3.3.1).

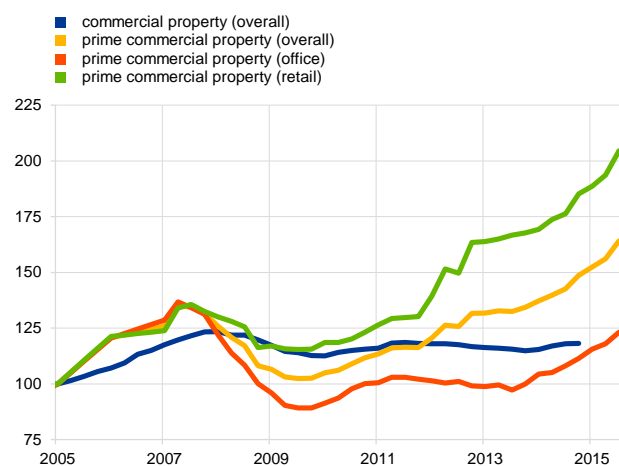
A similar regional pattern can be seen for prime commercial property markets, in addition to the strong dichotomy between developments in the prime and non-prime market segments (see [Chart 1.35](#)). In particular, the prime retail segment has continued on its ebullient course in the context of the current low-yield environment and the ongoing search for yield. Correspondingly, investment activity in commercial property markets has remained robust, with underlying transaction volumes reaching a new post-crisis high year-to-date (see [Chart 1.36](#)). Activity has continued to be driven by cross-border investment, with non-European investors, in particular international funds and US investors, further increasing their European commercial property holdings. Strong demand was accompanied by a continued decline in expected returns on prime commercial property (see [Chart 1.37](#)), which in several countries, such as Belgium, France and Germany, have already dropped to below pre-crisis levels. That said, continued competition for prime assets and yield compression in core euro area property markets are increasingly driving property investors towards the non-prime segment and non-core countries.

**Chart 1.35**

Buoyant developments in euro area prime commercial property markets have continued, driven predominantly by the retail segment

**Commercial property price indices**

(Q1 2005 – Q3 2015; index: Q1 2005 = 100)



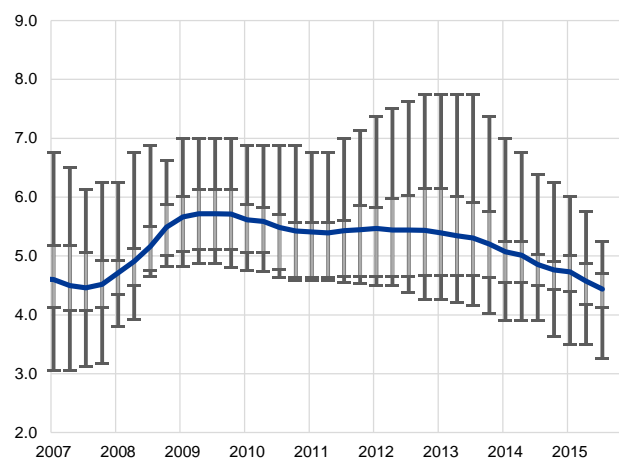
Sources: Jones Lang Lasalle and experimental ECB estimates based on MSCI and national data.  
Notes: Retail establishments include inter alia restaurants, shopping centres and hotels. Latest available data for overall commercial property price developments are for Q4 2014.

**Chart 1.37**

Expected returns on prime commercial property across euro area countries have dropped further amid continued signs of a search for yield

**Yields on prime commercial property in the euro area**

(Q1 2007 – Q3 2015; percentages; minimum, maximum, interquartile distribution and average)



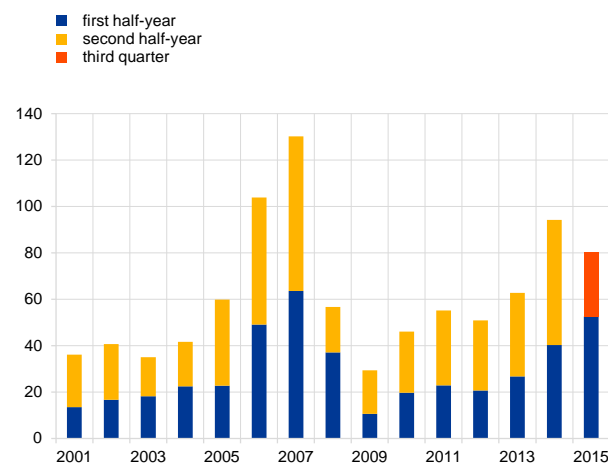
Source: Jones Lang Lasalle.  
Note: The euro area countries covered are Austria, Belgium, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain.

**Chart 1.36**

Investment activity in commercial property markets has remained strong, with underlying transaction volumes reaching new post-crisis highs

**Commercial property investment volumes in the euro area**

(H1 2001 – Q3 2015; EUR billions)



Source: Cushman & Wakefield.  
Note: Based on legacy DTZ data.

Valuation estimates for the euro area as a whole suggest that residential property prices are slightly below the levels that fundamentals would suggest (see **Chart 1.38**), but have moved further away from their long-term average for prime commercial property amid continued strong price increases (see **Chart 1.39**). However, these aggregate figures capture highly heterogeneous developments at the country level, which also hide strong regional disparities, as suggested for example by signs of overvaluation of residential property in some large cities in Austria and Germany. While these valuation estimates provide a consistent set of benchmarks to gain cross-country insights into prospective trends, their national relevance is conditioned by country-level specificities, such as fiscal treatment or structural property market characteristics like tenure status (see Box 3).

All in all, a gradual recovery of euro area residential and commercial property markets is under way and should gather further strength. With the macroprudential toolkit being arguably the most complete for the real estate sector, price developments may need to be carefully

monitored amid buoyant developments in some countries and asset classes in the

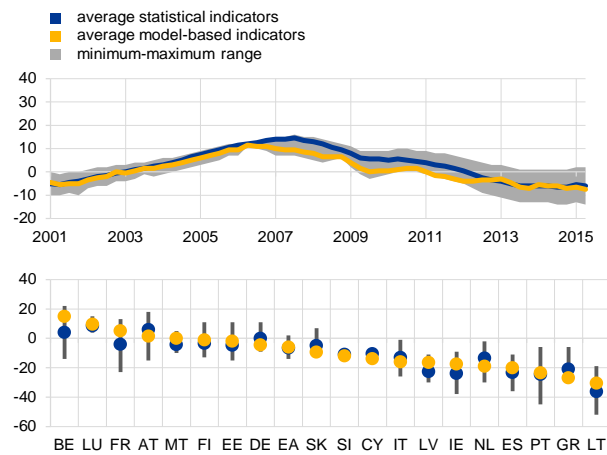
context of the current low-yield environment and the related ongoing search for yield (see Section 3.3). The outlook for euro area residential and commercial property markets remains vulnerable to adverse economic shocks which may endanger the sustainability of the nascent recovery and reverse the ongoing process of “defragmentation” across countries and market segments. Moreover, deteriorating financing conditions could affect the debt servicing capacity of households and commercial property investors via the more limited availability and higher cost of funding, further challenging the situation of those investors and borrowers who are already confronted with difficulties.

**Chart 1.38**

Euro area residential property prices are slightly below the levels that fundamentals would suggest...

**Valuation estimates of residential property prices at the euro area and country levels**

(Q1 2001 – Q2 2015; percentages; distribution across valuation estimates)  
(Q2 2015; percentages; distribution across valuation estimates)



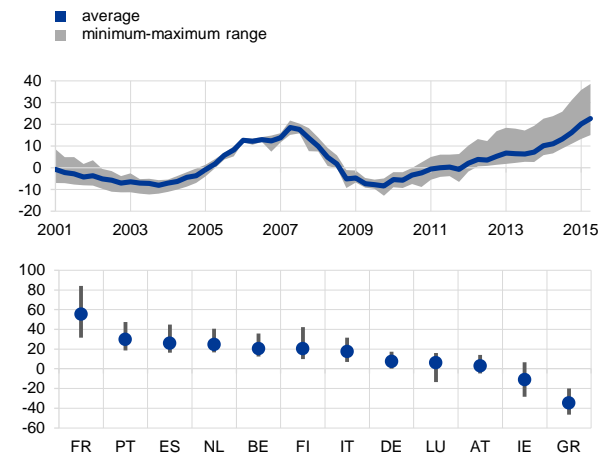
Source: ECB and ECB calculations.  
Notes: Last observation is Q2 2015 for all countries except Belgium and Finland (Q4 2014). Valuation estimates for residential property prices are based on four different valuation methods: two statistical indicators (i.e. the price-to-rent ratio and the price-to-income ratio) and two model-based methods (asset pricing approach and model-based approach). For methodological details on the two statistical indicators and the asset pricing approach, see Box 3 in *Financial Stability Review*, ECB, June 2011, while for more details on the model-based approach see Box 3 in *Financial Stability Review*, ECB, November 2015.

**Chart 1.39**

... while commercial property values have moved further away from their long-term average

**Valuation estimates of prime commercial property at the euro area and country levels**

(Q1 2001 – Q2 2015; percentages; distribution across valuation estimates)  
(Q2 2015; percentages; distribution across valuation estimates)



Sources: Jones Lang Lasalle and ECB calculations.  
Note: For details on valuation estimates for prime commercial property, see Box 6 in *Financial Stability Review*, ECB, December 2011.

**Box 3**

**A model-based valuation metric for residential property markets**

Reliable valuation metrics are key for monitoring residential property market developments from a financial stability perspective. Due to the heterogeneity and complexity of housing markets, no single metric of housing valuation at the macro level is sufficient to capture all relevant factors. Statistical indicators for measuring residential property price valuations offer intuitive appeal and ease of construction, but may fail to capture important fundamental factors.<sup>14</sup> By contrast, model-based approaches offer the advantage that they can explore a wider set of fundamental factors in a

<sup>14</sup> For further details, see Box 3 in *Financial Stability Review*, ECB, May 2015.

multivariate regression framework, but still can only go so far in capturing the symbiotic relationship between housing, rental and mortgage markets.

One such model-based approach is to adopt a textbook model where the supply of houses is given in the short run and prices are determined by the inverted demand curve.<sup>15</sup> The benefit of using a commonly applied model is that priors are available for the key long-run elasticities. The inverted demand equation can be formulated as follows:

$$\log rhp_t = \frac{[a_0 + a_1 \log y_t - \log hs_t - a_3 \text{int}_t]}{a_2} + \varepsilon_t$$

where  $rhp_t$  denotes real house prices,  $y_t$  is real disposable income per household,  $hs_t$  is the real housing stock per capita,  $\text{int}_t$  is the real average mortgage interest rate variable (as a proxy for the user cost of housing) and  $\varepsilon_t$  is a residual. In terms of expected signs, higher income is expected to exert upward pressure on house prices, while a higher housing stock and/or higher real interest rates should both dampen house prices. The residuals in the equation are then interpreted as misalignments of actual house prices from fundamentals.

The inverted demand equation is estimated for each individual country using Bayesian techniques to alleviate potential short sample issues.<sup>16</sup> The Bayesian estimator combines the information in the data with the prior beliefs of the econometrician concerning the value of the parameters. The prior distributions of the model coefficients are centred at the values typically found in the literature.<sup>17</sup> The same prior means are used for all euro area countries. The intensity with which the prior beliefs are enforced, referred to as the prior tightness, is obtained by maximising the marginal likelihood of the model. The prior distribution of the constant term is centred at zero and is flat.

The estimated misalignment can be embedded in a vector autoregressive (VAR) model. Given the symbiosis between housing and mortgage markets, developments in mortgage credit to households are also included as an additional variable in the VAR model. This model can then be used to produce conditional forecasts for house prices and for scenario analysis. An out-of-sample forecast assessment is performed in order to determine the optimal model for each country based on the root mean squared forecast error. On the basis of this assessment, country models would typically either include house prices, income, interest rates and the housing stock or all except the housing stock, with the latter model close in spirit to a housing affordability model.

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<sup>15</sup> See, for example, Muellbauer, J., "When is a housing market overheated enough to threaten stability?", *Department of Economics Discussion Paper Series*, No 623, University of Oxford, 2012.

<sup>16</sup> See Koop, G., *Bayesian Econometrics*, Wiley, 2003. Although panel estimation could also help to cope with short time series, it may not adequately accommodate the inherent cross-country heterogeneity in the structure of housing markets. Therefore, a Bayesian country-by-country approach is preferred.

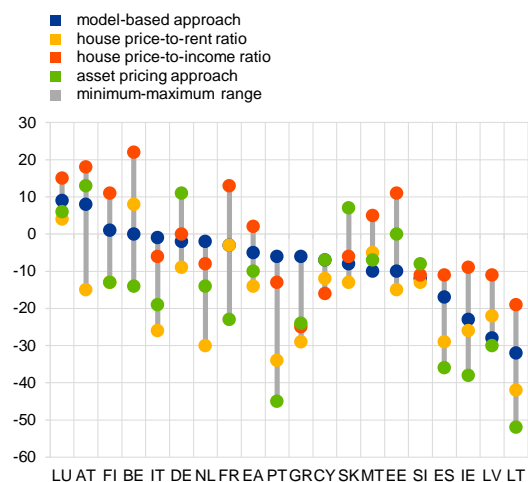
<sup>17</sup> The prior means for the model coefficients are -0.015 for interest rates, 1.6 for income and -2.5 for the housing stock. For example, an increase in real disposable income of 1% gives rise to a 1.6% increase in real house prices. See Meen, G., *Modelling spatial housing markets: theory, analysis and policy*, Norwell, MA: Kluwer Academic Publishers, 2001. Also, normal-gamma prior distributions are assumed, because they are a natural conjugate of this framework, having the same functional form as the likelihood. This is an algebraic convenience as analytical results are available.

## Chart A

House price valuation metrics are surrounded by a large degree of uncertainty

### Residential property price valuations for euro area countries

(Q2 2015, percentages; deviation from long-term averages or model-based equilibria of indicators)



Sources: Eurostat and ECB calculations.

Notes: Last observations refer to Q2 2015, except for Belgium and Finland (Q4 2014). Euro area valuations are estimated directly based on euro area aggregate data. There is no estimate for Estonia based on the asset pricing approach. Countries are ranked according to the results of the model-based approach. The sample size for all measures starts in the mid-1990s or later for all countries. For methodological details on the two statistical indicators, i.e. the house price-to-rent and the house price-to-income ratio, as well as the asset pricing approach, see Box 3 in *Financial Stability Review*, ECB, June 2011.

The new model metric lies in the middle of the range for the euro area and a significant number of euro area countries. Moreover, these country-wide results do not preclude the possibility of strong overvaluations at the regional level within certain euro area countries. In a euro area context, estimates such as those presented offer a guide to prospective (over/under)valuations, but need to be cross-checked with a variety of other information to ensure the right balance between cross-country consistency and national relevance.

The new model-based valuation indicator suggests that house prices were slightly below equilibrium levels in the euro area as a whole in the second quarter of 2015. However, it also suggests significant heterogeneity at the country level (see Chart A). According to the model metric, house prices in Luxembourg and Austria exhibit modest overvaluation, whereas those in the Baltic States, Ireland and Spain may be undervalued. Although generally preferable to statistical house price valuation metrics, the model-based measure is surrounded by a large degree of uncertainty. This reflects the challenge of adequately capturing in a similar fashion across countries the complex interaction of housing, rental and mortgage markets. Moreover, measurement issues can distort the picture, while the Bayesian approach may only partially offset any small sample bias.

In view of these limitations, other valuation measures need to be taken into consideration, the precise extent of which may differ given country specificities. In fact, the range across different valuation estimates can be quite wide for some countries (see Chart A), although the

## 2 Financial markets

*Global financial markets have continued to experience intermittent bouts of volatility. Related sell-offs have been increasingly linked to emerging market concerns, which, however, have been rather pervasive in their impact across several market segments including equities, currencies and commodities. Equity markets, in particular, witnessed substantial losses and sharp intraday movements of a magnitude not dissimilar to those witnessed during the recent global financial crisis, albeit less persistent. Developments in euro area financial markets were largely influenced by the weakening international growth outlook and falling oil prices, in an environment of increased volatility. Within the euro area, developments in Greece had a contained and temporary impact on equity and sovereign bond markets. While money and bond markets were largely resilient to these various episodes of global market turmoil, rising global risk aversion and idiosyncratic events did contribute to a further widening of corporate credit spreads. Moreover, while equity prices fell sharply during the summer turbulence, losses on euro area exchanges were of a smaller magnitude than those witnessed in other markets.*

*In general, the above developments suggest a pattern in global financial markets where asset prices trend steadily upwards, sometimes to extreme levels, and then correct suddenly and sharply. In this vein, the correction with roots in China appears similar in impact to previous periods of volatility over the last years, including the so-called “taper tantrum” in the summer of 2013, the US Treasury “flash crash” in October 2014 and the recent Bund sell-off in May 2015. To date these adjustments have proven short-lived in the context of an ongoing search for yield. They nonetheless demonstrate three concerning developments in markets: investor behaviour has become increasingly correlated, sentiment is fickle and market liquidity is prone to insufficiency during episodes of market tension. Indeed, changing sentiment towards financial asset valuations has tended to stem from a recurrent set of themes, most notably concerns regarding weakening global economic prospects (mainly in emerging markets) and adjustments – sometimes sharp – in market expectations regarding the future path of monetary policy across major economies.*

### 2.1 Bouts of volatility in global financial markets amid growing emerging market concerns

**Global financial markets** continue to be hit by bouts of volatility – short-lived but with an apparent increase in potency. Over the last six months, this volatility has shifted towards emerging markets as major events in China – ranging from sharp yuan devaluation<sup>18</sup> to strong equity market corrections – triggered turmoil there

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<sup>18</sup> In mid-August, the Chinese authorities changed their methodology for setting the central fixing rate of the Chinese yuan and devalued the currency by 1.9%, the biggest daily move since 1994. Global markets reacted sharply as many viewed the move as a signal of weakness in the Chinese economy.

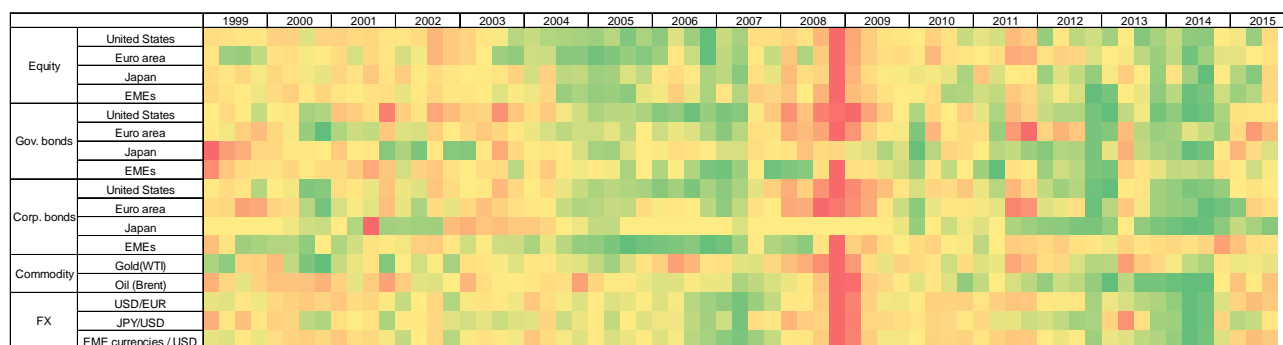


initially, with ensuing contagion to global asset markets. Emerging market currencies, global equities and commodity markets registered substantial losses and sharp spikes in volatility as fears of a global slowdown and disinflation intensified (see [Table 2.1](#) and Box 1).

**Table 2.1**

Volatility remains elevated across a number of markets including foreign exchange, commodity and equity markets

(quarterly data; Q1 1999 – Q3 2015)



Sources: Bloomberg and ECB calculations.

Notes: Volatility estimates are derived from a non-overlapping quarterly sample of daily price data. The colour codes are based on the ranking of the estimates. A red, yellow and green colour code indicates, respectively, a high, medium and low volatility estimate compared with other periods. For further details, see Box 3 entitled "Financial market volatility and banking sector leverage", *Financial Stability Review*, ECB, November 2014.

**Global equity markets** witnessed a broad-based fall in prices and sharp spikes in measures of volatility amid growing concerns regarding the global growth outlook. An unexpected yuan devaluation triggered a slide in global equity markets that gathered significant pace following the release of the weakest PMI report for China in over six years and a substantial correction in Chinese equities, which reverberated globally (see Box 1 in Section 1.1 and [Chart 2.1](#)). While equity markets recovered in subsequent weeks, the summer turmoil significantly eroded the year-to-date returns for most exchanges and contributed to a sharp spike in measures of equity market volatility.

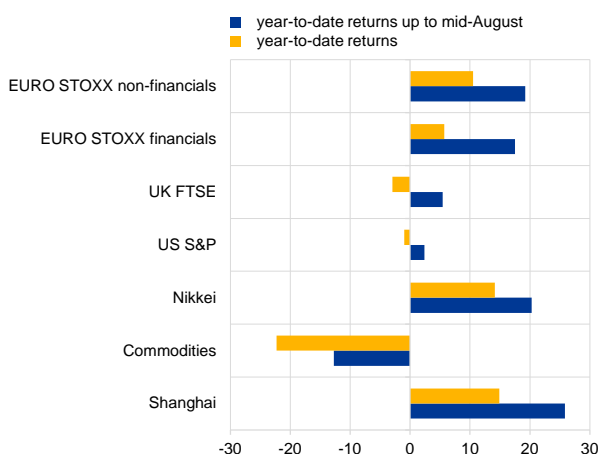
In this environment, a key trend emerging in **global bond markets** has been one of divergence, as risks are seen to rotate from advanced economies to emerging market economies (EMEs). A combination of factors including falling commodity prices, sharp currency depreciations, declining world trade and expectations of US rate increases have triggered significant generalised outflows from EME debt markets, while country or sector-specific vulnerabilities have led to some differentiation (see [Chart 2.2](#) and [Chart 1.10](#) in Section 1.1). Spreads for many EMEs have risen significantly in recent months and did so sharply for certain countries, such as Brazil, with large external financing needs and concerns regarding domestic imbalances. Growing credit risk concerns have contributed to significant outflows from emerging sovereign and, more recently, corporate debt markets. Foreign ownership has risen sharply in many EME local-currency debt markets. While this is a sign of confidence in the economies, it also represents a vulnerability as foreign investors tend to move in line with global risk sentiment and expectations regarding US monetary policy. Moreover, it highlights an additional channel through which difficulties in emerging markets could spill over to advanced economies.

### Chart 2.1

Chinese growth concerns triggered a sharp adjustment in domestic equities which reverberated across global equity and commodity markets

**Year-to-date returns for major global equity and commodity indices**

(Jan. 2015 – Nov. 2015; percentages)



Sources: Bloomberg and ECB calculations.

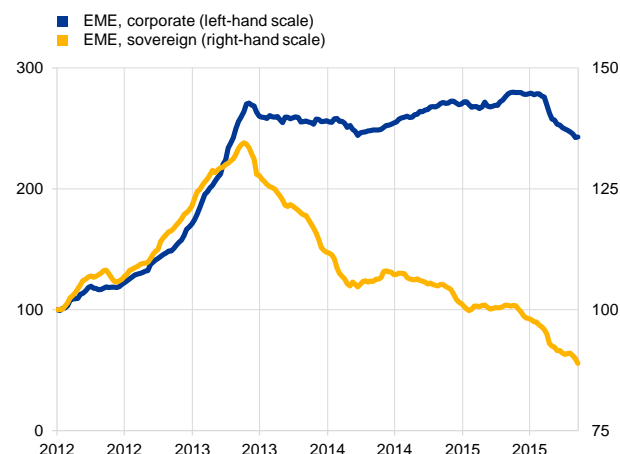
Note: Year-to-date returns are calculated for the period from 1 January 2015 to date and also for the period prior to the yuan devaluation on 12 August 2015 which triggered a slide in global equities that gathered significant pace on China's "Black Monday" (24 August).

### Chart 2.2

Growing credit concerns are contributing to a withdrawal of foreign investment from emerging sovereign and, more recently, corporate debt markets

**Cumulative global flows to emerging market bond funds since January 2012**

(Jan. 2012 – Nov. 2015; index: Jan. 2012 = 100)



Sources: EPFR and ECB calculations.

Note: Indices are constructed based on relative flows expressed as a percentage of total net assets in order to control for valuation effects and sample changes.

While markets have recovered somewhat from the summer turmoil, further volatility could be triggered by ongoing EME concerns and changing market expectations regarding the path of global monetary policy. One propagating factor that could bring otherwise confined regional asset market distress to the global level is continued **low underlying secondary market liquidity** across a broad range of markets, which is somewhat latent amid ample monetary liquidity. This could lead to market selling panics amid emerging market pressures and unexpected divergences in monetary policy expectations across major advanced economies. Market liquidity can be defined as the ability to rapidly (immediacy) execute large financial transactions with a limited price impact, meaning that in liquid markets the marginal transaction should not impact the overall market price, the supply of buying and selling orders (breadth and depth), the transaction cost (tightness) or the ability of new buyers to transact (market resilience). The US Treasury "flash crash", the Bund correction in May and recent equity market turmoil all raise the concern that liquidity can disappear during periods of market tension, thereby amplifying price movements. Evidence gathered in a recent study points to a measurable reduction in global financial market liquidity over the past five years.<sup>19</sup> The reduced liquidity is a product of many factors, including but not limited to the massive and rapid expansion of debt markets, less market heterogeneity, a reduced willingness of banks to act as market-makers during bouts of market stress and other changes in market microstructure (for

<sup>19</sup> See *Global Market Liquidity Study*, PwC, 2015.

example, the growth of algorithmic trading and alternative trading venues, see Box 4).

In an environment of low volatility and high returns on riskier assets, strong correlations across asset classes suggest that investor behaviour has become increasingly homogeneous. The increased correlation of global asset price movements over the past two years may be symptomatic of herding behaviour (see Overview [Chart 5](#)). This creates markets which trend steadily, often to extreme levels, but then correct very suddenly and sharply, as fewer participants are willing to take the other side of the trade.

## 2.2 Strong role of international developments in euro area financial markets

Developments across various asset classes in **euro area financial markets** have been largely influenced by international factors, including a weakening global growth outlook and falling commodity prices, in an environment of intermittent bouts of volatility. Domestic factors have also played a role, notably uncertainty associated with developments in Greece, which peaked during the summer, and idiosyncratic shocks to certain large corporates. Looking at various market segments, the impact on equity markets has been the strongest, although overall the financial impact was contained and temporary. This sensitivity of equity markets to developments was also witnessed in the aftermath of the events in China later in the summer and in the related spike in global uncertainty. Conditions in money markets, in contrast, have remained calm throughout various episodes of market tension. Short-term rates continued their steady decline in an environment of high excess liquidity. Long-term nominal government bond yields remained relatively stable during the periods of market turbulence, while corporate bond spreads increased slightly. Similar to global markets, low secondary market liquidity and a growing correlation of asset price movements are of concern for euro area markets. Broad measures indicate that secondary market liquidity is low across euro area bond markets compared with the pre-crisis era.<sup>20</sup> Moreover, the latest results from the ECB's SESFOD survey note a generalised decline in liquidity across a range of euro area markets (for bonds, equities, convertibles and asset-backed securities).<sup>21</sup>

Conditions in **euro area money markets** remained stable throughout the various bouts of market tension over the last months. While low volatility in an environment of heightened global risk aversion in part reflects the increased resilience of the market, it is also symptomatic of the sharp decline in activity over the past year and persistent fragmentation within this market segment.

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<sup>20</sup> See the box entitled "Commonality of bid-ask spreads in euro area bond markets", *Financial Stability Review*, ECB, May 2015.

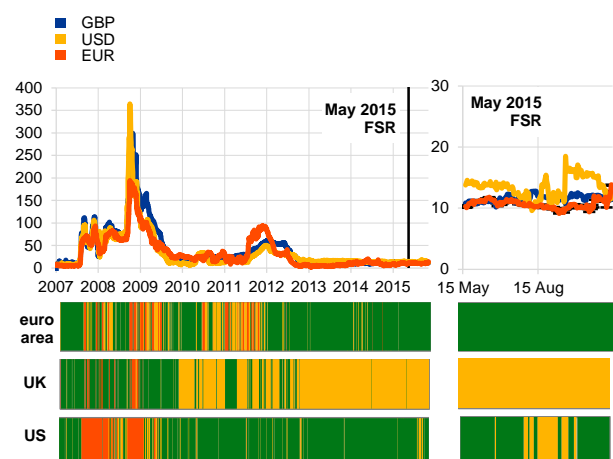
<sup>21</sup> See the *Survey on credit terms and conditions in euro-denominated securities financing and over-the-counter derivatives markets*, ECB, September 2015.

### Chart 2.3

#### Market-based measures of money market stress were relatively stable during the bouts of market tension

##### Spreads between unsecured interbank lending and overnight index swap rates

(Jan. 2007 – Nov. 2015; basis points; three-month maturities)



Sources: Bloomberg and ECB calculations.

Notes: Red indicates rising, yellow moderating and green falling pressure in the respective money markets. For more details, see Box 4 entitled "Assessing stress in interbank money markets and the role of unconventional monetary policy measures" in *Financial Stability Review*, ECB, June 2012.

Overall money market rates have been insulated from volatility episodes by a growing liquidity surplus in euro money markets. The increased resilience of money markets was evident during episodes of market tension stemming from domestic euro area issues, in particular those relating to Greece, namely the implementation of capital controls and the temporary closure of Greek banks in July. Market-based measures of stress for the euro area remained relatively stable throughout the periods of heightened risk aversion (see [Chart 2.3](#)). Moreover, while limited market access for lower-rated banks and increased recourse to Eurosystem funding had been a feature of previous episodes of Greece-related stress, banks' access to money markets was not hampered and recourse to the ECB's main refinancing operations fell during the summer turmoil. This contrasts with the experience of sovereign and corporate bond markets which were impacted, albeit temporarily, by Greek events.

Persistently low volatility can also manifest itself in an environment of lower activity among fewer participants. The latest Euro Money Market Survey indicates that market turnover has fallen by 12% over the past year, bringing activity back to 2012 levels (see [Chart 2.4](#)).<sup>22</sup>

In contrast to earlier years when low activity reflected significant credit risk concerns, the recent reduction has been driven by a number of other factors. These include a shift of funding and investment activity towards longer maturities, increased availability of funding from non-market sources, and a reduced willingness among banks to transact in an environment of high excess liquidity, low returns and increased regulation. Developments in market activity have varied across money market segments (see [Chart 2.5](#)). While turnover has fallen in most segments, activity in foreign exchange and interest rate swaps has increased owing to increased hedging needs, amid higher volatility in longer tenors, and to arbitrage opportunities, linked to diverging spreads between euro area and US rates.

While banks attributed the sharp decline in unsecured activity to more cyclical factors, structural factors are seen as the main drivers of the fall in turnover in secured markets. The decline in activity within money market segments has been most pronounced for the **unsecured segment**, where turnover is estimated to have fallen by over a third from the second quarter of 2014 to the second quarter of 2015. In their qualitative feedback for the recent Euro Money Market Survey, banks noted two key drivers of the sharp decline. For unsecured lenders, trading was seen as unprofitable at current market rates. For unsecured borrowers, increased recourse to non-market funding sources (for example, client deposits) was noted, alongside

<sup>22</sup> See *Euro Money Market Survey*, ECB, September 2015.

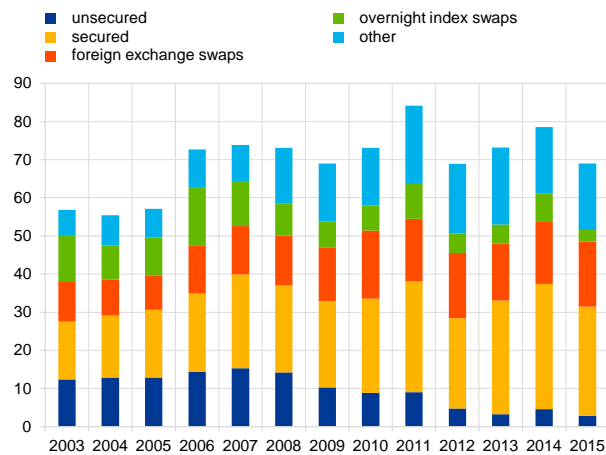
lower credit supply. Activity in the **secured segment** fell by 13% over the same period. While recourse to non-bank funding and low market rates also impacted activity in the secured segment, banks highlighted regulatory considerations and structural changes in their balance sheets as the dominant factors impacting turnover. In particular they noted that capital constraints, the leverage ratio and the liquidity coverage ratio were contributing to a decline in activity.

### Chart 2.4

Turnover in euro area money markets has fallen back to 2012 levels...

#### Market turnover in euro area money markets

(Q2 2003 – Q2 2015; EUR trillions)



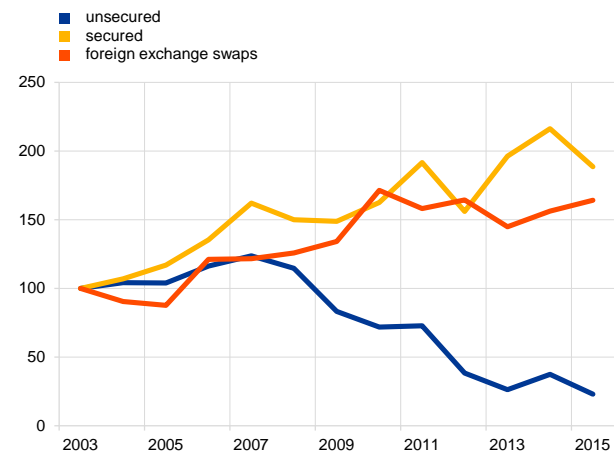
Source: ECB and ECB calculations.  
Notes: The panel includes 97 credit institutions. "Other" includes short-term securities, other interest rate swaps, forward rate agreements and currency swaps. Data refer to the second quarter of the respective years.

### Chart 2.5

... but trends in activity have varied across segments, with the decline in turnover most pronounced for the unsecured segment

#### Evolution of turnover in individual money market segments

(Q2 2003 – Q2 2015; index: Q2 2003 = 100)



Source: ECB and ECB calculations.  
Notes: The panel includes 97 credit institutions. Data refer to the second quarter of the respective years.

Cross-border flows remain low in money markets as fragmentation persists. Credit risk considerations and local bias are hampering cross-border activity, in particular for lower-rated banks. Banks headquartered in the countries most affected by the euro area sovereign debt crisis face higher funding costs and more limited access to markets, particularly in unsecured segments. Local bias remains a feature as regards counterparty selection in the unsecured segment and collateral decisions in the secured segment. The Euro Money Market Survey shows a decline this year, for banks from large euro area countries, in both the percentage of unsecured activity conducted with non-domestic euro area counterparties and the percentage of secured activity involving non-domestic collateral.<sup>23</sup> A higher concentration of activity within domestic markets, while not ideal, may contribute to the lower volatility as this source of funding tends to be more stable during bouts of market tension than cross-border funding.

The unprecedented low levels of euro area money market rates and their growing divergence with US rates have triggered two key changes in market functioning.

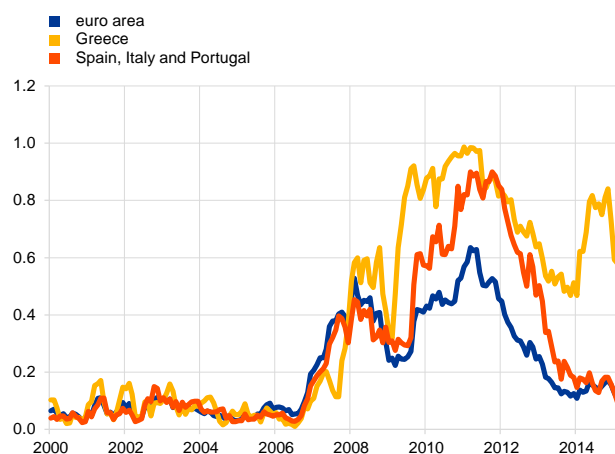
<sup>23</sup> Data on collateral for the secured segment are only available in 2015 for Germany and France.

First, issuance activity has fallen owing to an increase in maturity extensions and reduced supply given unprofitably low lending rates. Second, the growing divergence between euro area and US rates has resulted in efforts by issuers and investors to exploit differences in credit spreads that are not offset by the cross-currency basis. In doing so, euro area banks issue in US dollars, as the higher spread attracts investors, and swap back into euro. These developments have financial stability implications given the potential impact on market liquidity and the increased exposure of euro area entities to foreign exchange risk. The recent Euro Money Market Survey shows an increase in the percentage of banks reporting a decline in market liquidity within the secured segment.<sup>24</sup>

**Chart 2.6**  
Measures of sovereign stress show limited contagion from events in Greece to other euro area markets...

**Composite indicator of systemic stress in sovereign bond markets**

(Sep. 2000 – Nov. 2015; normalised scale)

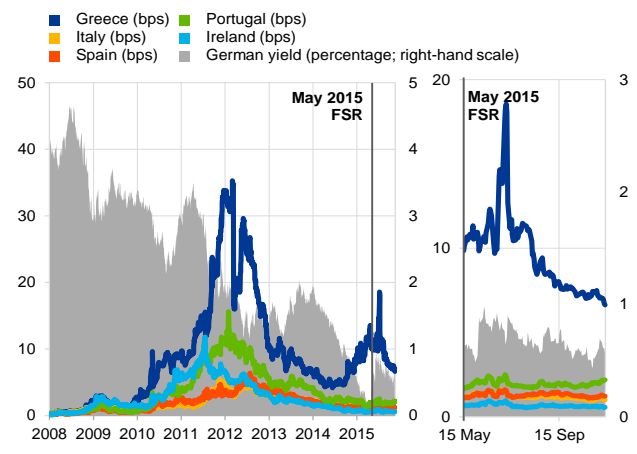


Sources: Bloomberg and ECB calculations.  
Note: For further details on the CISS methodology, see Hollo, D., Kremer, M. and Lo Duca, M., "CISS – a composite indicator of systemic stress in the financial system", Working Paper Series, No 1426, ECB, March 2012.

**Chart 2.7**  
... as did the evolution of spreads between lower-rated and higher-rated euro area government bonds

**Spread between yields on the ten-year German government bond and selected lower-rated euro area government bonds**

(Jan. 2008 – Nov. 2015; basis points; percentages)



Sources: Bloomberg and ECB calculations.

Measures of sovereign stress indicate limited contagion from events in Greece and China to **euro area government bond markets** (see **Chart 2.6**). The spike in uncertainty that accompanied developments during the summer had a relatively muted impact. This is evidenced by, among other developments, the spread between the yield on the ten-year German government bond and the corresponding yields for lower-rated euro area countries, which widened only marginally over this period and quickly returned to previous levels (see **Chart 2.7**). At the peak, ten-year sovereign spreads went up by at most 35 basis points for most euro area countries. Implied bond market volatility, among other measures of risk, rose only moderately and temporarily during the episodes of market tension.

<sup>24</sup> 37% of banks reported that market liquidity had deteriorated, compared with 22% in the second quarter of 2014.

## Chart 2.8

### Elevated correlations between US and euro area government bonds reflect global factors rather than monetary policy

#### Spillovers from US monetary policy to the euro area

(Jan. 2010 – Nov. 2015; regression coefficient of sensitivity of the euro area ten-year sovereign bond yield to US monetary policy expectations)



Sources: Thomson Reuters Datastream and ECB calculations.

Notes: This chart gauges the spillovers from US monetary policy to the euro area ten-year sovereign bond yield. US monetary policy, or expectations thereof, are proxied by the US one-year forward rate one year ahead. The chart plots the corresponding coefficient for regressions of changes in the euro area ten-year sovereign bond yield on changes in the US one-year forward rate one year ahead, controlling for changes in the euro area one-year forward rate one year ahead, changes in the VIX and changes in principal component macro variables for the euro area and the US. Regressions are based on six-month rolling windows of daily data. Missing coefficients in the chart are due to corrections for outliers in daily yield changes.

Yield curve models mainly attribute movements in the yields on higher-rated euro area government bonds since the beginning of the year to changes in the term premium component, rather than changes in expectations of future rates, which are estimated to have remained broadly stable. Similar to the US, term premia for the euro area have remained stable at levels well below long-run averages. The compressed level of term premia on both sides of the Atlantic has raised some concerns regarding the possibility of a sharp snapback as global monetary policy diverges. However, the gap between short-term and long-term yields has remained broadly constant in the euro area and the US since June in spite of mounting speculation about the possible tightening of monetary policy in the US and ongoing speculation regarding ECB monetary policy.

Correlations between euro area and US government bond markets remain at elevated levels, having increased noticeably during the first half of 2015.

However, regression analysis suggests that monetary policy has become less important in explaining correlations between these markets (see [Chart 2.8](#)).

This suggests that other factors, such as developments in China and oil markets, may be behind the increased co-movement in euro area and US sovereign bond

yields. While past experience suggests that developments in US markets can shape global market developments, in the current environment of diverging monetary policy cycles it is difficult to extrapolate from the past into the future, in particular given the enhanced toolkits of major central banks post-crisis. Undoubtedly, the impact of future US rate increases on euro area markets will be influenced not only by economic performance, but also by monetary policy decisions in the euro area amid non-standard monetary policy measures and strong forward guidance.

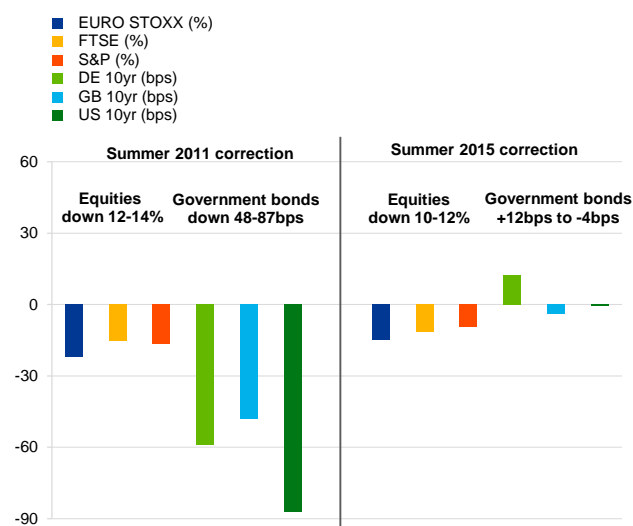
The stability of yields on **higher-rated global sovereign bonds** during the recent equity market sell-off is unusual given their safe-haven status and when compared with previous corrections of a similar magnitude (see [Chart 2.9](#)). The yield on the ten-year German government bond increased, while declines in yields on ten-year US Treasuries and ten-year Japanese government bonds were minor. The muted reaction may reflect, among other things, the following two factors. First, the safe-haven status of these assets may have been affected by major sell-offs over the past year – the US “flash crash” in October 2014 and the more recent Bund sell-off in May 2015 – and by persistent valuation concerns as yields deviate from growth expectations. Second, market reports suggest that official sector activity, including FX reserve sales in China, may have offset the impact of safe-haven flows during the recent correction. Chinese FX reserves fell by a record amount in recent months to their lowest level since July 2013. Approximately two-thirds of Chinese FX reserves are estimated to be held in USD-denominated assets, with the remainder largely

## Chart 2.9

Developments in the yields of higher-rated government bonds have been relatively muted compared with those observed during previous equity market corrections

### Changes in equity prices and yields on higher-rated government bonds during equity market corrections in 2011 and 2015

(percentages; basis points)



Sources: Bloomberg and ECB calculations.

Note: The equity market correction in 2011 occurred from mid-July to early August when stock markets were affected by concerns regarding a slowdown in US growth, the downgrade by Standard & Poor's of US government debt to below AAA rating for the first time, and the euro area sovereign debt crisis. The correction in 2015 occurred during the period between the yuan devaluation and China's "Black Monday" on 24 August.

consisting of euro, yen and sterling-denominated assets.<sup>25</sup> Therefore, a substantial sell-off of Chinese FX reserves could have important implications for higher-rated government bond markets.

Developments in **euro area credit markets** continue to be primarily driven by global factors, which include rising risk aversion and, more recently, a deterioration in the global growth outlook. Corporate bond spreads tended to rise in response to the uncertainty associated with developments in Greece and China, while lower-rated euro area firms appeared reluctant to issue during periods of heightened market uncertainty. The investment-grade sector was also affected by idiosyncratic events in September which contributed to a further widening of credit spreads and two atypical developments during that period. First, the index for non-financial corporate bonds for countries with higher-rated sovereigns underperformed that for issuers from countries with lower-rated sovereigns. Second, non-financial bonds underperformed financial bonds.

Credit spreads widened in an environment of rising risk aversion, which peaked for euro area firms in September as certain large corporations were hit by company-specific shocks. The spread between corporate bonds and the euro area average AAA-rated sovereign curve maintained the steady increase visible

from the summer of last year. A model-based decomposition indicates that the increase in spreads for larger euro area countries over the past year has been primarily driven by increased global uncertainty, while domestic factors largely exerted downward pressure on spreads (see **Chart 2.10**). Model-based evidence also indicates that a deterioration in the growth outlook contributed to an increase in spreads since June 2015. Echoing global trends, the spread between higher and lower-rated euro area corporate bonds also rose further. The magnitude of the spread widening within euro area credit markets has been somewhat smaller than that observed in the US, a reflection perhaps of the high proportion of energy firms (approximately 15%) in the US high-yield sector, which have been adversely impacted by sharp declines in global commodity prices, and the impact of company-specific shocks on the euro area investment-grade sector.

The increase in credit risk premia, after they had hit seven-year nadirs in June 2015, has eased overvaluation concerns somewhat, as corporate spreads are now close to their long-run averages. Moreover, ECB valuation models indicate that the excess bond premium (EBP) for euro area non-financial corporations, computed for corporate bond yields, has been reverting close to their historical mean. The EBP

<sup>25</sup> See *Weekly Insight: On Tenterhooks*, Institute of International Finance, September 2015.



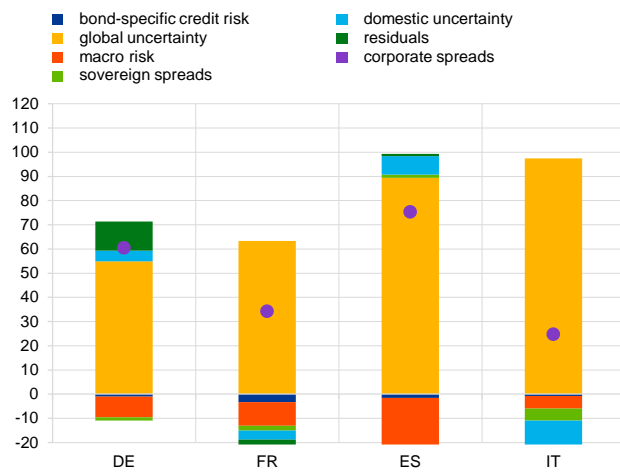
indicator computes the part of the bond yields which cannot be explained by bond characteristics such as the expected default frequency, credit rating, coupon, maturity and outstanding amount of the issuer. As at October 2015 estimates from two models place the EBP at or slightly above zero, implying that corporate yields are in line with credit and liquidity risk (see [Chart 2.11](#)).

### Chart 2.10

The increase in euro area corporate bond spreads has been driven to a large extent by global factors...

#### Decomposition of the change in corporate bond spreads

(Sep. 2014 – Sep. 2015; basis points)



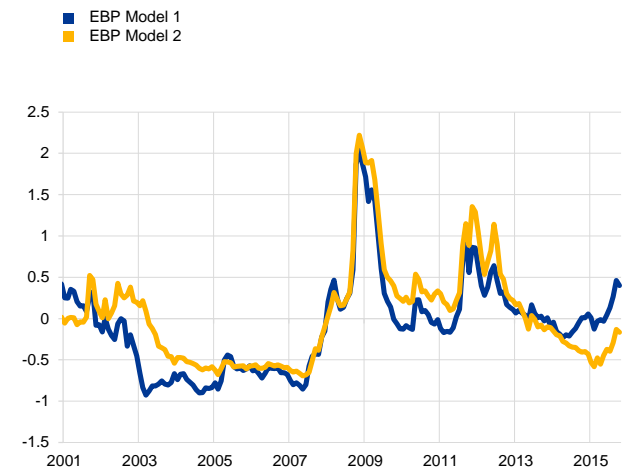
Source: De Santis, R., "Sovereign risk channel, misalignment and fragmentation in the euro area corporate bond market", mimeo, 2015.  
 Note: "Domestic uncertainty" reflects political and economic uncertainty and includes an index of political uncertainty and the dispersion among professional forecasters of one-year-ahead inflation and GDP growth.

### Chart 2.11

... and has brought valuations within the range from fairly priced to slightly underpriced

#### Euro area non-financial corporations' excess bond premium

(Jan. 2001 – Oct. 2015; percentage points)



Sources: Bloomberg, Merrill Lynch and ECB calculations.  
 Notes: The excess bond premium (EBP) is the aggregate mean of the deviation of credit spreads from measures of credit risk and liquidity risk at individual bond level, taken from the Merrill Lynch EMU corporate bond indices for non-financial corporations. Model 1 uses asset swap spreads derived from euro-denominated investment-grade and high-yield bonds. Model 2 uses the spread between corporate yields and the overnight index swap derived from euro-denominated investment-grade bonds.

Year-to-date corporate bond issuance is down compared with the same period last year. Primary market activity has weakened in recent months, particularly in the third quarter of 2015. In addition to the usual summer decline in activity, several risk events had a further negative impact on overall issuance (for example, the Greek crisis, events in China and idiosyncratic shocks). The decline in issuance was especially pronounced for the high-yield segment, where gross quarterly issuance was one of the lowest over the past five years. The increase in investors' risk aversion was reflected not only in the amounts issued but also in characteristics of the bonds issued, as the average maturity of new issuance decreased.

In line with global markets, the **euro area stock market** was impacted by the sharp rise in global uncertainty and risk aversion that accompanied events in China. The index fell by 17% in August 2015 and remained at low levels until early October when tentative signs of recovery emerged. Nonetheless, at the end of the review period the index remained 9% below its August peak. The decline has been primarily driven by an increase in the equity risk premium to a level that is high both by historical standards and compared with the levels in the United States (see [Chart 2.12](#)). The elevated level of risk premia in both markets compared with the pre-crisis

period is largely due to higher market volatility (see [Chart 2.13](#)). The gap between euro area and US equity risk premia that emerged during the financial crisis reflects the higher proportion of financial firms in euro area markets and the elevated risk premia of the euro area countries most affected by the sovereign debt crisis (see [Chart 2.14](#)). While equity premia on euro area financial shares have shown a steady decline following the ECB's comprehensive assessment, they remain elevated compared with their US peers.

**Chart 2.12**

The equity risk premium in the euro area is high and has recently increased again...

**Equity risk premia**

(Jan. 2005 – Oct. 2015; percentage points)



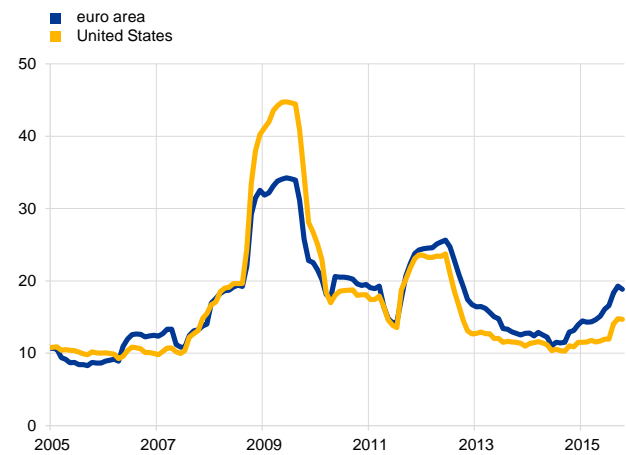
Sources: Thomson Reuters, MSCI I/B/E/S, Consensus Economics and ECB calculations.  
 Note: The equity risk premium is estimated by means of a two-stage dividend discount model.

**Chart 2.13**

... amid rising volatility

**Realised volatility**

(Jan. 2005 – Oct. 2015; percentages)



Sources: Thomson Reuters and ECB calculations.  
 Note: Realised volatility is computed as the standard deviation of realised daily returns over a one-year rolling period.

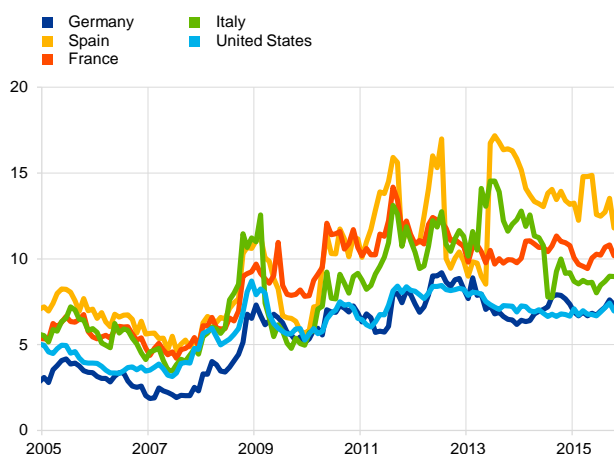
Despite the recent sharp price adjustments, valuation measures for US and euro area equity markets have increased further over the review period. Moreover, valuations for US equities are elevated compared with historical averages, while those for euro area markets are below long-term averages (see [Chart 2.15](#)). For US equities, recent corrections have to be placed in the context of a tripling of the valuations of the main indices over the past six years. Despite the recent correction, the cyclically adjusted price/earnings ratio for the S&P 500 index remains well above its historical average. While estimates of prospective asset overvaluations in any individual market segment differ, it is clear from recent developments that global equity price movements have become increasingly correlated and vulnerable to sharp changes in investor sentiment.

### Chart 2.14

Equity risk premia differ across euro area domestic markets

#### Equity risk premium for selected euro area countries and the United States

(Jan. 2005 – Oct. 2015; percentage points)



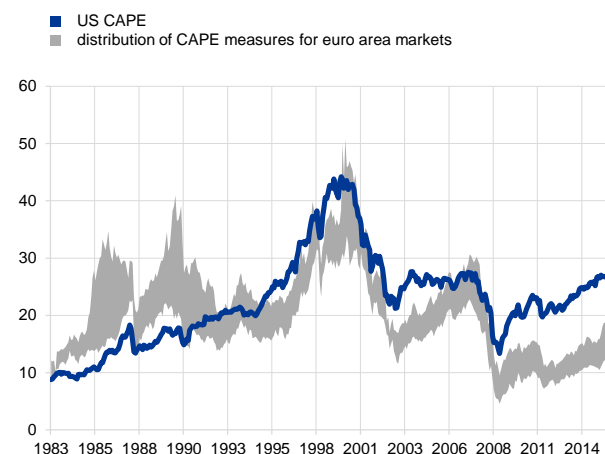
Sources: Thomson Reuters, MSCI I/B/E/S, Consensus Economics and ECB calculations.  
Note: The equity risk premium is estimated by means of a two-stage dividend discount model.

### Chart 2.15

Despite significant price corrections, CAPE measures still signal some overvaluation in US equities but not for euro area equities

#### Cyclically adjusted price/earnings ratio for euro area and US stock markets

(Jan. 1983 – Nov. 2015; grey area represents the 25th-75th percentiles)



Sources: Thomson Reuters Datastream, Robert Shiller's homepage (<http://www.econ.yale.edu/~shiller/data.htm>) and ECB calculations.  
Notes: The cyclically adjusted price/earnings (CAPE) ratio for the euro area is imputed from Datastream's stock market indices. The US CAPE is taken from Robert Shiller's homepage.

### Box 4

#### Dark pools and market liquidity

Concerns about potential market liquidity shortfalls have grown in recent years, amid changing roles of participants in financial markets and related trading patterns. As these structural changes have taken hold, one of the factors touted as harbouring the potential to disrupt market liquidity is a change in market microstructure. A particularly opaque element of this structural development has been the growth in little understood trading venues with no regulatory pre-trade transparency requirements – so-called “dark pools”. These types of venue emerged as the initial transparency regime for equities was implemented in the Markets in Financial Instruments Directive (MiFID). New regulation (MiFID II) aims to limit the size of less transparent trading activities and to bring more trades into light pool (or lit) venues where the order book is made public for all participants. Given the current debate on the impact of expanding the transparency regime to fixed income trading under MiFID II, assessing the development of dark pools within equity markets may provide some insights into the potential effect of the new requirements on bond market structure and liquidity.

The trading structure in equity markets noticeably changed after the implementation of MiFID in 2007. Previously, most trading in equities had occurred on a few large exchanges<sup>26</sup>. MiFID aimed to harmonise transparency, best execution and investor protection across European equity exchanges, and to facilitate competition between exchanges for the trading of equities. As a result, new venues competing for trades emerged, among them “dark” trading venues catering to investors

<sup>26</sup> Large exchanges acting virtually as single-country monopolies, such as the London Stock Exchange.

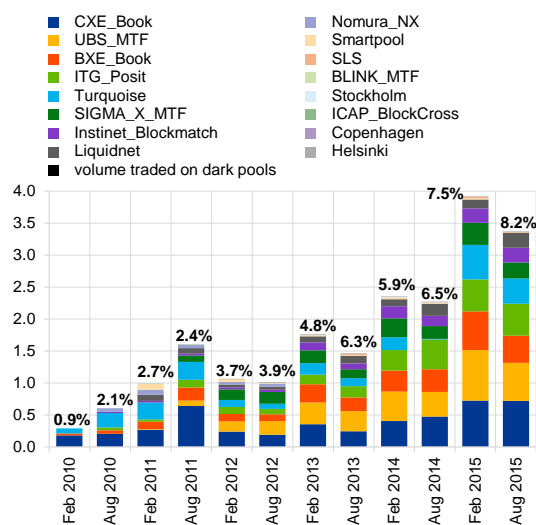
looking for reduced transparency. Using the exemptions for pre-trade transparency requirements, dark pools limit the dissemination of trade data, including information used for price formation. The growth of dark venues, which implies reduced availability of pre-trade information, as well as a higher level of market fragmentation, may be detrimental to market liquidity.

## Chart A

### Turnover in dark pools has grown rapidly

#### Reported equity volumes traded in dark pools in Europe

(y-axis: EUR billions; x-axis: traded volumes on the first trading Monday of each month; top of each bar: dark order book as a % of total reported volumes)



Source: BATS Chi-X Europe Market Data.

Notes: Volumes illustrated only for dark order books where data are available via BATS Chi-X Europe; these do not encompass all dark order books or dark pools. Percentages reflect the proportion of all traded volumes in equities on venues reporting to BATS Chi-X Europe.

Dark pools are a type of venue for trading equities with no pre-trade transparency requirements, which serves the needs of traders wishing to place and execute big-ticket orders with minimal adverse price effects. The main types of dark pools are dark order books (DOBs) and broker crossing networks (BCNs). DOBs are registered venues which use pre-trade transparency waivers and external reference prices. In contrast, BCNs are not officially registered venues and use various trade-matching methods. To illustrate the prominence of less transparent trading venues, Chart A shows the growth in volumes traded in a single day on selected DOBs in Europe. Daily trading on DOBs where data are available has grown from less than 1% in 2010 to over 8% of all trading in equities reported by the largest exchanges (including lit and dark order books). There is no equivalent data for volumes traded on BCNs, but studies approximate that 4-6% of volumes traded in equities use these venues.<sup>27</sup>

Certain investors, especially those looking to make large trades, may prefer using dark pools for a variety of reasons. One advantage in using them is that orders are generally executed based on the mid-point of an external reference price, and thus investors can avoid market impact costs.<sup>28</sup> Additionally, as the price and volume are not disclosed pre-trade, investors can place an order without revealing intentions and without allowing informed traders to take advantage. However, new regulation aiming to limit trading in dark pools should not be detrimental to investors placing larger orders, as they will be protected by the waivers and can use any venue type without pre-trade disclosure.

While uninformed traders may prefer dark pools, informed traders should favour lit markets, because they face lower execution probability in the dark if more of them cluster on one side of the market. As more uninformed traders move to dark pools, the risk of adverse selection for uninformed investors trading on lit venues is higher due to the fact that they are less likely to complete a profitable trade when trading against informed traders. Additionally, this shift may reduce the profits accruing to market-makers from capturing profitable uninformed order flows on lit

<sup>27</sup> The TABB Group estimates that BCNs accounted for 6% of pan-European equity market trading in 2012. Deloitte estimates that 4% of equity volumes were traded in BCNs in 2014.

<sup>28</sup> The additional transaction cost of executing a trade resulting from the movement in price required to complete it, which depends on market depth.

exchanges. However, market-makers are also active in dark pools, which allows them to also make some profit on these venues.<sup>29</sup>

Academic literature investigating the effect of dark pools on market liquidity has found mixed results. Those finding negative effects argue that dark pools remove liquidity and information from mainstream platforms where price formation occurs.<sup>30</sup> This leads to lower depth, increased trading costs and volatility on lit venues. They claim that consolidating liquidity on a few venues creates economies of scale and positive network externalities.<sup>31</sup> Thus, reducing dark pools by bringing more trades under a transparency regime may benefit market liquidity.<sup>32</sup> On the other hand, the defenders of dark pools argue that current levels of dark trading are too low to harm market quality and provide evidence that these venues benefit especially uninformed and small traders.<sup>33</sup>

The growth of dark pools under MiFID illustrates how regulation might influence evolving market microstructure, including a potential fragmentation of liquidity. According to the new provisions, all liquid financial instruments, including bonds, are to be subject to pre- and post-trade transparency on price and volume regardless of the trading venue. The new regulation aims to bring more trading to transparent venues, which, if successful, would also result in more liquidity on those venues. The majority of traders would benefit from consolidating information and promoting transparency, competition and financial stability. That said, some market participants might become more reluctant to engage in the market, as they may perceive transparency to increase the risks and costs of trading. Dark pools for fixed income instruments may emerge, pooling together liquidity and further changing the structure of these markets. Bonds are more heterogeneous than equities and traded less frequently but in larger trade sizes; thus fixed income traders may prefer dark pools to avoid revealing intent and trading with more informed counterparties on lit exchanges. Moreover, larger trade sizes in fixed income markets may make these trades more frequently eligible for transparency waivers. In light of this, more in-depth analysis of the development and potential effects of dark pools, as well as closer monitoring of the evolution of fixed income markets, are essential for designing regulation to adequately capture all facets of rapidly evolving financial markets.

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<sup>29</sup> Brugler, J., "Into the Light: Dark Pool Trading and Intraday Market Quality on the Primary Exchange", *Working Paper Series*, No 545, Bank of England, 2015.

<sup>30</sup> Degryse, H., De Jong, F. and Van Kervel, V., "The Impact of Dark Trading and Visible Fragmentation on Market Quality", *Review of Finance*, 2014.

<sup>31</sup> Each additional trader increases execution probability and reduces the market impact cost for others. For further discussion, see Pagano, M., "Endogenous market thinness and stock price volatility", *Review of Economic Studies*, Vol. 56(2), 1989, or Fioravanti, S. F. and Gentile, M., "The impact of market fragmentation on European stock exchanges", *Working Paper Series*, No 69, Commissione Nazionale per le Società e la Borsa, 2011.

<sup>32</sup> Comerton-Forde, C., and Putniņš, T. J., "Dark trading and price discovery", *Journal of Financial Economics*, 2015.

<sup>33</sup> Brugler, J. (2015), op. cit.

## 3 Euro area financial institutions

*Euro area financial institutions have continued to make steady progress in strengthening their balance sheets and building up their resilience to adverse shocks. Nevertheless, they still face challenges relating to weak economic growth prospects, legacy issues from the financial crisis, and a strengthened regulatory and prudential environment.*

*Notwithstanding a recent improvement in euro area banks' operating performance, finding sustainable sources of profitability remains a challenge in an environment of low nominal macroeconomic growth prospects and low interest rates across the maturity spectrum. Resolving a large stock of legacy problem assets also remains an issue, in particular in countries most affected by the financial crisis. Progress in removing non-performing loans (NPLs) from balance sheets remains moderate when measured against the stock of such loans, which remains an important obstacle to banks providing new credit to the real economy.*

*Similar to banks, the insurance sector faces profitability challenges. Although the latest reported profitability and capital positions remain solid, the prevailing low-yield environment is creating headwinds, and the market-consistent valuation approach of the forthcoming Solvency II regime will make these headwinds even stronger. In this environment, some insurers appear to be taking on more risks, with evidence of portfolio shifts towards infrastructure financing, equities and lower-quality bonds. On the liabilities side, life insurers are increasingly switching towards unit-linked policies and fee-based products for new business.*

*Amid ongoing repair in euro area banking and insurance sectors, the non-bank financial sector continues to grow apace. Commensurate to its growing size, it is also arguably becoming more central to the financial system. In the investment fund sector in particular, there are signs that rapidly growing exposures are accompanied by increased risk-taking.*

*Scenario analysis suggests that a materialisation of key risks to financial stability could have significant implications for banks and insurers alike in the euro area. At the same time, a complete assessment of financial stability risks remains hampered by a dearth of harmonised reporting outside these regulated sectors.*

*On the policy front, work continues apace to complete the regulatory foundations that foster financial system resilience and facilitate economic growth over the whole financial cycle. This includes not only a comprehensive regulatory overhaul for the banking sector both globally and in the EU in the wake of the global financial crisis, but also complementary parallel regulatory initiatives for non-bank financial entities. At the same time, there have been a variety of new macroprudential initiatives in euro area countries, mostly focused on mitigating risks originating from significant size, high concentration and interconnectedness in the banking sector.*

## 3.1 Repair continues in the financial sector

### 3.1.1 Bank balance sheet repair continues, but challenges from low profitability and high legacy problem assets remain<sup>34</sup>

Euro area banks' financial performance improved moderately in the first three quarters of 2015 and capital positions have been strengthened further. Nevertheless, many euro area banks continue to be challenged by low profitability, with their average return on equity remaining below the cost of equity. In an environment of low nominal growth and low interest rates, banks' earnings outlooks remain subdued owing to compressed net interest margins and sluggish loan growth. In this operating

environment, there is a clear need to reshape and rationalise their business mix and rethink their operational model in order to generate sustainable profitability in the medium term. However, execution risks in implementing new business strategies remain material in some cases and the pace of such adjustments remains rather uneven.

Compounding challenges in generating sustainable profitability growth, a large stock of legacy problem assets remains in the euro area banking sector, mainly in those countries most affected by the financial crisis. In some countries, improvements have been made towards a legal framework that is more conducive to effective NPL resolution. That said, progress in writing off and/or disposing of NPLs remains moderate when measured against the stock of such loans. In turn, the heavy burden of legacy problem assets remains an important obstacle to banks providing new credit to the real economy.

Overall, while the process of bank balance sheet repair continues at a steady pace, further progress is needed in parts of the banking system to address remaining fragilities and free up balance sheet capacity for new lending. This view is also in line with model-based evidence about vulnerabilities of euro area banks.

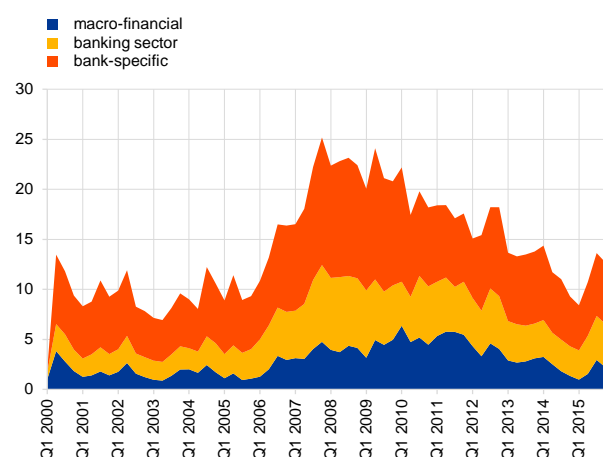
The latest results of a bank-level early warning model developed by the ECB's staff show that the aggregate forward-looking distress probability for euro area banks decreased slightly in the last quarter for which data are available and remains well below the peaks reached during 2007 (see [Chart 3.1](#)). This follows increases in the

**Chart 3.1**

Euro area banks' probability of distress within the next two years remains well below the peaks reached during 2007

#### Aggregate distress probability for euro area banks

(Q1 2000 – Q4 2015; percentage probability 1-8 quarters ahead; y-axis: weighted average distress probability)



Source: ECB calculations.

Notes: The results are based on a bank-level logit model with 11 risk drivers, built to indicate bank distress probabilities with a prediction horizon of one to eight quarters ahead. Bank distress events encompass bankruptcies, defaults, liquidations, state-aid cases and distressed mergers. The aggregation is done by weighting the bank-specific distress probabilities by the respective bank shares in aggregate bank assets of the euro area. The decomposition of individual distress probabilities into the different factors is done by using the (relative) distress probabilities that would prevail if all other variable blocks were set to their mean values. All results are derived from publicly available information. Further details about the underlying method and dataset can be found in Lang, J. H., Peltonen, T. and Sarlin, P., "A framework for early-warning modeling with an application to banks", Working Paper Series, ECB, forthcoming.

<sup>34</sup> The analysis in this sub-section is based on data for up to 94 significant banking groups (SBGs) in the euro area, including 18 large and complex banking groups (LCBGs). It should be noted that the sample of SBGs does not fully correspond to that of significant institutions that are under the direct supervision of the ECB. For instance, those significant institutions that are subsidiaries of other euro area SBGs or belong to non-euro area-based banking groups are not considered in the FSR analysis. For more details on the bank sample, see Box 5 in the November 2013 Financial Stability Review.

aggregate distress probability in the second and third quarters of 2015, which were partly driven by developments in Greece. A decomposition of the latest distress probabilities into contributing factors suggests that remaining fragilities in the euro area banking sector are mainly linked to bank-specific and country-level banking sector factors, while macro-financial factors, such as house prices or government bond yields, play a lesser role in most countries. A further breakdown of distress probabilities reveals that remaining bank-specific vulnerabilities are, in most cases, strongly linked with weak asset quality, further highlighting the need for dealing with NPLs in a comprehensive manner.

### Euro area banks' financial condition

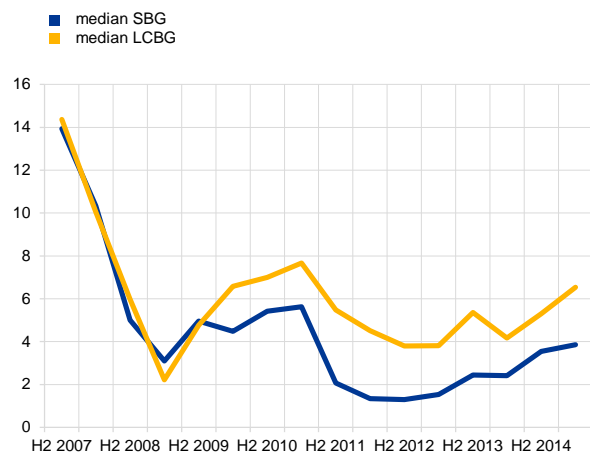
Euro area banks' **profitability** improved moderately in the first half of 2015 amid a gradual, albeit still fragile and uneven, economic recovery. The improvement in bank profitability was broad-based (see [Chart 3.2](#)), also extending to banks in countries most affected by the financial crisis. This, together with a further decline in banks' cost of equity, led to a narrowing of the negative return on equity gap for euro area banks (see [Chart 3.3](#)). Results for a sub-sample of quarterly-reporting SBGs indicate that, for the majority of these banks, profitability indicators also improved in the third quarter of 2015 in a year-on-year comparison, while showing a slight worsening compared with the second quarter.

**Chart 3.2**

Euro area banks' profitability showed signs of moderate improvement in the first half of 2015

#### Return on equity for euro area significant banking groups

(H2 2007 – H1 2015; percentages; median values)



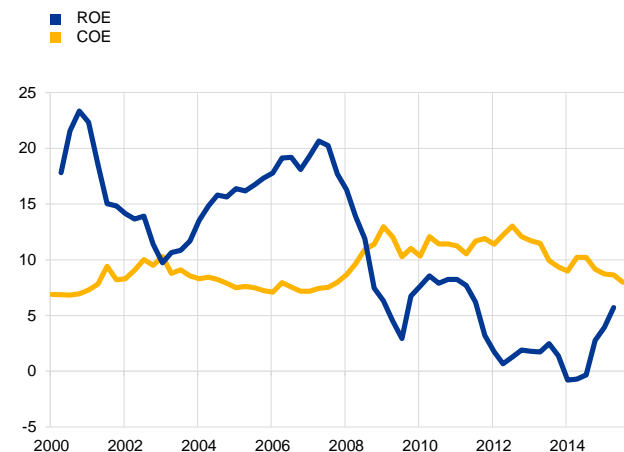
Source: SNL Financial.  
Notes: Based on publicly available data on significant banking groups. Two-period moving averages.

**Chart 3.3**

Banks' cost of equity continued to decline, but the negative return on equity gap persists

#### Return on equity and cost of equity for listed euro area banks

(Q1 2000 – Q3 2015; percentages)



Sources: Bloomberg, Thomson Reuters Datastream, Consensus Economics and ECB calculations.  
Notes: Based on the sample of all 33 euro area banks included in the EURO STOXX index. (Trailing) return on equity (ROE) is the weighted average (by market capitalisation) of individual ROEs. Cost of equity (COE) is the expected return on an investment in a weighted portfolio of all 33 banks, as implied by the capital asset pricing model (CAPM). Betas are estimated on rolling windows of one year of daily data, with the market portfolio proxied by the EURO STOXX index. The estimate of the equity premium, for the EURO STOXX index, is based on I/B/E/S earnings forecasts and Consensus Economics estimates of long-term real GDP growth. The latest observation is for Q3 2015.



A decomposition of the aggregate return on equity for euro area significant banking groups (SBGs) reveals that recent improvements in bank profitability were driven by a pronounced increase in non-interest income, a decline in loan loss provisions from historically high levels, as well as decreasing funding costs, which together outweighed the negative impact of asset yield compression and higher operating costs (see [Chart 3.4](#) and [Chart 3.5](#)).

Among the main sources of **operating income**, the contribution of net interest income to profitability moderately increased in the first half of 2015, on a year-on-year basis, as the decline in funding costs outpaced that of asset yields, in particular in countries most affected by the financial crisis. In particular, funding cost declines in these countries reflect a normalisation from the elevated levels experienced during the crisis. That said, net interest margins remain at a historically low level and the median ratio of net interest income to total assets dropped compared with the second half of 2014. This suggests that further improvements in net interest income may be difficult to achieve in an environment of low interest rates and flat yield curves, since associated declines in asset yields are less likely to be compensated for by a further fall in funding costs (see also Box 5).

## Box 5

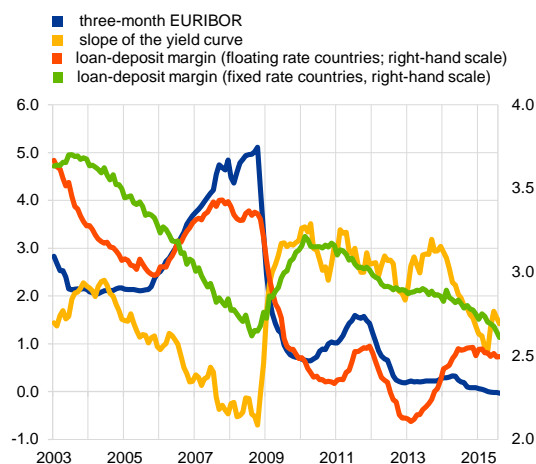
### Euro area banks' net interest margins and the low interest rate environment

#### Chart A

Low interest rates have contributed to depressing banks' net interest margins

#### Short-term interest rate, slope of the yield curve and MFI loan-deposit margins

(Jan. 2003 – Sep. 2015; percentages)



Sources: ECB, Bloomberg and ECB calculations.

Notes: Loan-deposit margins are defined as the volume-weighted lending rates to households and non-financial corporations minus the volume-weighted deposit rates on deposits from households and non-financial corporations. Weights are based on outstanding amounts.

In recent years interest rates have fallen to historical lows across the maturity spectrum, which has been accompanied by a substantial flattening of the yield curve. Concerns have arisen that, should such a constellation continue for a protracted period of time, this may hamper euro area banks' ability to generate net interest income – further dampening profitability that is already depressed by low economic growth and lingering legacy asset quality issues.

Should this low interest rate environment persist over a longer period, banks could see a decline in their net interest margins, particularly smaller institutions that are less capable of hedging their interest rate risk than larger banks. Moreover, when assessing the impact of low interest rates on banks' net interest margins, it is important to distinguish between banks primarily granting loans at floating rates and banks primarily granting fixed rate loans. The level of short-term rates is more important for the net interest margins of banks with predominantly floating

rate loans, while the steepness of the yield curve plays a relatively larger role for those banks favouring fixed rate loans (see Chart A).

## Table

### Net interest margin regression results

	Net interest margin		
	(1)	(2)	(3)
Net interest margin (t-1)	0.60*** (0.08)	0.58*** (0.08)	0.56*** (0.09)
CPI inflation	0.05* (0.02)	0.01 (0.02)	0.01 (0.02)
Real GDP growth	0.04*** (0.01)	0.03** (0.01)	0.02 (0.01)
Short-term interest rate	0.07** (0.03)		0.49*** (0.14)
Slope of the yield curve	0.07*** (0.02)		0.80*** (0.28)
Market capitalisation as % of GDP	0.00** (0.00)	0.00** (0.00)	0.00*** (0.00)
Common equity over total assets	0.10*** (0.03)	0.09*** (0.03)	0.09*** (0.02)
Loan growth	0.00*** (0.00)	0.00*** (0.00)	0.00*** (0.00)
Bank size			0.09 (0.09)
Short-term rate * floating rate dummy		0.08*** (0.03)	
Short-term rate * fixed rate dummy		-0.03 (0.03)	
Slope of the yield curve * floating rate dummy		0.06*** (0.02)	
Slope of the yield curve * fixed rate dummy		0.11*** (0.04)	
Bank size * slope of the yield curve			-0.07*** (0.03)
Bank size * short-term rate			-0.04*** (0.02)
Chi2	34196.6	29470.5	13344.0
Hansenp	0.31	0.34	0.46
AR2p	0.43	0.44	0.19
Number of observations	846	846	846

Notes: The net interest margin is defined as the net interest income over total earning assets. Heteroskedasticity and autocorrelation robust standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1. The Hansen test of over-identifying restrictions confirms that the (internal) instruments are valid, and the Arellano-Bond test rejects significant second-order serial correlation in the error term. The Wald test indicates that all the estimated coefficients are jointly significant.

A dynamic panel model can help to gauge the general effects of both the level of the short-term interest rate and the slope of the yield curve for a large number of banks. The analysis looks at the effects of bank-specific characteristics and of macroeconomic and financial conditions on the net interest margin.<sup>35</sup> In an empirical application to euro area banks over the 1994-2014 period,<sup>36</sup> two bank-specific variables (equity over total assets – as a proxy for the solvency position – and loan growth) and five macroeconomic variables<sup>37</sup> (real GDP growth, inflation, stock market capitalisation

<sup>35</sup> The regression includes bank fixed effects as well as time fixed effects.

<sup>36</sup> The banking data were taken from Bloomberg. The macroeconomic variables were sourced from the World Bank's World Development Indicators database. The inclusion of a lagged dependent variable in a panel framework might yield biased and inconsistent estimates owing to the correlation between the lagged dependent variables and the error terms. To address this issue and to tackle the possible endogeneity of the bank-specific explanatory variables, the model is estimated using a system GMM estimator. In this context, the explanatory variables are instrumented by using "internal" instruments.

<sup>37</sup> Other explanatory factors that could be taken into consideration when studying the relationship between banks' net interest margins and the interest rates are the maturity gap, the flexibility of contractual spreads, the amount of non-maturing deposits as a share of total deposits, and the residual maturity of loans granted.

as a ratio to GDP, the short-term interest rate and the slope of the yield curve) are included in a benchmark model for 72 institutions (column 1 in the table).<sup>38</sup>

The regression analysis suggests that the net interest margin is positively and significantly related to both the level of short-term interest rates and to the slope of the yield curve (see column 1 in the table).<sup>39</sup> These results can be attributed to the two key services supplied by banks and reflected in their interest income earnings: maturity transformation services and deposit transaction services.

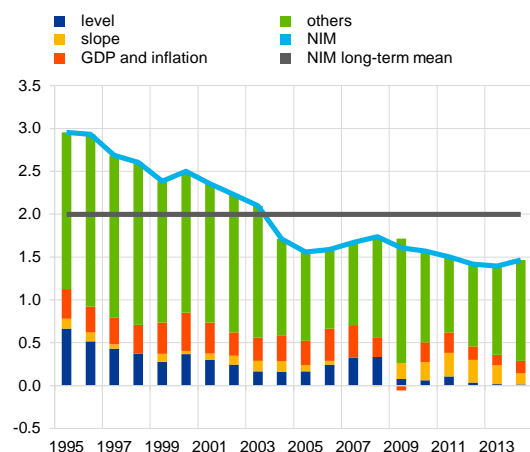
The short-term interest rate result may reflect the fact that bank deposit rates are typically lower and stickier than market rates (since banks provide transaction services). In particular, banks often fund a portion of their interest-earning assets with non-interest-bearing liabilities which primarily correspond to demand and transaction deposits. In addition, as bank deposit rates are constrained by the zero lower bound, low levels of market rates will tend to compress deposit margins (i.e. the spread between the market rate and bank deposit rates).

### Chart B

The contribution of interest rates to net interest margins has diminished over time

#### Net interest margin decomposition over time

(1995-2014; percentages)



Source: ECB calculations.

Notes: The net interest margin (NIM) is defined as the net interest income over total earning assets. "Others" includes the lagged dependent variable, the capital ratio, loan growth, stock market capitalisation, time dummies and the residual.

The importance of accounting for the loan rate fixation periods when assessing net interest margin developments is further examined in column 2 of the table, where the short-term rate and the slope of the yield curve are interacted with dummy

The slope of the yield curve result is also not surprising. Owing to their maturity transformation activities, banks tend to benefit from a steep yield curve characterised by a wide spread between long-term and short-term interest rates. By contrast, a flattening of the yield curve exerts downward pressure on banks' net interest margins.

Moreover, based on the benchmark regression (column 1 in the table), Chart B shows a decomposition of the average contribution of the different explanatory factors to euro area banks' net interest margins over the period 1995-2014. While there was a steady decline in net interest margins in the pre-crisis period, the fall in short-term rates since 2008 has further reduced margins. More recently, especially in 2014, the yield curve flattening has also contributed to the compression of net interest margins.

<sup>38</sup> The slope of the yield curve is defined as the spread between the ten-year sovereign bond yield and the short-term money market rate.

<sup>39</sup> All the other explanatory variables have the expected positive signs and are significant. In particular, the positive coefficient of the lagged net interest margin suggests strong persistence of the dependent variable over time, and the positive coefficients of real GDP and inflation might indicate that improving macroeconomic conditions are associated with improved borrower financial conditions boosting banks' profitability. The positive coefficient of bank capital may reflect the fact that banks with higher capital ratios tend to have lower funding costs and a broader capacity to extend credit, and thus broader scope to generate interest income.

variables for countries where lending is predominantly done either with fixed rate loans<sup>40</sup> or with floating rate loans<sup>41</sup>. As expected, the results suggest that (i) changes in the short-term rate mainly affect banks' net interest margins in "floating rate countries", while (ii) the slope of the yield curve is more relevant for banks exposed to fixed rate lending.

Finally, as shown in column 3 of the table, when bank size (measured as the logarithm of the bank's total assets) is interacted with both the short-term interest rate and the slope of the yield curve, larger banks display a lower sensitivity to interest rate and yield curve changes than smaller banks. This could indicate that larger banks are able to undertake hedging activities which allow them to better offset some of their exposures to interest rate risk.<sup>42</sup>

Overall, these findings indicate that the prolonged period of low interest rates is posing material challenges for banks' net interest income generation.<sup>43</sup> While some banks may be capable of coping with these challenges, the low interest rate environment may induce a number of banks to adjust their business models towards activities that rely less on traditional interest income-generating business.<sup>44</sup>

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<sup>40</sup> i.e. Belgium, France, Germany and the Netherlands. "Floating rate countries" and "fixed rate countries" are identified using the ECB's MFI interest rate statistics. More specifically, in "floating rate countries" the majority of new business loans to households for house purchase are given floating rates or an initial rate fixation period of up to one year, while in "fixed rate countries" a large share of new business loans to households for house purchase are granted with an initial rate fixation period of more than five years. However, it is worth mentioning that banks within the same country might have diverse business models and, thus, rate fixation periods that differ from those of their EU peers.

<sup>41</sup> i.e. Austria, Cyprus, Finland, Greece, Ireland, Italy, Luxembourg, Slovenia, Spain and Portugal.

<sup>42</sup> A similar result is found using data for US banks in Genay, H. and Podjasek, R., "What is the impact of a low interest rate environment on bank profitability?", *Chicago Fed Letter*, No 324, July 2014.

<sup>43</sup> However, it is important to note that the estimated negative effects on banks' net interest margins stemming from the low interest rate environment would be at least partly compensated for by the likely positive effects on net interest margins of low interest rates boosting economic activity.

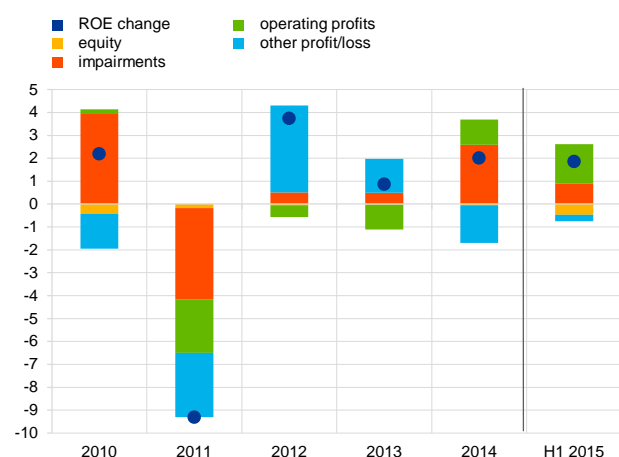
<sup>44</sup> For example, some banks may choose to rely more on fees and commissions to generate income; see also Kok, C., Mirza, H. and Pancaro, C., "Macro stress testing European banks' fees and commissions", *Working Paper Series*, ECB, forthcoming.

**Chart 3.4**

Recent profitability improvements were driven by both increasing operating profits and falling loss provisions

#### Decomposition of changes in the return on equity of euro area significant banking groups

(2010 – H1 2015; percentage points)



Sources: SNL Financial and ECB calculations.

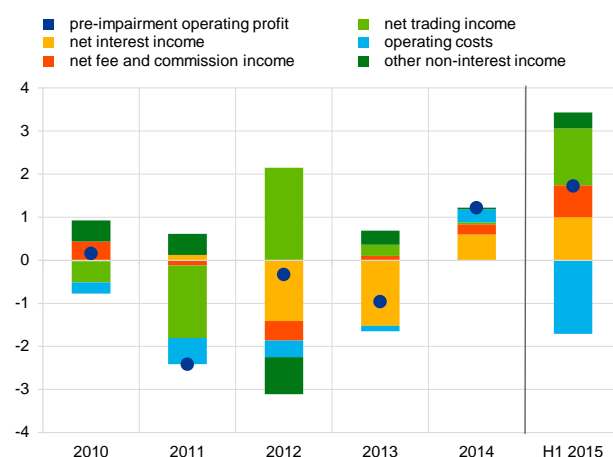
Notes: Based on aggregate data for 69 significant banking groups. The decomposition for H1 2015 is based on annualised half-yearly results. Changes in equity and impairments are shown with the opposite sign, i.e. higher (lower) equity and impairments contribute to lower (higher) return on equity.

**Chart 3.5**

The rise in operating profits was mainly due to a surge in non-interest income

#### Contribution of main operating profit components to the change in euro area significant banking groups' return on equity

(2010 – H1 2015; percentage points)



Sources: SNL Financial and ECB calculations.

Notes: Based on aggregate data for 69 significant banking groups. H1 2015 changes are based on annualised values.

Continued pressure on net interest margins was partly offset by higher non-interest income, with both fee and trading income showing an increase in the first half of 2015 (see [Chart 3.5](#)). Some banks benefited from an increase in asset management-related fee income on the back of higher inflows into investment funds. Data for a sub-sample of quarterly-reporting SBGs suggest that the trend of increasing fee income halted in the third quarter of 2015, partly related to a drop in investment fund inflows.

Banks' trading income followed a similar pattern in the first three quarters of 2015. Trading results showed a year-on-year increase in the first half of 2015, driven by higher equity (and equity derivative) revenues, realised gains from selling available-for-sale assets (e.g. sovereign bonds) as well as higher foreign currency gains. However, data for a sub-sample of quarterly-reporting SBGs show that, against the background of worsening financial market conditions between July and September, the contribution of trading income to banks' profits decreased in the third quarter of 2015.

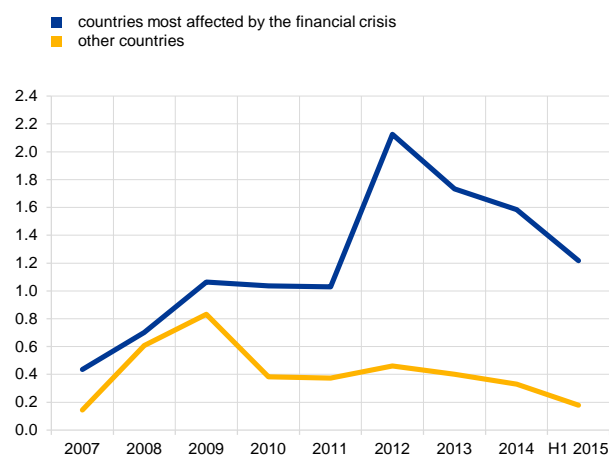
Given the continued subdued growth in revenue, banks are also looking to improve operating profits by containing costs. Following an improvement in 2014, progress in achieving cost efficiency gains halted in the first half of 2015, as the median ratio of operating costs to both total assets and operating income edged up from a year earlier. Looking ahead, some banks have announced cost-cutting targets as part of their restructuring plans, involving a reduction in the retail branch network in line with customers' increased propensity to use digital services.

### Chart 3.6

Loan loss provisions continued to decline, but remain above pre-crisis levels in the countries most affected by the crisis

#### Loan loss provisions of euro area significant banking groups

(2007 – H1 2015; percentage of total loans; median values)



Source: SNL Financial.

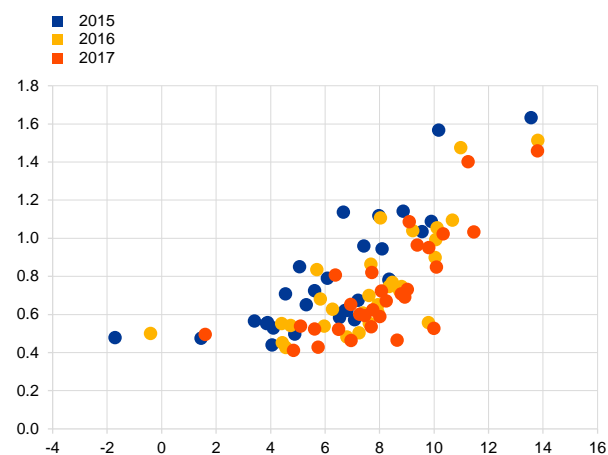
Notes: Based on publicly available data for significant banking groups. H1 2015 ratios are based on annualised values. Countries most affected by the crisis include Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain.

### Chart 3.7

Expectations of subdued bank profitability are reflected in low price-to-book ratios

#### Analyst forecasts for listed euro area banks' profitability and expected price-to-book ratios

(2015-2017; percentage and ratio; x-axis: return-on-equity forecast; y-axis: price-to-book ratio forecast)



Source: Bloomberg.

Note: Based on forecasts for 30 listed significant banking groups.

Loan loss provisions declined year on year for the majority of euro area SBGs in the first six months of 2015 (see [Chart 3.6](#)), thereby contributing to improving financial performance. This positive effect was more pronounced, on average, in countries most affected by the financial crisis, although provisioning levels remain elevated in many banks located in these countries. In other countries that were less affected by the crisis, loan loss provisions are close to pre-crisis levels for the majority of banks, which suggests that falling provisions in these countries are unlikely to lead to significant improvements in profitability in the period ahead.

Notwithstanding recent improvements, concerns remain about the outlook for euro area banks' profitability. Analyst forecasts for 2016 and 2017 earnings suggest only a moderate improvement in the next two years, with the low nominal growth and low interest rate environment still weighing on the outlook for bank profitability. Investor perceptions of a persistently subdued earnings outlook are also reflected in banks' current and forecasted price-to-book ratios (see [Chart 3.7](#)).

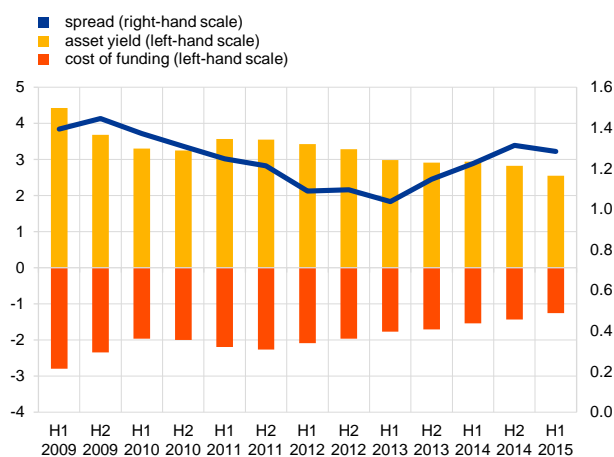
Concerns regarding the profitability outlook are partly related to continued pressures on net interest margins. While euro area SBGs' net interest income, on average, held up relatively well in the first half of 2015, the outlook for net interest income for 2016 remains subdued. In fact, the median interest spread (i.e. the difference between asset yield and cost of funding) for SBGs already tightened somewhat in the first half of the year as the decline in asset yields outpaced that of funding costs (see [Chart 3.8](#)).

### Chart 3.8

Following an increase in 2014, bank margins tightened again in the first half of 2015 owing to an acceleration in asset yield declines

#### Interest spread and its components for euro area significant banking groups

(H1 2009 – H1 2015; percentages; median values)



Source: SNL Financial.

Notes: Based on publicly available data for significant banking groups. Two-period moving averages.

In a number of euro area countries, margins between new loans and deposits have narrowed so far in 2015, as lending margins have compressed, partly owing to intense competition, while the positive impact of deposit repricing is fading. In addition, the contribution of (sovereign) bond portfolios to net interest income – a significant income source for some banks – is expected to decline in the period ahead as banks reinvest funds obtained from the sale or the maturing of higher-yielding bonds back into lower-yielding securities.

Looking at structural factors, banks' return to sustainable profitability is also dependent on their ability to adapt their business mix to the new operating environment. Pre-crisis profitability levels of many banks were boosted by high leverage and/or reliance on relatively cheap wholesale funding as well as, in some cases, higher risk-taking (such as real estate lending or securitisation exposures) in order to generate revenues. For instance, the reduction in leverage and diminishing trading profits accounted for around one-third of the decline in euro area SBGs' aggregate return on equity between 2007 and 2014.

Progress in reshaping business models has continued, driven by stricter regulatory requirements, restructuring resulting from state-aid investigations as well as “voluntary” changes on account of banks' altered risk-return preferences. As a result, euro area banks have scaled back their activities in several areas. For instance, some cross-border banking groups reduced their international presence by selectively withdrawing from non-core markets, while several banks downsized certain investment banking activities as well as legacy securitisation exposures that were particularly affected by new regulatory requirements. Banks have also reduced certain lending activities in higher-risk sectors (e.g. commercial real estate, shipping) or those that used to rely on volatile wholesale funding.

Results of the latest EBA risk survey show that less than one-third of surveyed EU banks foresee further material changes to their business models going forward.<sup>45</sup> Survey responses by this sub-set of banks suggest a refocusing on core activities and markets, with certain wholesale lending activities (e.g. international leasing, shipping) and non-domestic activities mentioned most frequently among business lines to be scaled down. By contrast, retail activities are mentioned most frequently among business lines that banks are planning to expand.

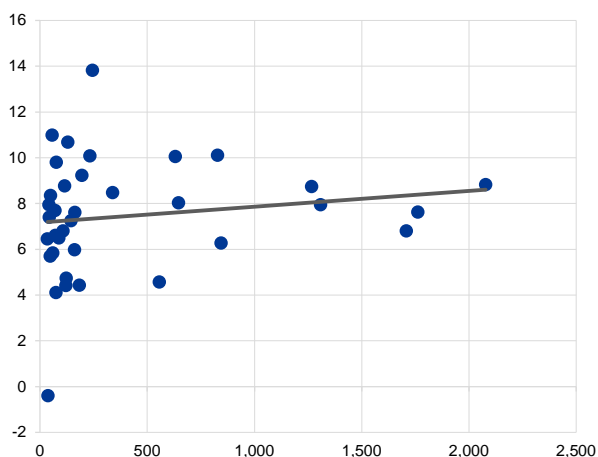
<sup>45</sup> See *Risk assessment of the European banking system*, EBA, June 2015.

### Chart 3.9

#### Investor expectations for future bank profitability do not seem to correlate with bank size

##### Return-on-equity forecasts and total assets of listed euro area banks

(x-axis: 2014 total assets, EUR billions; y-axis: return-on-equity forecasts for 2016, percentages)



Sources: Bloomberg and SNL Financial.

In addition, certain aspects of regulation intended to make the system more resilient (e.g. by reducing too-big-to-fail risk) may diminish the benefits of scale. In fact, market participants' expectations for future bank profitability do not seem to correlate with bank size (see [Chart 3.9](#)). Measures needed to achieve sustainable profits vary across banks and include, among others, improving capital efficiency, lowering cost bases or focusing on core activities for revenue generation.

Banks' **solvency** ratios continued to improve in the first half of 2015, with the median phased-in CET1 ratio rising to 12.6% in June 2015 from 12.3% at the end of 2014 (see [Chart 3.10](#)). This can be mainly attributed to increases in CET1 capital, helped by both increasing internal capital generation and, in some cases, capital-raising. On average, increases in total assets made a small negative contribution, while the impact of the change in average risk weight (i.e. risk-weighted assets to total assets) was neutral (see [Chart 3.11](#)).

At the same time, the median Basel III fully loaded CET1 ratio, which will be a requirement as of 2018, remained broadly stable at 11.5% (see [Chart 3.10](#)). The different patterns in the phased-in and fully loaded ratios can be partly attributed to the fact that while part of the decline in unrealised gains on available-for-sale assets, related to the rise in sovereign bond yields in the second quarter of 2015, did not affect phased-in ratios owing to the use of prudential filters (at least by some banks), in the case of fully loaded ratios it has broadly offset the impact of capital increases.

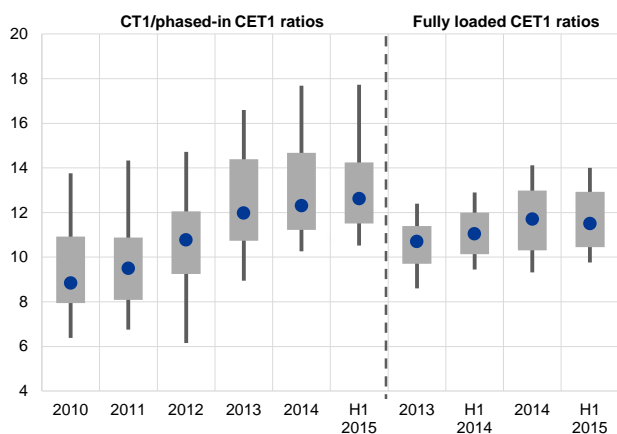


**Chart 3.10**

Solvency ratios improved on a phased-in CET1 basis, but remained broadly stable on a fully loaded basis

**Core Tier 1/common equity Tier 1 capital ratios of significant banking groups in the euro area**

(2010 – H1 2015; percentages; 10th and 90th percentiles, interquartile distribution and median)



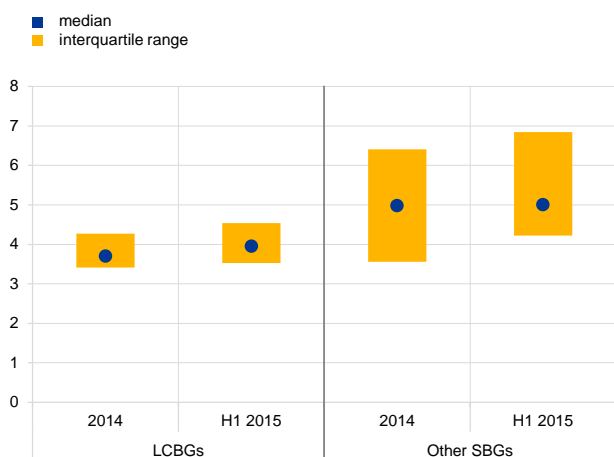
Source: SNL Financial.  
Note: Based on publicly available data for a sample of 76 significant banking groups (phased-in CET1) and 55 significant banking groups (fully loaded CET1) respectively.

**Chart 3.12**

Leverage ratios edge up further, but large and complex banking groups continue to lag behind

**Basel III leverage ratios of significant banking groups in the euro area**

(2014 – H1 2015; percentages; medians and interquartile ranges)



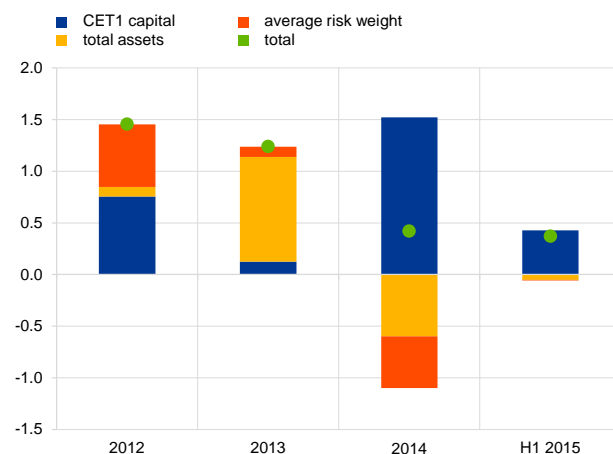
Source: ECB.

**Chart 3.11**

The improvement in phased-in CET1 ratios was mainly driven by capital increases

**Contribution of changes in capital and risk-weighted assets to phased-in common equity Tier 1 capital ratios**

(2012 – H1 2015; percentage points)



Sources: SNL Financial and ECB calculations.  
Notes: Based on publicly available data for a sample of 76 significant banking groups. Changes in total assets and average risk weight are shown with a negative sign as their decline indicates a positive contribution to the capital ratios.

Paralleling developments in risk-weighted capital ratios, euro area banks' **leverage** ratios also continued to improve at a moderate pace in the first half of 2015. Differences across banks of different sizes persisted, with large and complex banking groups (LCBGs) still lagging behind other SBGs with median leverage ratios of 4% and 5% respectively at the end of June 2015 (see [Chart 3.12](#)). While most SBGs exceed the preliminary target level of 3% for the leverage ratio, market pressure remains for those large banks lagging behind their peers and some of these institutions intend to implement further significant reductions in their leverage exposures to reach the target ratio of at least 4% (for a discussion on the impact of the leverage ratio on risk-taking and bank stability, see Special Feature A).

At the same time, banks still face some uncertainty about future capital requirements, with possible implications for their lending behaviour in the period ahead. A key uncertainty relates to the review of the

risk-weighted capital ratio framework, the purpose of which is to improve internal models and increase the risk sensitivity of the standardised approach for credit, market and operational risks. Basel proposals stemming from this review could result

in higher capital requirements for banks, not least owing to the planned introduction of risk-weighted asset floors for mortgages and corporate loans.

These prospective changes are of key importance to reducing the excessive variability of risk weights across banks and countries, thereby improving the credibility of the risk-weighted capital framework. That said, the uncertainty around the magnitude of resultant changes in capital requirements is likely to have some implications for banks' capital management and risk-taking behaviour in the period ahead. In particular, some banks may need to continue focusing on building capital rather than expanding their balance sheet, not least owing to the fact that evolving capital requirements are being increasingly factored into investor perceptions.

## Credit risk

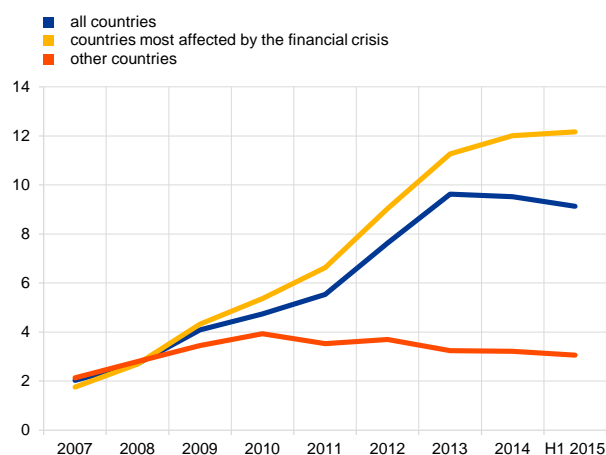
**Credit risk** conditions for the euro area banking sector have remained broadly unchanged since the finalisation of the May 2015 FSR. Despite the ongoing recovery, economic conditions remain weak in the euro area, implying heightened income and earnings risks for households and non-financial corporations (NFCs). This, coupled with legacy balance sheet issues, continues to negatively affect borrowers' debt servicing capacities, but is offset by favourable financing conditions. In addition, euro area banks face the prospect of rising credit risks emanating from foreign exposures, and in particular exposures to vulnerable emerging market economies (see Section 1).

### Chart 3.13

Reported asset quality indicators suggest a modest improvement, but asset quality trends continue to diverge

#### Impaired loan ratios for euro area significant banking groups

(2007 – H1 2015; percentage of loans, median values)



Source: SNL Financial.

Notes: Based on publicly available data for a sample of 55 significant banking groups. Countries most affected by the crisis include Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain.

**Asset quality** trends continued to diverge in the euro area, although reported impaired loan ratios suggest a modest improvement in the first half of 2015 (see **Chart 3.13**). Similarly, the median NPL ratio of SBGs decreased to around 12% at end-June 2015 from 13.5% six months earlier. That said, around one-third of SBGs experienced a worsening in their asset quality in the first half of this year, suggesting that some banks have not yet “turned the corner” in terms of the stock of problem loans.

The coverage of non-performing loans by loan loss reserves improved slightly in the first six months of 2015 (from 47% to 48%), although dispersion across banks remains significant with the interquartile range of coverage ratios between 41% and 56%.

The sectoral breakdown of NPLs shows that the accumulation of such loans following the sovereign debt crisis was driven mainly by deteriorating credit quality in the corporate sector and, to a lesser extent, by the rise in delinquencies in the household segment (see **Chart 3.14**). A further breakdown of NFC exposures, by

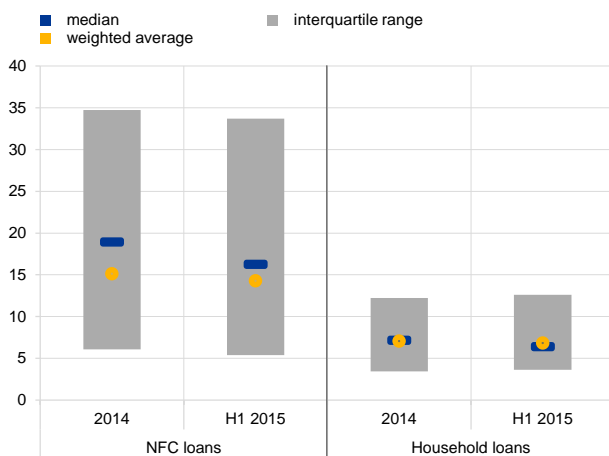
economic activity, reveals that the construction and real estate sectors account for

around 40% of euro area banks' corporate NPLs, with an average NPL ratio of nearly 20% (see [Chart 3.15](#)). This is followed by the transportation (mainly owing to shipping), manufacturing and trade sectors. While the credit risk outlook has deteriorated in some energy sectors, on aggregate the electricity and gas sector accounts for only 5% of total NFC loans and has a below-average NPL ratio.

**Chart 3.14**  
Non-performing loan ratios remain elevated in the corporate sector...

**Non-performing loan ratios of significant banking groups in the euro area, by sector**

(2014 – H1 2015; percentage of loans; median, weighted average and interquartile range distribution across SBGs)

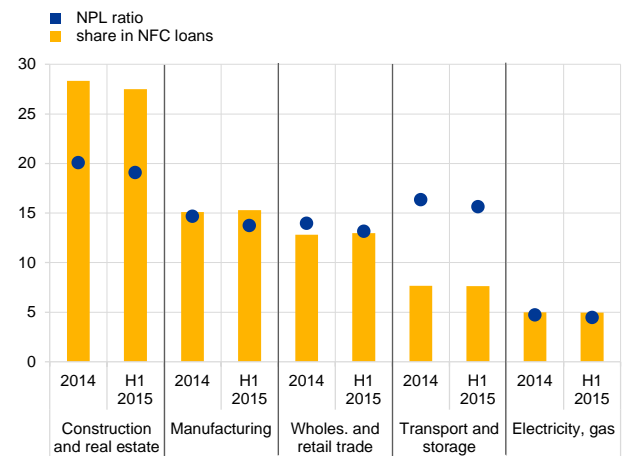


Source: ECB.

**Chart 3.15**  
... with the construction and real estate sectors displaying the worst credit quality

**Non-performing loan ratios of significant banking groups in the euro area, by economic activity**

(2014 – H1 2015; percentage of loans)



Source: ECB.

Note: Weighted averages for those SBGs that reported the industry breakdown of non-performing loans in the NFC sector.

Regarding the level of NPL ratios, variation across banks and countries remains significant, with a number of banks still burdened by a large stock of NPLs that are mostly a legacy of the recession triggered by the sovereign debt crisis. The high level of NPLs weighs on profitability, as it entails additional operating costs and reduces the net interest margin, and it also holds back new lending. Furthermore, banks with a large volume of NPLs and moderate coverage ratios are more vulnerable to negative shocks affecting the credit quality of borrowers (see [Chart 3.16](#)).

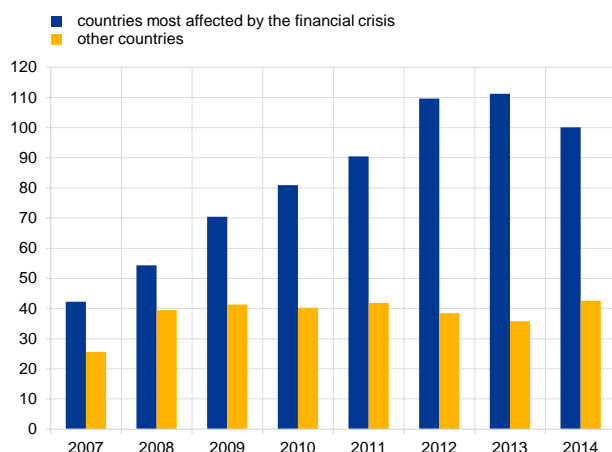
Positively, in some jurisdictions progress has been made in improving the legal framework to facilitate more effective NPL resolution. Notably, new legislation has been introduced in Italy that aims to reduce the fiscal disincentive for banks to provision for NPLs and write off bad debt and to improve insolvency procedures. In the medium term, this could also contribute to better loss recognition by banks and faster foreclosure of collateral underlying NPL portfolios, thereby contributing to a more effective NPL market.

**Chart 3.16**

Banks in countries burdened with a high level of non-performing loans have limited buffers against further credit losses

**Ratio of non-performing loans to tangible equity and loan loss reserves for euro area significant banking groups**

(2007-2014; percentages, median values)



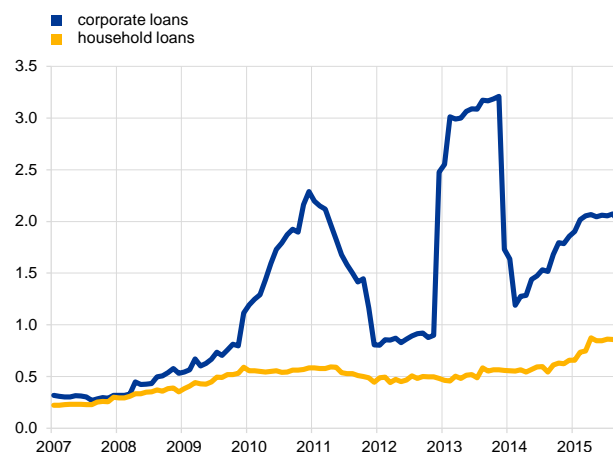
Source: SNL Financial.  
Notes: Based on publicly available data for a sample of 60 significant banking groups. Countries most affected by the crisis include Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain.

**Chart 3.17**

Write-off rates levelled off in countries most affected by the financial crisis

**Write-off rates on loans of euro area monetary financial institutions to the non-financial private sector in countries most affected by the financial crisis**

(Jan. 2007 – Sep. 2015; percentage of loans; weighted averages)



Source: ECB.  
Note: Countries most affected by the crisis include Cyprus, Greece, Ireland, Italy, Portugal, Slovenia and Spain.

That said, progress to date in NPL disposals remains moderate when compared with the volume of problem loans in euro area banks. Slow progress in selling and writing off NPLs may also reflect the limited buffers that some banks have against possible further losses (see [Chart 3.16](#)). In countries with a high level of NPLs, the median ratio of NPLs to tangible equity and loan loss reserves (known as the “Texas ratio”) stood at around 100% the end of 2014.

MFI data suggest that, after a steady increase starting in early 2014, write-off rates on corporate loans have levelled off since the second quarter of 2015 and in some countries with a high level of NPLs they remain at low levels (see [Chart 3.17](#)). Therefore, banks should take advantage of the current environment to clean up their balance sheets and free up balance sheet capacity for new lending.

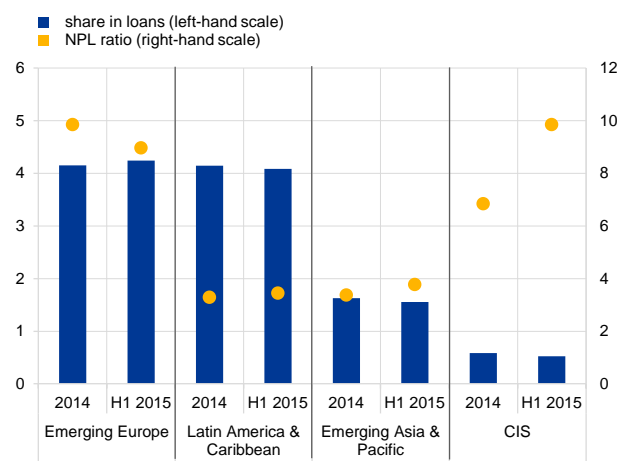
Against the background of increasing credit risks in [emerging economies](#) (see Section 1, including Box 1 on China), euro area banks with material exposures to vulnerable emerging market economies face heightened earnings risks and could see their loan losses rise in the period ahead.

**Chart 3.18**

**Euro area banks' direct exposure to risks in emerging Asia and Latin America is relatively contained**

**Euro area banks' exposures and non-performing loan ratios in selected emerging market economy regions**

(2014 – H1 2015; percentage of total loans; weighted averages)



Source: ECB.

Note: Based on a sample of significant banking groups that report the geographical breakdown of their exposures.

Aggregated bank supervisory data suggest that cross-border claims of euro area banks on emerging Asia are contained, accounting for less than 2% of euro area SBGs' assets, while the average NPL ratio stood close to 4% in the first half of 2015 representing a slight increase from end-2014 (see [Chart 3.18](#)). By comparison, euro area banks' exposures to Latin America are more significant, albeit with an average NPL ratio of slightly above 3% at the end of the first half of 2015, broadly unchanged from six months earlier.

While asset quality in these two regions compares favourably with those in CIS countries and emerging Europe, banks are likely to incur higher loan losses on their Asian and Latin American exposures in the period ahead. While the direct impact of worsening credit quality in these regions appears to be manageable, second-round effects (possibly involving a broader-based deterioration in emerging market economies) could be more significant.

## Funding liquidity risk

**Market-based bank funding conditions** have become less favourable since the third quarter of 2015, with credit spreads widening amid uncertainty associated with developments in Greece and China. In bank debt markets, spreads on euro-denominated senior unsecured debt and, in particular, on subordinated debt widened more markedly, while spreads on covered bonds rose to a lesser extent (see [Chart 3.19](#)). The widening of spreads for both senior and subordinated debt was largely due to increased risk aversion in markets. In future, the pricing of senior debt is also likely to be affected by the ongoing implementation of bail-in rules at the national level, as indicated by the widening of the senior spread following the announcement of the German statutory subordination proposal in June.

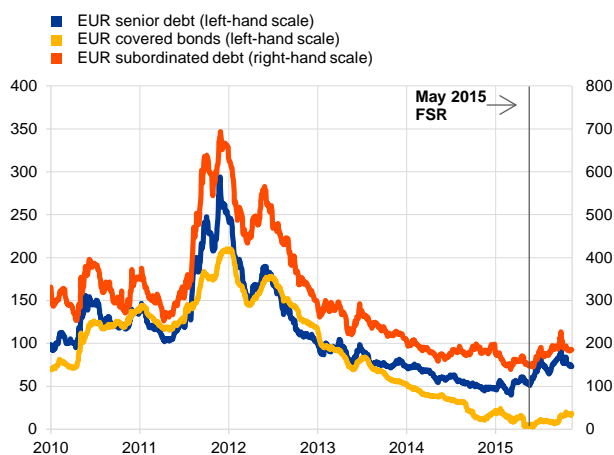
**Bank debt issuance** patterns also reflected increased risk aversion, with a shift towards covered bond issuance and away from unsecured debt issuance (see [Chart 3.20](#)). This can be partly attributed to the less favourable pricing conditions for issuers in the senior unsecured segment and the impact of the ECB's third covered bond purchase programme (CBPP3) on primary market activity, while for some banks the substitution of senior debt with long-dated central bank borrowing through the targeted longer-term refinancing operations (TLTROs) could have also played a role.

### Chart 3.19

Bank debt spreads have widened since May owing to increased risk aversion in credit markets...

#### Spreads on banks' senior debt, subordinated debt and covered bonds

(Jan. 2010 – Nov. 2015; basis points)



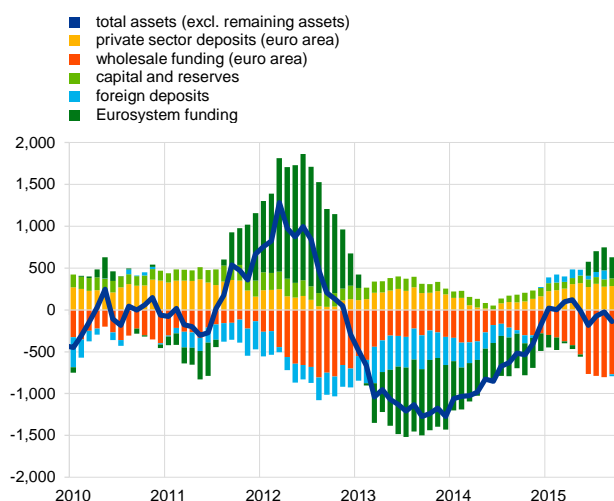
Sources: ECB and Markit.

### Chart 3.21

Deposit growth remained stable, while wholesale funding continued to decline

#### Twelve-month flows in main liabilities of the euro area banking sector

(Jan. 2010 – Sep. 2015; EUR billions)



Source: ECB.

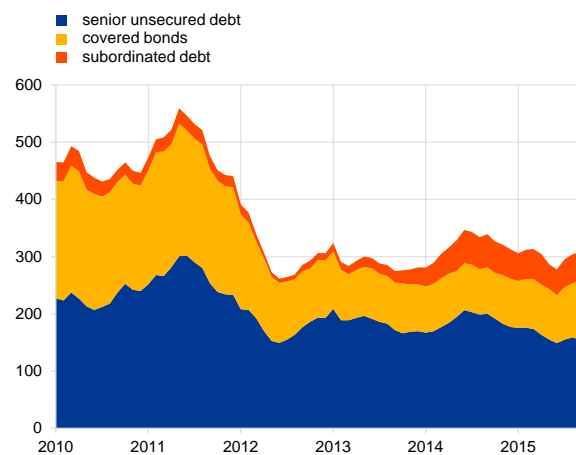
their use of Eurosystem funding facilities, via borrowing through TLTROs which was partly used to replace more expensive debt funding. These changes are partly a reflection of the profitability pressures felt by euro area banks.

### Chart 3.20

... also reflected in a shift in the structure of new debt issuance towards secured debt

#### Gross issuance of medium and long-term debt by euro area banks

(Jan. 2010 – Oct. 2015; 12-month cumulative issuance; EUR billions)



Source: Dealogic.

Note: Excludes retained issuance and government-guaranteed debt.

At the same time, the issuance of subordinated debt in the first ten months of 2015 was below that of the same period last year, with activity adversely affected in periods of heightened volatility in debt markets. That said, subordinated debt issuance remains robust overall and continues to be driven by banks' adaptation to new regulatory requirements, namely the minimum requirement for own funds and eligible liabilities (MREL) and the total loss-absorbing capacity (TLAC) requirements.

The issuance of asset-backed securities by euro area banks picked up somewhat, with non-retained issuance standing at €36 billion in mid-November, broadly in line with the average issuance volume over the same period in the last five years, but representing a 25% increase year on year.

Changes in banks' **funding mix** have been characterised by a further decline in wholesale funding, including continued net redemption of debt securities, while deposit growth remained broadly stable (see **Chart 3.21**). At the same time, banks also increased

Banks continued to make progress towards meeting the new Basel III requirements on stable funding. According to the EBA's latest Basel III monitoring report, at the end of 2014 about 60% of the large, internationally active EU banks (Group 1 banks) and 75% of the other EU banks (Group 2 banks) subject to the monitoring exercise had already met the required minimum net stable funding ratio (NSFR) of 100%, with average NSFR ratios of 102% and 109% respectively.

Similarly, banks are making steady progress towards meeting new regulatory requirements for liquidity buffers. In fact, at the end of 2014 87% of Group 1 banks and 68% of Group 2 banks had already achieved a 100% liquidity coverage ratio, a requirement that will be applicable from the beginning of 2018. At the end of 2014 banks subject to the monitoring exercise had a shortfall of only €17 billion relative to the minimum requirement of a 70% liquidity coverage ratio applicable from 1 January 2016.

The continued implementation of **bail-in** rules at national level as well as preparation for future TLAC requirements remain an important determinant of banks' funding strategies in the near to medium term. In some countries, new draft proposals on the transposition of the Bank Recovery and Resolution Directive have been put forward that aim to enhance the implementation of the bail-in tool in resolution. One approach taken is the statutory subordination of senior unsecured debt to other (operational) senior liabilities, as is the case in Germany, while other proposals target contractual subordination by allowing for an additional layer (Tier 3) in banks' capital structure (e.g. as is the case in Spain). Regarding future TLAC requirements for global systemically important banks (G-SIBs), both statutory and contractual subordination would help banks fulfil new TLAC requirements. At the same time, addressing MREL and TLAC requirements will remain an important challenge for euro area banks in the coming years, with possible negative implications for their funding costs.

## Market and operational risks

Banks' **market risk** increased in the second and third quarters of the year on the back of heightened volatility across all segments of financial markets. Banks' **interest rate risk** remains the most significant source of market risk, with the share of debt securities in SBGs' total assets remaining broadly stable in the first half of 2015, at around 15%. Regarding the composition of debt holdings, sovereign bonds comprise the largest part, totalling nearly 10% of SBGs' total assets, albeit with significant dispersion across countries. With respect to other fixed income exposures, holdings of debt issued by credit institutions and other financial institutions accounted for 2.7% and 1.7% of SBGs' total assets respectively, followed by bonds issued by non-financial corporations (see [Chart 3.22](#)).

Since the finalisation of the May 2015 FSR, interest rate volatility has risen significantly, with implications for the valuation of banks' debt instruments. In particular, yield increases could have negative effects on banks' profit and/or capital

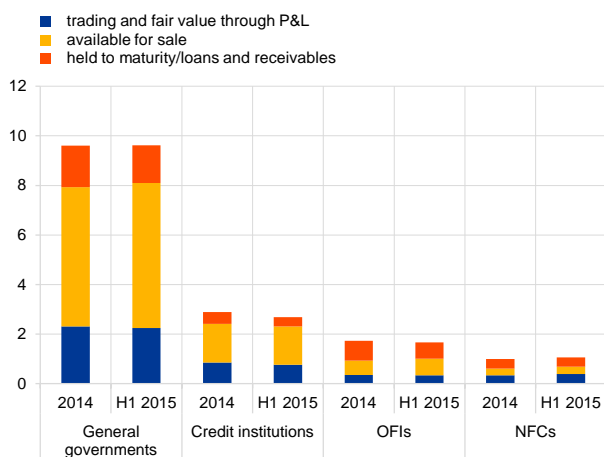
through valuation losses on their bond portfolios, depending on the duration and accounting treatment of these portfolios.

### Chart 3.22

#### Bond market exposures remain stable, with sovereign bonds accounting for the largest part

##### Debt securities holdings of euro area significant banking groups, by sector and portfolio

(2014 – H1 2015; percentage of total assets)



Source: ECB.

On average, over one-half of euro area banks' fixed income portfolios are in the available-for-sale category (see **Chart 3.22**), where rate increases could have a direct negative impact on banks' equity and, depending on the use of regulatory filters, also on capital ratios. Furthermore, around one-quarter of SBGs' debt securities holdings belongs to categories that are marked to market with valuation changes directly affecting banks' profits and loss.<sup>46</sup> In fact, the significant yield increases observed in the second quarter of 2015 had a negative impact on many banks' equity positions as valuation adjustments (related to available-for-sale assets) dropped markedly, although some of this was reversed in the third quarter when government bond yields declined somewhat. Looking ahead, however, banks remain vulnerable to further unexpected increases at the long end of the yield curve.

At the same time, aggregate data on the ratings and average maturity of euro area banks' debt securities portfolio show few signs of a broad-based increase in

risk-taking in the euro area banking sector in a search for higher returns. In fact, the share of lower-rated securities remained broadly unchanged in the first two quarters of 2015, while the average maturity of debt securities held by banks declined in the first half of 2015, reversing the increase observed in 2014 (see Chart A and Chart C in Box 7).

Euro area banks' **exposures to equity markets** increased somewhat in the first half of 2015, on average, with the median share of SBGs' equity holdings edging up from 0.9% at the end of 2014 to 1.1% in June 2015. Significant heterogeneity across banks of different sizes persists, with some LCBGs maintaining an exposure of between 5% and 10% of total assets. Therefore, some banks remain exposed to volatility in equity prices, such as that observed in the third quarter of the year.

Risks relating to information technology continue to be among the main **operational risks** for banks and, accordingly, IT security remains one of the focal points for European banking supervisors. The recent increase in banks' and supervisors' awareness of these risks stems from banks' increased vulnerability to high-impact IT-related disruptions, given the wider use of information technology across different business lines and institutions' increasingly complex and interconnected systems. A particular concern relates to the rising risk of high-profile IT incidents or cyber attacks that could negatively affect banks in various ways, including through direct financial

<sup>46</sup> This includes debt securities held for trading and debt securities designated at fair value through profit or loss.



impact, disruption of services as well as legal and reputational damage. In addition, banks are confronted with increased IT-related risks at a time when they face pressure to contain costs in a low-profitability environment.

The results of the June 2015 EBA risk survey suggest that banks are aware of the need to address IT risks, with increased spending on IT security being the most frequently mentioned response to address these risks, followed by the strengthening of governance, risk culture and business continuity plans. Similarly, supervisors are stepping up their efforts to address cyber security concerns by requiring institutions to reinforce IT controls and audits, carrying out targeted on-site inspections of IT security systems and initiating cyber security tests. In the euro area, IT risk monitoring is among the main priorities of the SSM's work in the area of operational risk, with a focus on underinvestment and loopholes in IT systems and the related risk management framework, cyber security and data integrity.

## Box 6

### The information in systemic risk rankings

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One of the legacies of the 2008-09 global financial crisis has been a proliferation of approaches to quantifying and ranking the contributions of firms in the financial sector to “systemic risk”. Risk rankings can be based on a variety of well-known systemic risk measures, such as “SRISK” or “Delta CoVaR”, or, alternatively, on balance sheet items (such as a firm's leverage ratio).<sup>47</sup>

However, these systemic risk ranking approaches have seen limited use by policy institutions such as central banks and supervisory authorities. Possible reasons for this include limited theoretical foundations and the reliance of some measures on volatile financial market data.

To evaluate the policy usefulness of such systemic risk ranking approaches, a principal components-based methodology is used to combine the systemic risk rankings of financial institutions in order to determine a robust combined ranking.<sup>48</sup> The combined ranking is derived from six individual rankings based on a firm's SRISK, marginal expected shortfall, leverage, systematic risk, Delta CoVaR, and value at risk, and disentangles their common (signal) and idiosyncratic (noise) components. This approach takes into account the fact that policy-makers are conscious of modelling risks and prefer to implement policies only when complementary approaches point in the same direction. The methodology was applied to the EU financial sector and covered 113 firms over 139 months, from March 2002 to September 2013.

First, combining currently available systemic risk rankings suggests that there is scope for amplifying the signal from this class of indicators, and reducing the noise attributable to modelling risk and estimation uncertainty. Indeed, there is substantial evidence that the cross-sectional consistency between different systemic risk ranking methodologies is far from perfect. Chart A presents cross-sectional scatter diagrams showing SRISK and three other rankings for a specific

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<sup>47</sup> See Brownlees, C. and Engle, R., “SRisk: A conditional capital shortfall index for systemic risk measurement”, unpublished working paper, 2015, and Adrian, T. and Brunnermeier, M., “CoVaR”, *Federal Reserve Bank of New York Staff Reports*, No 348, 2014. SRISK is available at <http://vlab.stern.nyu.edu/>. Statistics based on Delta CoVaR measures are reported in the ESRB risk dashboard; see [www.esrb.europa.eu/](http://www.esrb.europa.eu/).

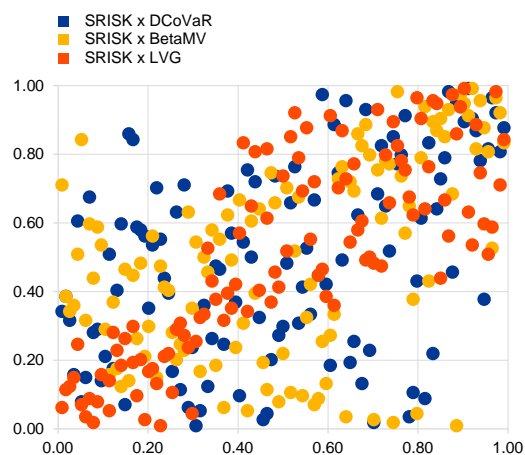
<sup>48</sup> See Nucera, F., Schwaab, B., Koopman, S. J. and Lucas, A., “The information in systemic risk rankings”, *Working Paper Series*, ECB, forthcoming, 2015. See also Tinbergen Institute Discussion Paper No 15-070.

date. The R-squared statistics from a linear regression of one ranking on another are typically low and do not exceed 0.22 in two cases (SRISK vs. Delta CoVaR, and SRISK vs. systematic risk). The association between SRISK and leverage is higher, as the latter is used in the computation of the former, but the R-squared from a linear regression does not exceed 0.66. The low association is not due to a few outliers, but is symptomatic of the different rankings ordering the firms in the sample differently. This may be problematic for supervisory purposes.

### Chart A

The cross-sectional consistency between different rankings is far from perfect

Scatterplots for SRISK x DCoVaR, Beta and leverage

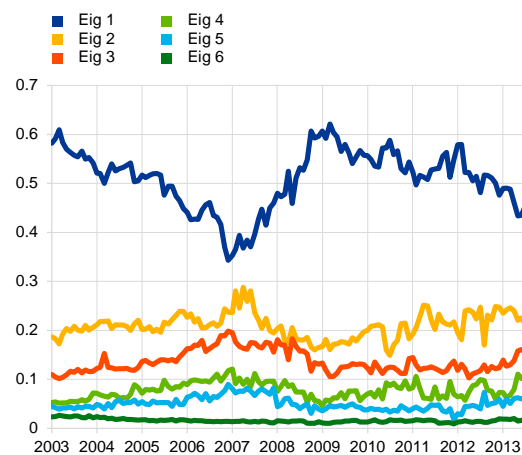


Sources: [www.vlab.stern.nyu.edu](http://www.vlab.stern.nyu.edu) and ESRB submissions.  
Notes: Three scatterplots report SRISK vs. Delta CoVaR, SRISK vs. Beta x equity market capitalisation, and SRISK vs. leverage. Ranks are distributed uniformly between 0 and 1 by construction, with the most systemically important financial firm close to 1. The R-squared statistics are 0.20, 0.22, and 0.66 respectively. The rankings are reported for a specific date: 29 June 2012.

### Chart B

Systemic risk rankings agree the least when they are arguably the most important

Eigenvalues from a principal components analysis



Sources: [www.vlab.stern.nyu.edu](http://www.vlab.stern.nyu.edu) and ESRB submissions.  
Notes: Eigenvalues from a repeated cross-sectional factor analysis of six systemic risk rankings. Factor analysis is a statistical method used to describe the variability among observed correlated variables in terms of a potentially lower number of unobserved variables called factors. The first eigenvalue is the share of total variation in the cross-section that can be attributed to the first factor, which explains the most variation in the panel subject to a normalisation constraint. The lowest value is achieved in December 2006.

Second, the robustness of the signal from a combined ranking appears to be limited for policy purposes such as targeted banking supervision. When studying the time-series dimension of the results of the principal components analysis, an increasing discrepancy becomes apparent during 2006-07, namely between the loadings of price-based systemic risk rankings (such as value at risk, Delta CoVaR and marginal expected shortfall) versus systemic risk rankings that also incorporate book values (such as leverage and SRISK). Chart B plots the explained variances associated with the principal components across rankings over time. The explained variances appear to signal a dislocation between market prices and fundamentals prior to the onset of the 2008 financial crisis. For example, the minimal eigenvalue associated with the first principal component is obtained in December 2006. This is interesting from an early warning perspective.<sup>49</sup> On the other hand, this finding also suggests that different systemic risk measures signal different messages at a time when they are, arguably, the most important. This data feature is problematic from a supervisory perspective.

<sup>49</sup> This finding is also in line with the financial stability paradox as formulated in Borio, C., "Rediscovering the macroeconomic roots of financial stability policy: journey, challenges and a way forward", *Working Paper Series*, No 354, BIS, 2011, pp. 1-34. It is also in line with the volatility paradox as formulated in Brunnermeier, M. and Sannikov, Y., "A macroeconomic model with a financial sector", *American Economic Review*, Vol. 104, No 2, 2013, pp. 379-421.

Third, a robust measure of systemic risk contribution correlates negatively with financial institutions' cost of debt finance in a way that is, in some cases, in line with a public sector guarantee for the most systemically important institutions. Systemic importance, when robustly measured as a weighted average across different ranking methodologies, varies inversely with a bank's credit default swap spread, provided that the respective European sovereign is financially healthy. As a result, the extent of systemic importance is associated with a benefit from a funding perspective in the market for unsecured funds.<sup>50</sup>

To conclude, the results summarised in this box suggest that both macroprudential and microprudential supervisors could benefit from increased attention to systemic risk rankings, as recently proposed in the academic literature. That said, such measures are subject to caveats<sup>51</sup>, which may limit their general usefulness in terms of concrete applicability in specific circumstances. Indeed, the results support the notion that inference is most reliable if it is based on a combination of alternative approaches.

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### 3.1.2 Large euro area insurers: continued adjustment to the new regulatory framework in a low-yield environment

Large euro area insurers continue to adjust to the challenges posed by weak economic growth prospects and the associated prevailing low-yield environment, as well as adjusting to the forthcoming Solvency II regime. Their overall solid profitability to date has made it possible to boost capital levels further. On the assets side, the low interest rate environment is incentivising insurers to take more risks so as to maintain returns. In particular, there is evidence of portfolio shifts towards infrastructure financing, equities and lower-rated bonds.

On the liabilities side, life insurers are switching towards unit-linked policies and fee-based products for new business. Whereas large insurers typically have more means to adjust, non-diversified, small or medium-sized life insurers that have extended high policyholder guarantees in the past are under pressure ahead of Solvency II. Flexibility to adjust old policies varies to a large extent across jurisdictions – system-wide action may be required in the countries where disadvantageous business models are widespread.

Non-life business is generally less affected by low yields, but competition in certain markets remains intense. Reinsurance faces challenges resulting from the ample capacity in the market, which affects pricing. In particular, the market for insurance-linked securities continues to thrive, not least owing to demand from a growing investor base willing to bear the associated risks.

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<sup>50</sup> This is in line with the proposition in Kelly, B. T., Lustig, H. and van Nieuwerburgh, S., "Too-systemic-to-fail: what option markets imply about sector-wide government guarantees", *Working Paper Series*, No 17149, NBER, 2011. For more details on this point, see Nucera et al., *ibid*.

<sup>51</sup> See, for example, Löffler, G. and Raupach, P., "Pitfalls in the use of systemic risk measures", *University of Ulm Working Papers*, 2015.

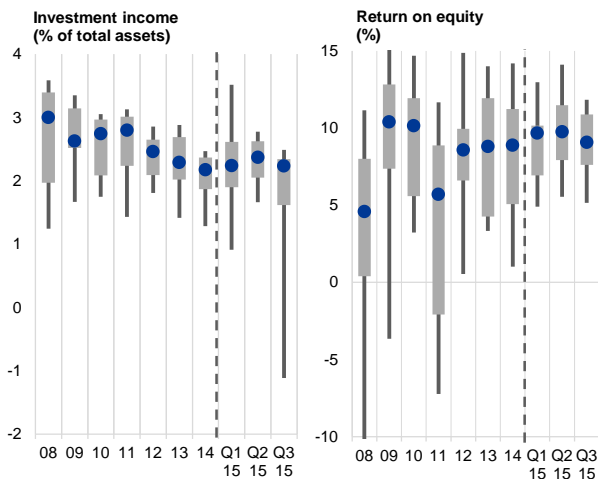
## Financial condition of large insurers<sup>52</sup>

Large euro area insurers continued to report solid profitability, with median returns on equity hovering at around 9% in the third quarter of 2015 (see [Chart 3.23](#)). Whereas growth in both life and non-life premiums remained positive for most large insurers in the second quarter of 2015, the third quarter saw a marked deterioration on the life insurance side (see [Chart 3.24](#)). Given that many insurers have switched to selling unit-linked and other non-guaranteed products lately, this outcome may demonstrate the difficulty in attracting this type of savings in a low-yield environment, particularly when stock market volatility is high. Year-on-year results however still point towards increasing premiums for 2015. Overall, the growth in both life and non-life premiums for globally active insurers benefited from positive business developments in emerging markets, which so far have displayed a healthy demand for insurance products. However, going forward, a further slowdown in economic growth prospects in emerging markets could dampen revenues for globally active, well-diversified insurers.

**Chart 3.23**  
Investment income contributes to aggregate profitability, despite weakening for the lowest decile

### Investment income and return on equity for a sample of large euro area insurers

(2008 – Q3 2015; percentages; 10th and 90th percentiles, interquartile distribution and median)

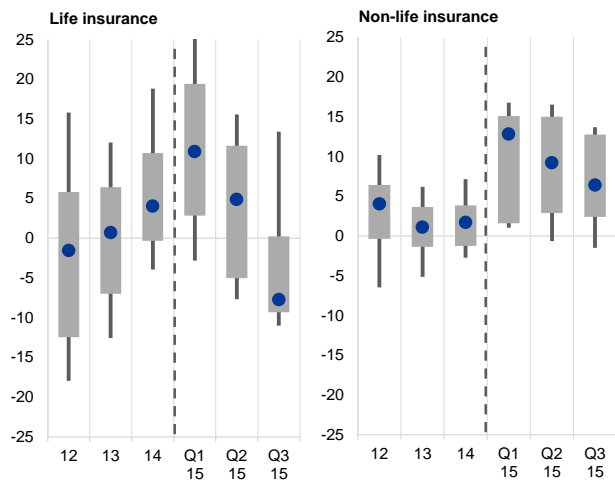


Sources: Bloomberg, individual institutions' financial reports and ECB calculations.  
Note: Investment income excludes unrealised gains and losses.

**Chart 3.24**  
Underwriting business volatile for life insurance

### Growth of gross premiums written for a sample of large euro area insurers

(2012 – Q3 2015; percentages; 10th and 90th percentiles, interquartile distribution and median)



Sources: Bloomberg, individual institutions' financial reports and ECB calculations.

Both investment and underwriting results have supported the robust profitability for most insurers in the sample. That said, the investment returns of large euro area insurers, excluding unrealised gains, markedly decreased in the third quarter of 2015 for the lowest decile of the reporting insurers, albeit after a relatively good result in

<sup>52</sup> The analysis is based on a varying sample of 21 listed insurers and reinsurers with total combined assets of about €4.9 trillion in 2014, or around 78% of the assets in the euro area insurance sector. Quarterly data were only available for a sub-sample of these insurers.

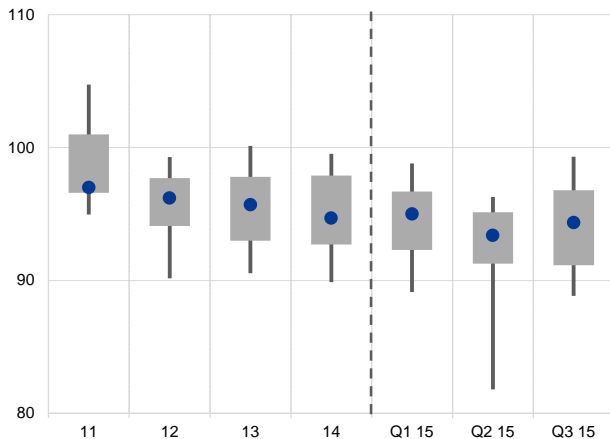
the previous quarter (see [Chart 3.23](#)). The strong valuations of bonds that result from the low-yield environment seem to have induced some insurers to realise some of the gains in their fixed income portfolios through sales in the market. Portfolio shifts towards equities and other asset classes and the subsequent increased dependence on price developments in these markets may have also contributed to the developments. On the non-life side, combined ratios (i.e. incurred losses and expenses as a proportion of premiums earned) remained below 100% for most insurers, owing to the absence of large-scale loss events in the second and third quarters of 2015 (see [Chart 3.25](#)).

### Chart 3.25

The cost side of non-life business reflects the benign loss developments

#### Combined ratio for a sample of large euro area insurers

(2011 – Q3 2015; percentages; 10th and 90th percentiles, interquartile distribution and median)



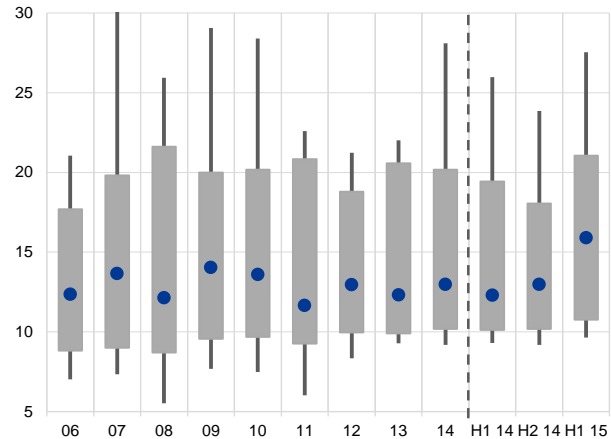
Sources: Bloomberg, individual institutions' financial reports and ECB calculations.  
Notes: The combined ratio expresses the sum of incurred insurance losses and expenses as a share of net premiums earned. A ratio of below 100% indicates an underwriting profit.

### Chart 3.26

Capital issuance and retained earnings boost capital-to-asset ratios

#### Capital distribution for a sample of large euro area insurers

(2006 – H1 2015; percentage of total assets, 10th and 90th percentiles, interquartile distribution and median)



Sources: Bloomberg, individual institutions' financial reports and ECB calculations.  
Notes: Capital is the sum of borrowing, preferred equity, minority interests, policyholders' equity and total common equity.

The first half of 2015 saw a marked increase in capital-to-asset ratios, when valued according to the current national regulatory regimes (see [Chart 3.26](#)).<sup>53</sup> The increase reflects the ongoing preparations by large euro area insurers for the forthcoming Solvency II regime, with the associated move towards market valuations everywhere in the EU. Many large insurers have retained earnings and issued capital instruments. These actions have, on average, more than offset the impact of the unrealised investment losses on capital following the interest rate increases in the second quarter of 2015.<sup>54</sup>

<sup>53</sup> Large euro area insurers generally follow the International Financial Reporting Standards (IFRS), which ensure a uniform treatment of financial assets (depending on a respective accounting classification to held to maturity, available for sale, held for trading and designated at fair value through profit or loss), but (currently) not liabilities.

<sup>54</sup> As interest rates rise, the value of fixed income assets decreases and insurers have to book unrealised losses on their balance sheet. This, in turn, decreases capital.

The current low-yield environment puts pressure on economic capital, which is a market-consistent measure that the industry uses to give some indication of future Solvency II ratios.<sup>55</sup> When interpreting the economic capital ratios, however, care should be taken, as uncertainty still prevails as regards the supervisory approvals of internal models and the potential transitional measures that will be in place as of 2016.

### Insurance sector outlook: market indicators and analyst views

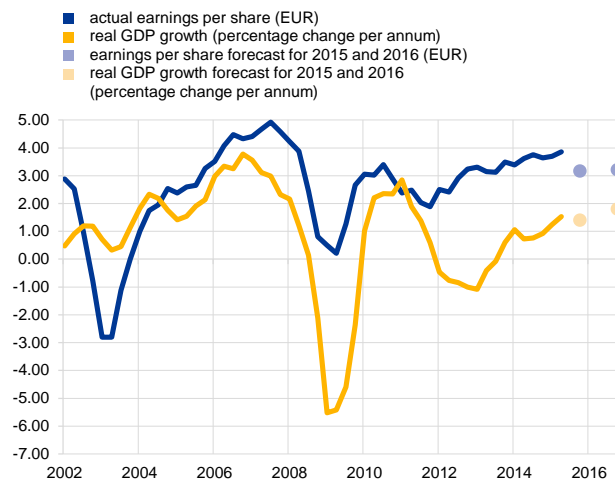
Earnings forecasts suggest that analysts expect the profits of large euro area insurers to moderately decline in 2016 (see **Chart 3.27**). Prospects are suppressed by low investment income expectations in particular. Low yields limit the margin for profit in the life insurance industry given high policyholder guarantees in certain cases. For non-life insurance, limited investment income may not fully compensate for potential underwriting losses, in particular in those fields of activity where competition remains fierce and pricing subdued. Ample capital and the ensuing pressure on pricing are expected to dampen profitability in the reinsurance sector as well.

**Chart 3.27**

Analysts expect moderately lower profitability for euro area insurers

Earnings per share of selected euro area insurers and real GDP growth

(Q1 2002 – 2016)



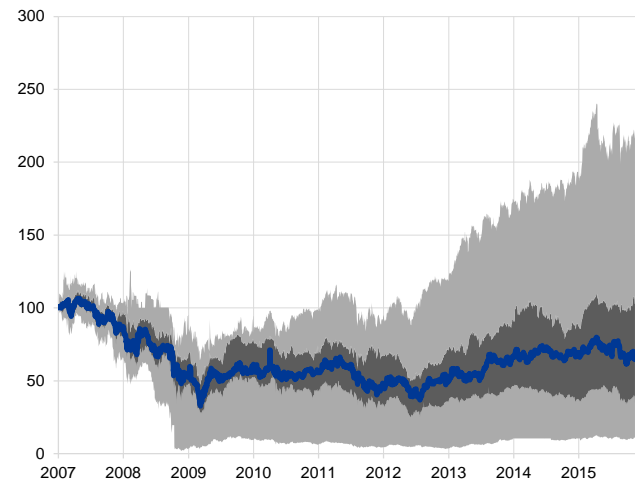
Sources: ECB, Thomson Reuters and ECB calculations.

**Chart 3.28**

Stock prices reflect muted expectations

Stock performance of a sample of large euro area insurers

(2007-2015; index: 2 Jan. 2007 = 100)



Sources: Thomson Reuters, Bloomberg and ECB calculations.

Note: The shaded areas indicate the minimum/maximum and interquartile ranges across equities of selected large euro area insurers.

<sup>55</sup> The economic capital ratio is calculated using market-consistent valuations for assets and liabilities, and therefore it bears a close relation to the method used in the Solvency II framework. It should however be noted that large euro area insurers will most likely use internal capital models to compute Solvency II ratios. These models require regulatory approval before application and may therefore differ from the models currently used by companies to calculate their economic capital ratios.

In the short term, analysts expect an overall smooth transition to Solvency II among large euro area insurers. Cost-cutting and retained earnings are expected to offset the impact of low yields on market-consistent Solvency II ratios. Insurers appear to have the capacity to adjust their business mix, including through gradual changes in investment portfolios and a move towards unit-linked or fee-based products. These trends are expected to continue. By contrast, analysts believe some smaller life insurers may not be able to meet the requirements, owing to their vulnerability to low yields and their limited capacity to adjust. The impact of any potential shortfalls is, however, expected to remain limited, given the long-term nature of life insurance liabilities and the size of the insurers that are most in danger.

In the long term, analysts expect increased efficiency to be key for better performance, should the low-yield environment persist. Demographics and economic trends are expected to lead to increased long-term savings in Europe, implying stronger inflows into life insurance. On the reinsurance side, analysts expect the large European players to profit from the changes in the sector as they are better able to adjust their business mixes and investment strategies than small firms and currently have strong market positions in reinsurance.

The muted profitability expectations have been reflected in the stock market performance of large euro area insurers since the publication of the May 2015 FSR (see [Chart 3.28](#) and [Chart 3.35](#)). The subdued price developments may also partly reflect the continued uncertainty about the capital adequacy of euro area insurers under the forthcoming Solvency II framework. Indeed, many analysts note that regulatory approvals for internal models and clarity on the use of transitional measures are as yet largely lacking.

### Investment portfolios are adjusting to the low-yield environment

As large euro area insurers are important institutional investors in the financial markets, their investment behaviour may be a significant factor for financial stability, especially if aligned actions take place simultaneously.

[Chart 3.29](#) shows that large euro area insurers continue to invest predominantly in government and corporate bonds, which makes them vulnerable to low interest rates. The longer the low-yield environment continues, the higher the share of investment portfolios that needs to be reinvested. Without any adjustments in portfolio allocation, there would be a decreasing investment return on assets. Moreover, if interest rates rise, returns may remain locked in low-yielding products. This risk would be exacerbated by increasing maturities that may be sought as part of a generalised search for yield, and may even trigger a liquidity risk if policyholders begin surrendering policies on a large scale in order to switch to more lucrative savings products.<sup>56</sup>

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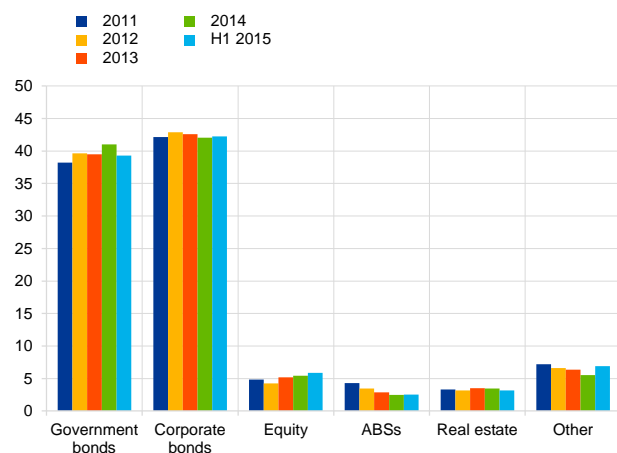
<sup>56</sup> See Feodoria, M. and Förstemann, T., "Lethal lapses – how a positive interest rate shock might stress German life insurers", *Discussion Paper Series*, No 12/2015, Deutsche Bundesbank. However, empirical evidence of such a phenomenon is scarce.

**Chart 3.29**

**Fixed income securities dominate investment portfolios**

**Investment portfolio split of selected euro area insurers**

(2011 - H1 2015; percentages of total investments; weighted averages)



Sources: JPMorgan Cazenove, individual institutions' financial reports and ECB calculations.

Note: Based on available data for 15 large euro area insurers and reinsurers.

Data and reports by individual insurers imply that, faced with the need to roll over investments in the low-yield environment, the re-risking of portfolios has continued in 2015. Many insurers report realised gains from sales of equities and highly rated government bonds, implying that reinvestment amounts currently exceed the amounts coming to maturity. Moreover, the announced strategies include plans to increase allocations to equity investments and infrastructure, in particular. Indeed, **Chart 3.29** shows a continuous increase in equity investments, albeit from a very low level, and a jump in the “other investments” category.

Data also show that the shift within the government bond portfolio away from AAA-rated debt and sovereign debt of euro area countries less affected by the crisis has continued, although some of the shift is likely to have been a result of rating downgrades (see **Chart 3.30** and **Chart 3.31**). Evidence from a new dataset, however, shows that some of the movement is related

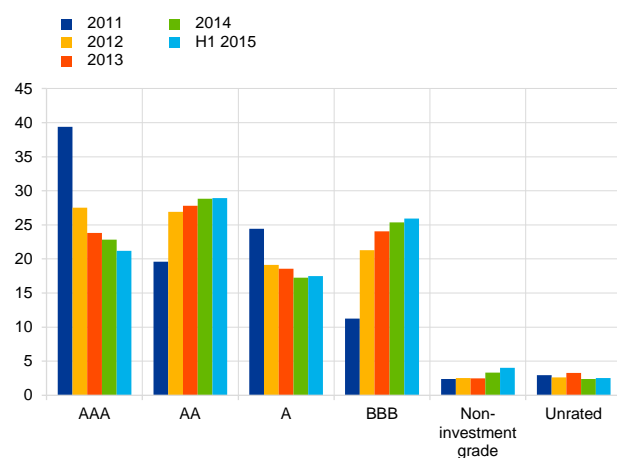
to real portfolio reallocations (see Box 7). To some extent, this may be welcome diversification away from the dominating, highly rated, fixed income securities portfolio. As the demand for these assets increases, however, it may be difficult to obtain adequate compensation for the increased illiquidity and credit risk inherent in the portfolio shifts.

**Chart 3.30**

**Exposures to lower rating categories are increasing...**

**Bond investments of selected large euro area insurers split by rating category**

(2011 – H1 2015; percentage of total investment portfolio; weighted averages)



Sources: JPMorgan Cazenove, individual institutions' financial reports and ECB calculations.

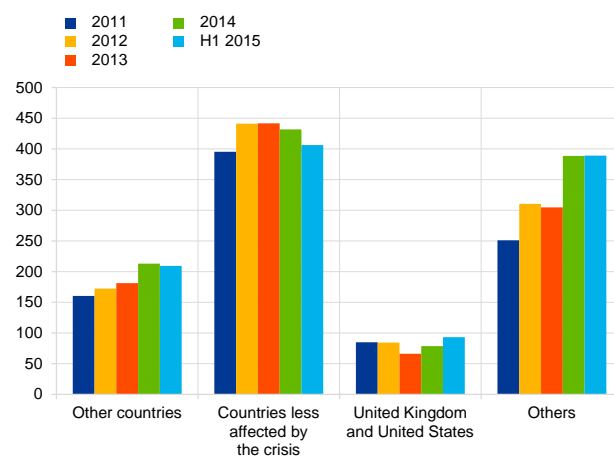
Note: Based on available data for 15 large euro area insurers and reinsurers.

**Chart 3.31**

**... while sovereign exposures move away from euro area countries less affected by the crisis**

**Geographical split of the government bond holdings of selected large euro area insurers**

(2011 – H1 2015; EUR billions)



Sources: JPMorgan Cazenove, individual institutions' financial reports and ECB calculations.

Notes: Other countries are Greece, Ireland, Italy, Portugal and Spain. Countries less affected by the crisis are Belgium, France, Germany, Luxembourg and the Netherlands. Based on available data for 15 large euro area insurers and reinsurers.

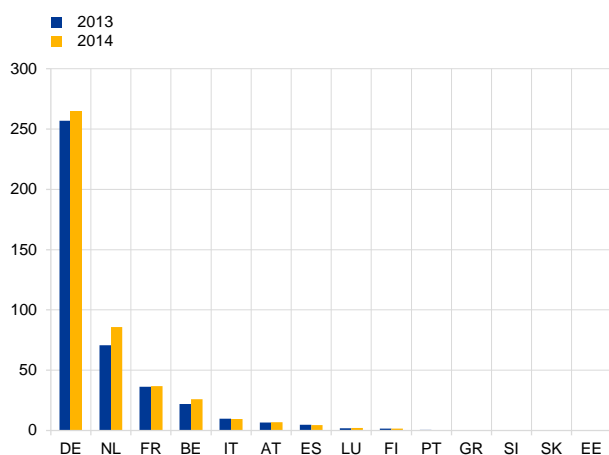


**Chart 3.32**

Lending by insurers is significant and increasing in a few euro area countries

**Lending by euro area insurance corporations**

(2013-2014; EUR billions)



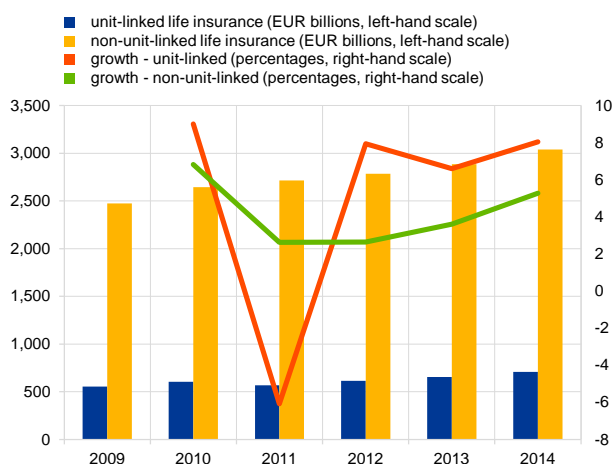
Sources: ECB data from balance sheets of insurance corporations and pension funds. Notes: Data for insurance corporations and pension funds are collected taking a short-term approach and are not fully harmonised. Data are not available for Cyprus and Ireland.

**Chart 3.33**

Unit-linked life insurance growing, but still at modest levels

**Net equity of households in unit-linked and non-unit-linked life insurance**

(2009-2014; percentages, EUR billions)



Sources: ECB data from balance sheets of insurance corporations and pension funds.

Although lending activities by euro area insurers are not extensive on aggregate, they are significant in some countries. Loans account for more than 5% of insurers' total financial assets in the Netherlands, Belgium and Germany. In 2014 the highest growth rates of lending by insurance companies were seen in the Netherlands and in Belgium (see [Chart 3.32](#)).

A sudden increase in lending may be motivated by a search for yield. Given that lending is not a core insurance business, it is essential to make sure that insurers which take it up have adequate risk management in place. If done in a prudent way, lending by insurers can improve welfare by acting as a substitute for bank credit, possibly in a counter-cyclical manner. However, the activity is not yet significant when compared with the total bank credit extended.

**Liabilities side: guaranteed life insurance model under pressure**

Low yields make it difficult to maintain a margin above the yields that have been guaranteed to life insurance policyholders. This may require system-wide action in some jurisdictions where disadvantageous business models are widespread. In countries where guarantees do not exist or are adjustable, competition from other savings products may hamper the possibility for insurers to lower returns to policyholders. The mismatch between the investment return and the guaranteed return to policyholders may, however, become a problem particularly for non-diversified life insurers in those jurisdictions where such guarantees are rigid and have been set at high levels in the past. Undiversified life insurers may also be subject to larger duration mismatches between assets and liabilities, owing to the very long nature of the latter. As a consequence, some of them may face difficulties in fulfilling the Solvency II requirements at the start of 2016. Special Feature B illustrates the interest rate risk for policies made in the past using synthetic portfolios that mimic the regulatory frameworks for guarantees in

selected euro area jurisdictions.

Life insurers have adjustment tools in place on the liabilities side for the design of new business. Unit-linked insurance and fee-based operations are less capital-intensive than guaranteed products and reduce the exposure of insurers to the low-

yield environment. Some individual insurers currently report high growth in sales of unit-linked products. At the euro area aggregate level, this development does not yet seem marked, however. At the end of 2014 unit-linked insurance still constituted less than 20% of the life insurance policies in the euro area and the pace of growth remains moderate (see [Chart 3.33](#)).

These developments may reflect the competitive disadvantage of such policies as investment products in the current low-yield environment. Indeed, abolishing the insurance feature inherent in guaranteed returns renders life insurance susceptible to competition from other savings and asset management products. On the other hand, such a change increases the degree of substitutability in the market, thereby making life insurers less systemic from a financial stability point of view.<sup>57</sup>

### Non-life insurance and the reinsurance market: competition from within and outside the sector

Pressures in non-life insurance arise mainly from retail business, in particular motor insurance. Intense competition and claims developments are likely to continue to weigh on profitability.<sup>58</sup> The insurance and reinsurance industry have, however, once again benefited from a below-average loss period as far as natural catastrophes are concerned: insured losses amounted to USD 12 billion in the first half of 2015.<sup>59</sup> The Atlantic hurricane season is also expected to remain well below average in 2015.<sup>60</sup> These factors are likely to support stable developments in the non-life sector in general.

The European reinsurance market is concentrated, which heightens the need for monitoring for financial stability purposes.<sup>61</sup> A systemic event could arise through counterparty risk or disruption of vital services. The reinsurance market also has the potential to affect the financial markets, in particular through alternative investment products – such as catastrophe bonds – in the presence of a search for yield.

Catastrophe bond issuance remained strong in the first half of 2015, at USD 3.8 billion, although not keeping pace with the maturing amounts. As a result, the outstanding amounts in the market decreased to USD 21.6 billion from the record volume of USD 22.9 billion at the end of 2014 (see [Chart 3.34](#)).

The prolonged period of relatively benign catastrophe payouts and the capital inflows into the catastrophe bond market have led to overcapacity in the reinsurance market

<sup>57</sup> See also French, A., Vital, M. and Minot, D., “Insurance and financial stability”, *Bank of England Quarterly Bulletin*, Q3 2015, pp. 242-258.

<sup>58</sup> In motor insurance, for example, lower oil prices typically increase the frequency of claims, following an increase in the use of private cars. In addition, claims inflation in courts can affect the amounts claimed.

<sup>59</sup> See *Natural catastrophes in the first half year of 2015*, MunichRe, July 2015 (available on MunichRe’s website at <http://www.munichre.com>).

<sup>60</sup> Forecasts are available, for example, from the University of Colorado (see <http://hurricane.atmos.colostate.edu/Forecasts/>). Other risks are unlikely to manifest themselves on a significant scale over the next few years (e.g. climate change) or in a way which would create losses that could lead to systemic stress in the insurance sector (e.g. cyber risk).

<sup>61</sup> For concentration ratios, see for example, ECB, *Report on financial structures*, October 2015.

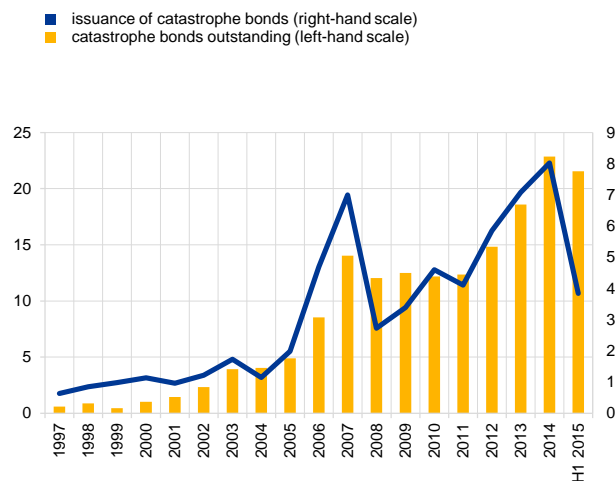
and were the underlying cause of the decreasing reinsurance rates in the past few years (see [Chart 3.35](#)). The recent renewal rounds have seen a slight stabilisation in reinsurance pricing. However, the fierce competition is expected to continue in the future as well. Nevertheless, strong market positions and the ongoing adjustments towards business lines and product types that are less susceptible to competition within and outside the sector are counteracting the impact of price developments on large euro area reinsurers' profitability and capital levels.

**Chart 3.34**

Issuance of catastrophe bonds at a high level, but not yet compensating for maturing bonds

**Catastrophe bond issuance and amounts outstanding**

(1997 – H1 2015; EUR billions)



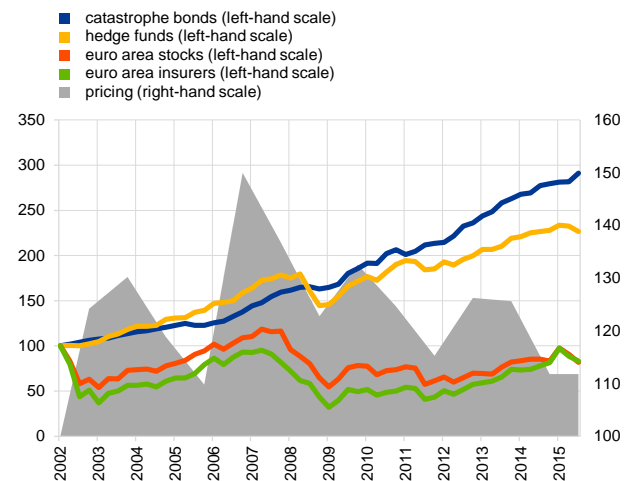
Source: Guy Carpenter.

**Chart 3.35**

Reinsurance and catastrophe bond prices show some stabilisation

**Cumulative return profiles, broken down by market asset class and reinsurance pricing**

(Q1 2002 – Q3 2015; index: Q1 2002 = 100)



Sources: Bloomberg, Guy Carpenter and ECB calculations.  
 Notes: The EURO STOXX index is used as benchmark for euro area stocks. The Guy Carpenter World Property Catastrophe RoL Index tracks changes in property catastrophe reinsurance premium rates on a worldwide basis.

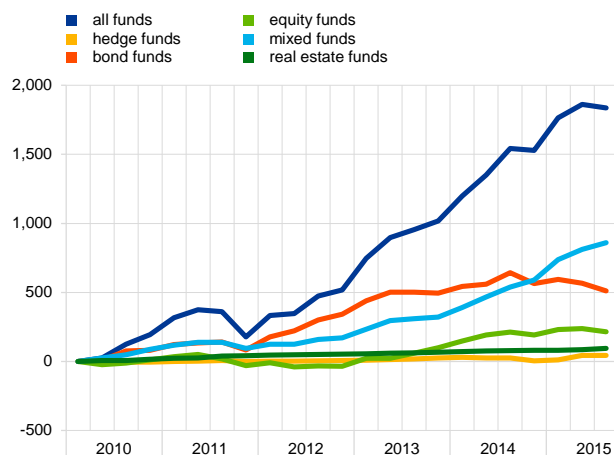
A functioning catastrophe bond market enlarges the range of products on offer in the financial markets. Hedge funds, but also pension funds and life insurance companies, are typical investors in catastrophe bonds, in their effort to increase yields in the low interest rate environment and to diversify away from the risks related to the financial cycle. The increased demand for such products, however, strengthens the correlation of pricing with the other products in the financial markets and thereby increases the pro-cyclicality of the market, as the recent declines have demonstrated. In addition, insurance-linked securities may lead to the build-up of tail risk for investors who are not aware of, let alone appropriately able to manage, this risk. In the euro area, the absolute volumes still remain modest, however.

### 3.1.3 Euro area investment funds: growing footprint amid increased risk-taking

**Chart 3.36**  
Net inflows into euro area investment funds continued to be strong until mid-2015

#### Cumulated net flows into euro area investment funds

(Q1 2010 – Q3 2015; EUR billions)



Source: ECB and ECB calculations.

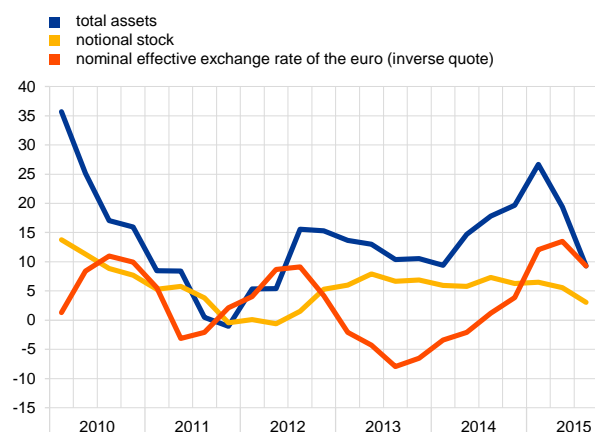
The growing exposure of investment funds to global asset markets, both in nominal and in value terms, raises the potential impact on capital markets of any investment decision by the funds and the investors behind them. These exposures have been building up over the past few years.

Rising asset prices globally and the sustained low opportunity cost of investing versus holding cash have certainly helped funds attract **net inflows**. Euro area investment funds received a total net inflow of €330 billion during the first half of 2015, while €25 billion of net outflows were observed during the third quarter of 2015. Most notably, inflows to bond and equity funds have slowed substantially compared with previous years. Mixed funds saw further inflows, compensating somewhat for the stagnation or decline in the growth of other types of fund (see [Chart 3.36](#)). Hedge funds also grew rapidly during the first half of 2015, attracting net inflows of more than 13% of total assets, while they experienced net outflows during the third quarter of 2015. Although the euro area hedge fund sector appears to be small, hedge funds domiciled in global financial centres, including offshore, are relevant for euro area financial stability, i.e. if they are borrowing from euro area banks or investing in euro area assets.

**Chart 3.37**  
Recent acceleration in growth caused predominantly by valuation effects, including foreign exchange

#### Annual growth of the euro area investment fund sector

(Q1 2010 – Q3 2015; year-on-year percentages)



Sources: ECB and ECB calculations.

Up to the second quarter of 2015, growth in the euro area investment fund sector accelerated to an annual rate of more than 25%. Exposure of these investment funds to global financial markets has been increasing owing to a growing notional stock (with annual growth of 5%), rising asset prices and the weakening of the euro against other currencies. Growth in the investment fund sector has slowed substantially since the second quarter of 2015. Since mid-2010, growth in total assets has been closely correlated with the euro nominal effective exchange rate (see [Chart 3.37](#)), reflecting the large share of non-euro area assets in the holdings of euro area funds.

Euro area investment funds have continued to increase their **foreign exposures** until recently, including to emerging markets. These funds hold €4.3 trillion of non-euro area assets across a broad range of industrial and emerging market countries, of which €1.9 trillion are debt securities, nearly €2.3 trillion equities, €100 billion

deposits and loans, and €20 billion non-financial assets. The overall share of foreign investments has slightly increased over the past year, from 38% in mid-2014 to 41% in mid-2015. Adding to the currency risk of these foreign holdings, the ratings of debt securities holdings tend to be much lower for foreign debt securities than for euro area debt securities (see **Box 7**).

## Box 7

### Debt securities holdings of the financial sector in the current low-yield environment

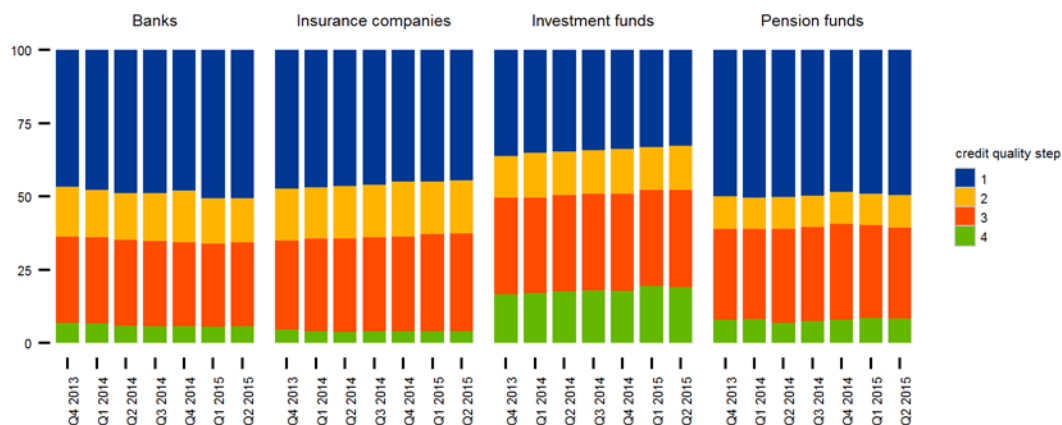
The protracted low-yield environment in the wake of the global financial crisis and the dearth of assets perceived as risk-free have challenged financial institutions' investment strategies. As risk/return strategies adapt to this environment, increased risk-taking is likely. From a financial stability standpoint, such risk-taking is meaningful to the extent that an agglomeration of exposures within key sectors could leave the financial system more vulnerable to an abrupt reversal of risk premia. Debt securities markets, including traditionally conservative segments, are one area where it is possible that investors have substantially increased their exposure to credit and interest rate risk in an effort to achieve higher returns.

### Chart A

Investment funds and insurers have shifted their holdings from higher- to lower-rated debt securities on average, but banks have not

#### Share in nominal debt securities holdings by sector and rating category

(Q4 2013 – Q2 2015; percentages)



Source: ECB and ECB calculations.

Notes: Credit quality steps are defined in accordance with the Eurosystem credit assessment framework (ECAAF), which provides a harmonised rating scale classifying ratings into three credit quality steps. The first category includes securities rated from AAA to AA-, the second from A+ to A- and the third from BBB+ to BBB-. A fourth category is added which includes all rated securities with a rating below credit quality step three. The analysis is based on the nominal amounts of euro and foreign currency-denominated securities, including "alive" and "non-alive" securities. The investment fund sector excludes money market funds.

One means of identifying the topography of increased risk-taking in the euro area financial sector is by looking at information on asset holdings. The ECB's securities holdings statistics (SHS)<sup>62</sup> provide

<sup>62</sup> The SHS data help to fill long-standing statistical gaps. SHS coverage in the period under review is, on average, equal to or higher than 90% of the value reported in benchmark statistics such as euro area national accounts or balance sheet item statistics. See "Who holds what? New information on securities holdings", *Economic Bulletin*, Issue 2, ECB, March 2015, pp. 72-84.

a wealth of information on the euro area in this regard as they contain data on individual securities held by resident investors, and cover all euro area countries and sectors. When used in combination with securities ratings, these data can help to address questions related to the changing composition of portfolios held by the financial sector – in particular, exposures to credit and interest rate risk by euro area banks (credit institutions), insurance companies, pension funds and non-money market investment funds.

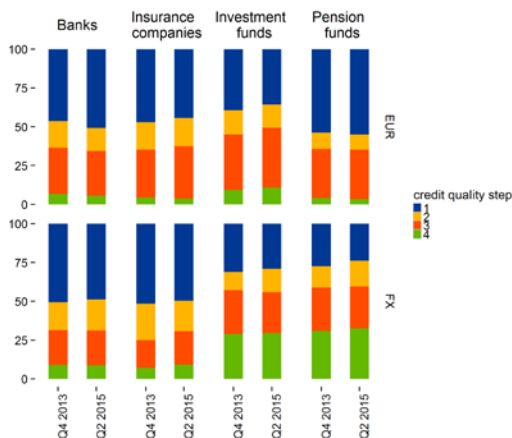
An important observation is the clear shift in asset allocation from higher- to lower-rated debt securities for the investment fund sector. A similar shift could be observed for the insurance sector, albeit less pronounced and with the relative amount of debt holdings “below credit quality” declining (see Chart A).<sup>63</sup> The overall shifts in portfolio composition have largely been driven by an actual reduction in the holdings of higher-rated securities and an increase in lower-rated securities, rather than by a decline in the rating quality of securities held.<sup>64</sup> While pension funds have kept their exposures largely constant, banks have shifted their allocation from lower- to higher-rated securities. The four broad rating categories referred to in Chart A correspond to the categories defined in the Eurosystem credit assessment framework.<sup>65</sup>

### Chart B

Higher share of lower-rated securities in foreign currency-denominated securities

Share in nominal debt securities holdings by sector, rating category and currency of denomination

(Q4 2013; Q2 2015; percentages)



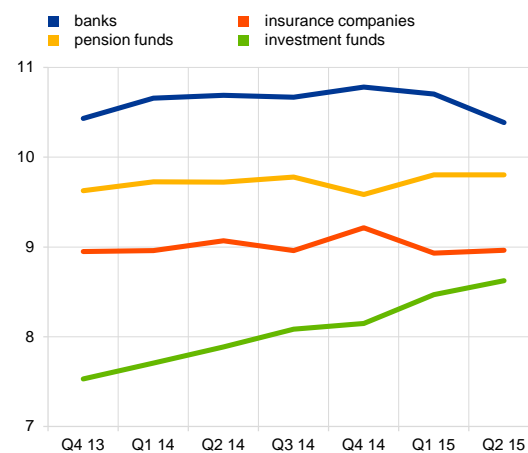
Source: ECB and ECB calculations.  
Note: See notes to Chart A.

### Chart C

Increase in residual maturities in the investment fund sector

Weighted average residual maturity

(Q4 2013 – Q2 2015; years)



Source: ECB and ECB calculations.  
Notes: All “alive”, rated and non-rated euro and foreign currency-denominated debt securities are included. In order to estimate the average, residual maturities are weighted by the nominal amount held of each security by each sector over the total debt holdings of each sector.

<sup>63</sup> The analysis is based on nominal amounts so as to eliminate potential valuation effects and focus on the actual change in portfolio composition. With the initial SHS data referring to holdings at the end of December 2013, the limited time span does not make it possible to identify definite trends. However, it does show how financial institutions have adjusted their portfolios of debt securities in the period between the fourth quarter of 2013 and the second quarter of 2015.

<sup>64</sup> Robustness checks considered rating changes for the securities held throughout the period under consideration, as well as the ratings of securities that had left or newly entered the dataset. This information was used to assess the impact of rating changes on the results presented.

<sup>65</sup> See <https://www.ecb.europa.eu/paym/coll/risk/ecaf/html/index.en.html>

In addition, a structural difference can be seen in institutions' portfolio allocations for securities denominated in euro and securities denominated in foreign currencies (see Chart B). Investors appear to hold a higher share of the lowest-rated securities when these are issued in non-euro-denominated securities. This pattern in allocation is particularly pronounced for the investment and pension fund sectors which, coincidentally, are the two sectors with the highest relative exposure to foreign currency-denominated securities.

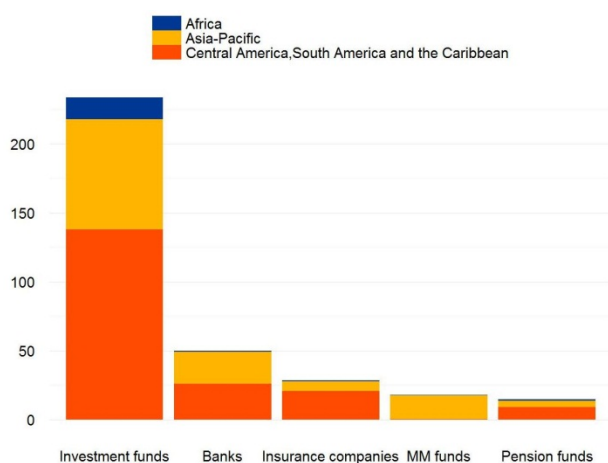
Since December 2013, average residual maturities have increased by almost one year for euro area investment funds' debt securities holdings (see Chart C). Other sectors have displayed much less variation in the remaining maturities, meaning that a definite trend cannot be identified. There has been an increase in remaining maturities for lower-rated securities across all sectors, with the exception of pension funds. On the other hand, governments and corporates have issued longer-term debt, thereby strengthening resilience to a reversal in rates (see Chart 1.17 in Section 1.2).

Overall, it appears that exposures to credit and interest rate risks have increased somewhat outside the core financial system, i.e. among investment funds and, to a lesser extent, insurers and pension funds. At first sight, this bodes well for the stability of the euro area financial system, as marginal risks are borne by investors and institutions that are potentially of less systemic relevance because they reside outside the banking sector. Nevertheless, the diagnosis lends support to concerns over the growing susceptibility of non-bank financial intermediation, in particular by investment funds, to an abrupt reversal in global risk premia.

**Chart 3.38**  
Emerging market exposures vary widely across sectors

**Investment fund holdings of emerging market debt securities issued in non-domestic currencies**

(Q2 2015; EUR billions)



Source: ECB and ECB calculations.

Notes: Debt securities holdings are classified according to the country of residence of the issuer. Countries are grouped into three regions. Debt securities issued in Japan are excluded from the Asia-Pacific category. Only issuance of "hard currency" debt is considered, including securities issued in USD, EUR, GBP, CHF and JPY. MM funds = money market funds.

Some euro area investment funds have significant exposures to emerging markets. The relative share invested in securities outside the United States, Japan or the EU ranges from 8% for mixed funds, through 13% for bond funds to 20% for equity funds (see [Chart 10](#) in the Overview). Euro area investment funds also play an important role in providing "hard currencies" to the emerging market economies. As at the first quarter of 2015, euro area funds had invested around €230 billion in emerging market debt securities denominated in non-domestic currencies. These assets are largely held by dedicated emerging market funds and funds investing globally. Although the share of this emerging market debt in the funds' total debt securities holdings remains below 7%, exposures to emerging markets are much higher for funds than for any other part of the financial sector (see [Chart 3.38](#)). The investment fund sector hence represents an important channel for inward and outward spillovers related to the emerging markets.

The recent market volatility stemming from developments in China had limited effects on the euro area investment fund sector and financial markets. However, concerns remain that any future round of repricing could affect debt markets at the global level and have

much wider financial stability implications. Increased **risk-taking** has already left the euro area fund sector more exposed to any future reversal in global risk premia, were such a reversal to materialise. Over the past year, the funds have shifted their asset allocation from higher- to lower-rated debt securities, while the average residual maturities have increased by almost one year (see **Box 7**).

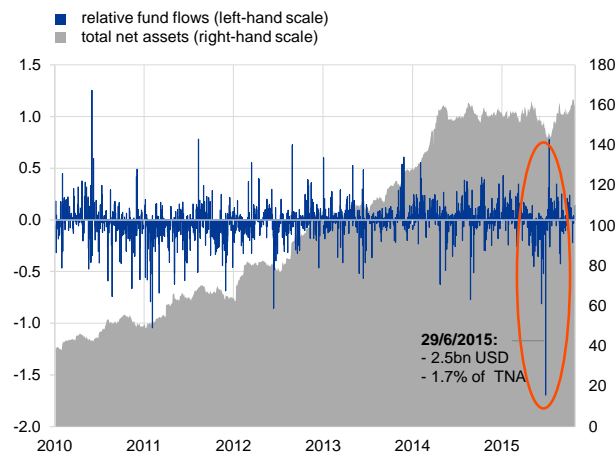
The large and growing exposures of the fund sector have spurred concerns that the potential for this sector to amplify any **market-wide shocks** is increasing. The concerns are that funds may become part of so-called “liquidity spirals”, similar to those witnessed in the global financial crisis of 2008. High redemptions or increased margin requirements would force funds to adjust their portfolios within a short time frame, thereby adding to liquidity pressures in the relevant markets. If liquidity conditions were to deteriorate, initial asset price adjustments would be amplified, triggering further redemptions and margin calls, and thus fuelling such negative spirals. The more the funds engage in liquidity transformation, the more likely they are to face selling pressures in a severe market downturn. Leverage can intensify these spirals by forcing the fund managers to sell a larger share of their invested portfolio for any given amount of outflows.

**Chart 3.39**

Significant outflows of up to 1.7% per day during the Greek sovereign crisis at the end of June, which accumulated to over 5% of net asset value

**European sovereign bond fund flows and total net assets**

(Jan. 2010 – Oct. 2015; daily net flows as a percentage of total assets; total net assets in USD billions)



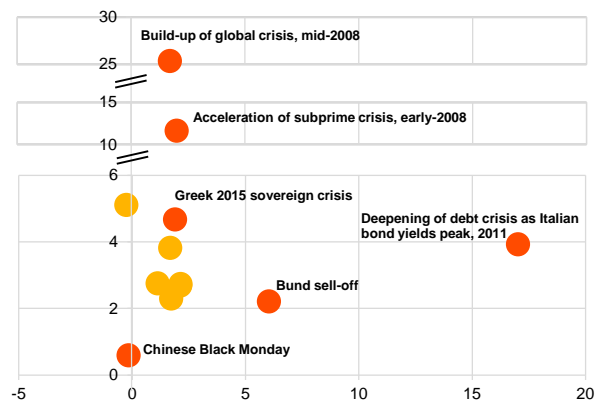
Sources: EPFR and ECB calculations.

**Chart 3.40**

Only a few events affected net flows and liquidity conditions simultaneously

**European sovereign bond fund net outflows and changes in sovereign bond bid-ask spreads**

(Jan. 2008 – Sep. 2015; x-axis: bid-ask spread change in basis points; y-axis: four-week cumulative flows as a percentage of total net assets)



Sources: EPFR, iBoxx and ECB calculations.

Notes: Western European bond funds include dedicated regional and country-specific funds that invest in the EU plus Norway and Switzerland. Net outflows are represented as a relative share of total net assets in order to control for the significant increase in the size of bond funds over time. Outflows are cumulated over a four-week, non-overlapping window from the start of the event date. The following event windows were considered: acceleration of sub-prime crisis in early 2008 (17 Jan. – 13 Feb. 2008); build-up of global crisis in mid-2008 (12 June – 9 July 2008); deepening of debt crisis in 2011 (29 Sep. – 26 Oct. 2011); Bund sell-off (16 Apr. – 13 May 2015); Greek 2015 sovereign crisis (4 June – 1 July 2015); Chinese “Black Monday” (20 Aug. – 16 Sep. 2015). The largest weekly changes in bid-ask spreads observed during the event window are shown.

Earlier this year, a temporary sell-off in the German government bond market already caused notable outflows from European government bond funds. Although



this did not lead to immediate stability concerns, the period of outflows coincided with a significant deterioration in the bid-ask spreads of euro area sovereign bonds (see [Chart 3.40](#)). Looking at more recent events, a noteworthy withdrawal of global investors from European sovereign bond funds was evident in the week following the breakdown of the negotiations in Greece (see [Chart 3.39](#)). However, the large-scale withdrawal proved temporary and was limited to sovereign bond funds. Moreover, contagion from Greek to other sovereign debt markets was limited and the bid-ask spreads of euro area government bonds were, on average, only mildly affected by the closure of the Greek banks and the imposition of capital controls (see [Chart 2.9](#) in Section 2).

Referring to earlier episodes of distress, including the global financial crisis of 2008, it seems that very few events have the potential to pose a systemic threat to the euro area bond markets, i.e. affecting fund flows and liquidity conditions simultaneously. The European sovereign debt crisis in 2011 is one notable exception. The most recent episode of market turmoil – triggered by a sudden price decline in the Chinese equity markets – had hardly any effect on euro area sovereign bond funds and markets, whereas net outflows could be observed for some equity funds (see [Chart 1.10](#) in Section 1.1).

Some factors **mitigate** the risk of funds acting as potential amplifiers in any shock scenario, such as if they have adequate risk management processes and liquidity buffers in place. While leverage is generally regulated by the Undertakings for Collective Investment in Transferable Securities (UCITS) Directive and the Alternative Investment Fund Managers Directive (AIFMD), euro area investment funds are allowed to create leverage synthetically, within certain limits.<sup>66</sup> Redemption notice periods and gates can be specified to further reduce susceptibility at the firm level to sudden outflows, in particular in real estate and hedge funds. The suspension of share redemptions can in principle be used to stop a run on fund assets, though clearly a widespread application of any such measures under distress could have a systemic impact.

### Other euro area non-bank entities: much of the euro area shadow banking sector still not visible

The broad shadow banking sector has continued to grow over the past year, driven primarily by non-money market investment funds, which expanded owing to net inflows and rising valuations, as mentioned above.<sup>67</sup> The recent decline in total assets of investment funds was mainly due to a decline in asset valuations during the second and third quarters of 2015, while net inflows declined during the third quarter (see [Chart 3.41](#)). Euro area money market funds expanded slightly, receiving nearly €17 billion of net inflows between the second quarter of 2014 and

<sup>66</sup> See Box 7 entitled “Synthetic leverage in the investment fund sector”, *Financial Stability Review*, ECB, May 2015, pp. 92-94.

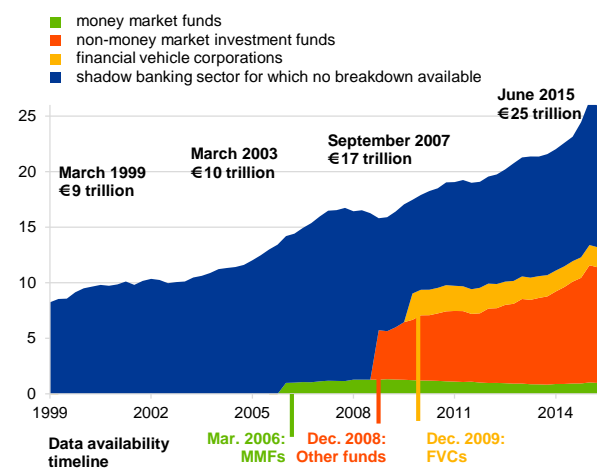
<sup>67</sup> The broad measure calculated for the euro area covers money market funds, non-money market funds, financial vehicle corporations and the other financial intermediaries. For the latter, the entity types cannot be identified on the basis of national accounts data.

### Chart 3.41

The broad measure of the shadow banking sector has expanded mainly because of investment funds and other financial intermediaries

#### Total assets of the broad shadow banking measure

(Q1 1999 – Q2 2015; EUR trillions)



Source: ECB and ECB calculations.

Note: A breakdown of statistical data for money market funds (MMFs), other funds and financial vehicle corporations (FVCs) is available only from the indicated dates onwards. The broad shadow banking measure includes money market funds and all other non-monetary financial institutions apart from insurance corporations and pension funds.

the second quarter of 2015. Growth was driven predominantly by money market funds domiciled in Ireland and Luxembourg, although in Ireland net inflows turned negative in the second quarter of 2015.<sup>68</sup> Euro area financial vehicle corporations have continued to decline over the past year owing to continued weak loan origination and securitisation activity by euro area credit institutions.

Concerns remain that risks may be building up in the part of the shadow banking sector for which a statistical breakdown is not readily available, but which is growing in size. A significant proportion (up to two-thirds) of the residual for which the ECB statistics do not provide a breakdown can be attributed to special financial institutions and holding companies, as well as other entities not engaged in shadow banking activities. For the remaining share of the entities for which no breakdown is available, it cannot be excluded that those entities engage in risky liquidity transformation or credit intermediation.<sup>69</sup>

## 3.2 Evaluating the resilience of euro area financial institutions through scenario analysis

This section provides a quantitative assessment of four macro-financial scenarios that map the main systemic risks identified in the analysis presented in the previous sections of this issue of the FSR (see **Table 3.1**). The assessment of the impact of macro-financial shocks on euro area banks and insurers is based on a macroprudential simulation exercise involving top-down stress-testing tools.<sup>70</sup> Owing to limited availability of disaggregated data on assets, liabilities, capital and profitability of financial institutions other than banks and insurers, this section does

<sup>68</sup> When looking at the euro area money market fund sector, it should be noted that the geographical concentration of this sector is high, with Ireland accounting for 43%, France for 30% and Luxembourg for 24% of the total assets held by euro area money market funds in 2015. Other euro area countries account for less than 3%.

<sup>69</sup> The Financial Stability Board is currently gathering data at national level to further close the remaining gaps and to help determine whether certain types of entities engage in shadow banking activities. With the statistics available at the euro area level, some shadow banking activities can indeed not be identified by type of entity.

<sup>70</sup> The tools employed are: (i) a forward-looking solvency analysis, similar to a top-down stress test, for euro area banks; and (ii) a forward-looking analysis of the assets and liabilities side of the euro area insurance sector. For a more detailed description of the tools, see Henry, J. and Kok, C. (eds.), "A macro stress-testing framework for systemic risk analysis", *Occasional Paper Series*, No 152, ECB, October 2013, as well as "A macro stress-testing framework for bank solvency analysis", *Monthly Bulletin*, ECB, August 2013.

not assess the resilience of the shadow banking sector or possible feedback loops between banks and the shadow banking sector.

**Table 3.1**  
Mapping main systemic risks into adverse macro-financial scenarios

Risk	Scenario	Key assumptions driving impact on GDP
Abrupt reversal of compressed global risk premia amplified by low secondary market liquidity	Global risk aversion scenario	Shocks to risk aversion and investor confidence worldwide fuelling stock price declines, widening of corporate bond spreads, and lower euro area foreign demand
Weak profitability prospects for banks and insurers in a low nominal growth environment, amid incomplete balance sheet adjustments	Weak bank operating environment scenario	Shocks to private investment and consumption
Rising debt sustainability concerns in the public and non-financial private sectors amid low nominal growth	Sovereign and private debt crisis scenario	Renewed rise in sovereign bond yields to elevated levels and stock price declines
Prospective stress in a rapidly growing shadow banking sector, amplified by spillovers and liquidity risk	Shadow banking spillover scenario	Reversal of the improvement in euro area bank funding conditions, leading to higher money market rates and funding costs for the real economy

Source: ECB.

## Main features of the adverse macro-financial scenarios

The four macro-financial scenarios are designed using a range of tools. Statistical simulations are used to derive shocks to government bond spreads, stock prices and asset values of the shadow banks, as well as responses of other financial market parameters to these shocks. International spillovers of financial shocks are modelled using Bayesian VARs and the GVAR<sup>71</sup>, while the impact of global developments outside the EU on euro area foreign demand is assessed using NiGEM. The impact of the shocks on the euro area economies has been derived using stress-test elasticities (STEs).<sup>72</sup> The baseline scenario used in the assessment is derived from the European Commission's autumn 2015 economic forecast.

**Table 3.2**  
Overall impact on euro area GDP growth under the adverse macro-financial scenarios

	2014	2015	2016	2017	Q4 2017
Baseline (annual percentage growth rates)	1.3	1.6	1.8	1.9	
		percentage point dev. from baseline growth			% dev. from baseline level
Global risk aversion scenario		-0.2	-1.1	-0.6	-1.8%
Weak bank operating environment scenario		-0.6	-1.4	-0.5	-2.4%
Sovereign and private debt crisis scenario		-0.7	-0.9	-0.1	-1.7%
Shadow banking spillover scenario		-0.1	-0.3	-0.3	-0.7%

Sources: European Commission and ECB.

The weak bank operating environment scenario would have the strongest impact on euro area economic activity. It would be followed by the global risk aversion scenario (see [Table 3.2](#)). The materialisation of the first and second risks, identified as medium-level systemic risks, is considered more likely than the materialisation of the

<sup>71</sup> For details on the GVAR model, see Dees, S., di Mauro, F., Pesaran, M. H. and Smith, L. V., "Exploring the International Linkages of the Euro Area: A Global VAR Analysis", *Journal of Applied Econometrics*, Vol. 22, 2007, pp. 1-38.

<sup>72</sup> STEs are a multi-country, EU-wide simulation tool. STEs are based on impulse response functions (from ESCB central banks' models) of endogenous variables to pre-defined exogenous shocks. The STEs furthermore incorporate intra-EU trade spillovers.

third and fourth risks, which are deemed to be potential systemic risks (see the Overview).

With regard to the key financial market parameters, the global risk aversion scenario involves a flattening of the yield curves in the euro area together with a significant drop in stock prices (see [Table 3.3](#)). By contrast, the sovereign and private sector debt crisis scenario exhibits a steepening of the yield curve, albeit with a large dispersion across the individual euro area countries. In the case of the weak EU bank operating environment scenario, the yield curve would remain unchanged, while in the case of the shadow banking spillover scenario, a slight flattening would be associated with an upward shift of the curve.

**Table 3.3**

Overall impact of the adverse macro-financial scenarios on interest rates and asset prices

	Global risk aversion scenario	Weak bank operating environment scenario	Sovereign and private sector debt crisis scenario	Shadow banking spillover scenario
Average euro area increase in short-term interest rates (basis points)	80	0	0	80
Average euro area increase in long-term government bond yields (basis points)	47	0	76	61
Shock to euro area real estate prices (%)	-2	0	0	0
Shock to euro area equity prices (%)	-14	0	-8	-8

Source: ECB.

## Global risk aversion scenario

The first adverse scenario reflects the risk of an abrupt reversal of investor confidence and risk aversion worldwide. This scenario would be triggered by two events assumed to occur simultaneously. First, the slowdown in economic activity in China would induce a decline in the expected growth prospects for major emerging markets, reversing capital flows and leading to a significant reduction in emerging market asset prices. This would also lead to protracted downward pressure on domestic aggregate demand. The second trigger event would originate from the United States, whereby it is assumed by market participants that monetary policy will be tightened sooner than expected, which in turn would lead to a rapid increase in market uncertainty. This episode of heightened volatility and declining global asset prices would persist for several quarters. Taken together, these two shocks would, in turn, lead to a mild recession in the United States and a sharp economic slowdown in key emerging market economies, and would – via trade and confidence spillovers – have negative implications for the economic outlook in the euro area.

In this scenario, US stock prices would decline by 14% in the fourth quarter of 2015, with stock prices assumed to continue falling until the end of 2017, by a cumulative 21%. US long-term interest rates would initially increase by about 80 basis points, standing at about 130 basis points above current market expectations at the end of 2017. As a result, the EU's external demand, derived using the NiGEM model, would decrease by 6.3% by 2017, relative to the baseline.

This scenario translates into an overall deviation of real euro area GDP of 1.8% below the baseline level by the end of 2017. The real economic impact differs

considerably across countries (ranging from a -1.0% to -4.7% deviation from baseline levels by the end of 2017), depending, in particular, on their degree of openness and the strength of financial spillovers from the global markets.

### Weak bank operating environment scenario

This scenario captures the risk of persistently weaker than anticipated domestic economic activity in many euro area countries, in an environment of negative headline inflation. To this end, the scenario involves country-specific negative shocks to aggregate demand in the form of an imposed slowdown with respect to the baseline for both private fixed investment and private consumption. The prices of oil and other commodities are assumed to remain well below the baseline scenario. While this would support real economic growth, lower commodity prices would also exert additional downward pressure on inflation, thereby increasing the real debt service burdens of the real economy. The resulting negative inflation would further reinforce the contraction of aggregate demand, as consumption and investment would be deferred in expectation of lower future prices.

Overall, real euro area GDP would stand 2.4% below the baseline level by the end of 2017. The real economic impact would differ considerably across euro area countries (ranging from a -1.4% to a -5.7% deviation from the baseline level by the end of 2017). Financial market parameters are assumed to evolve in line with the baseline projection in this scenario.

### Sovereign and private debt crisis scenario

The sovereign and private debt crisis scenario envisages a renewed increase in euro area sovereign bond yields to elevated levels. The sovereign bond yield shocks have been calibrated at a 1% probability level for the aggregate euro area sovereign credit spreads.<sup>73</sup> However, these shocks may not be fully representative of future developments, as – over the medium term – the low yields of euro area sovereign bonds would be further supported by the Eurosystem's expanded asset purchase programme. The same simulation is used to infer the size of spillovers from bond markets to euro area stock markets.

Long-term government bond yields are assumed to increase by about 65 basis points above the current market expectations in the euro area in the fourth quarter of 2015. Sovereign bond yields would maintain a constant distance from the baseline over the horizon until the end of 2017. The dispersion of the long-term rate shocks across all euro area countries would be relatively pronounced, falling into the range

<sup>73</sup> To that end, a non-parametric simulation approach has been employed to simulate the joint forward distribution of ten-year bond yields and stock prices over a horizon of 60 business days. The underlying sample covers the period between 3 August 2012 and March 2015, with the starting point chosen so as to account for the significant regime change introduced by the ECB's announcement on Outright Monetary Transactions (OMTs) on 2 August 2012. The slope of national yield curves relative to the national ten-year benchmark bond yields (at the cut-off date of 31 December 2014) is used to transpose the simulated shock to maturities other than ten years.

from close to zero to 300 basis points. The resulting decline in euro area stock prices would be close to 6%, with impacts on specific countries ranging up to 15%.

In parallel, financing conditions in the euro area private non-financial sector would tighten owing to rising concerns about high private indebtedness in the euro area. Lenders would reduce the supply of loans which would increase financing costs. Overall, the aggregate stock of outstanding loans to the non-financial private sector would be reduced by about 5.4%.

The effect of these assumptions would be lower than in the previous scenarios, with euro area real GDP 1.7% below the baseline by the end of 2017. This effect is estimated using a DSGE model to translate the reduction in loan volumes into shocks to the main components of aggregate demand. In the next step, the STEs are used to combine the demand shocks with financial shocks to obtain the overall impact on GDP.<sup>74</sup>

### Shadow banking spillover scenario

The shadow banking spillover scenario considers the spillovers from the non-bank financial sector to the EU banking sector via the funding channel and lower asset valuations. It is assumed to be triggered by an abrupt drop in returns on investment in shadow banks, which would lead to heightened redemptions. That initial drop in the valuation of the shadow banking sector would correspond to the 1% probability level. Forced sales of assets by that sector would reduce asset prices and the supply of funding to the banking sector. Consequently, the bank funding costs would increase.

Although some of the assumed asset price shocks are similar in scope to those included in the global risk aversion scenario, the triggers and propagation mechanisms for the two scenarios differ.

The deterioration of bank funding conditions would affect the banking sector via three channels. First, the rollover of maturing wholesale funding at higher spreads would directly erode banks' net interest margins. Country-specific shocks to the wholesale funding cost are derived from the aforementioned statistical simulations, amounting to, on aggregate, about 40 basis points. Second, a shock to the three-month EURIBOR of about 80 basis points captures the risk of worsening conditions in money markets. Third, banks affected by funding constraints are assumed to increase the cost of extending credit to the private sector and to limit the supply thereof. To account for this effect, a set of country-specific shocks is applied to the

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<sup>74</sup> Shocks to long-term government bond yields and stock prices are entered directly into STEs.

cost of corporate credit (via the user cost of capital) and to interest margins on loans to households (via the financial wealth of households).<sup>75</sup>

The impact of these assumptions on GDP is moderate. Euro area real GDP would be 0.7% below its baseline level by the end of 2017.

## Solvency results for euro area banking groups

The impact of the four scenarios on bank solvency is broken down into the direct impact on capital of individual banks, on the one hand, and indirect effects stemming from cross-institutional contagion, on the other. The direct impact is obtained from a projection of the main variables that determine banks' solvency, such as the credit risk parameters, profits and risk-weighted assets. The indirect impact is related to the possibility that some of the euro area banks may default as a result of losses incurred through the direct impact, thereby amplifying the losses of other institutions. In the absence of detailed data on interbank exposures, publicly available information and dynamic network modelling are used to simulate instances where a financial institution can cause contagion effects throughout the financial system.<sup>76</sup> Having computed the effects of the various shocks on the above-mentioned balance sheet components, the overall impact is expressed in terms of changes to banks' CET1 capital ratios.

Under the baseline scenario, the capital position of the euro area banking groups is projected to weaken slightly. The aggregate CET1 capital ratio is projected to decrease from 11.9% in the second quarter of 2015 to 11.6% by the end of 2017 (see Chart 3.42). The positive retained earnings (contribution of 2.6 percentage points to the aggregate CET1 capital ratio) would be more than sufficient to absorb the flow of impairment charges on loans and other financial assets (contribution of -1.5 percentage points). However, the concurrent increase in risk-weighted assets and other effects – related mainly to the gradual phasing-in of the requirements set out in the Capital Requirements Directive IV (CRD IV) – would lead to an overall decline in the CET1 capital ratio.

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<sup>75</sup> The country-specific shocks are calibrated taking into account the plausible further fragmentation of funding markets (and differentiation in credit conditions for the private sector) across EU Member States in order to reflect the differing risks of being severely affected by the adverse macroeconomic developments. The magnitudes of the shocks are derived from market and expert assessments of severe macroeconomic risks, under the assumption that wholesale and retail funding shocks would lead to a tightening of bank credit standards that, in turn, would weaken economic activity. The translation of funding shocks into the impact on GDP was carried out using a DSGE model, and the STE platform was used to calibrate the cost of capital and household financial wealth shocks which replicate the GDP impact derived from the DSGE model.

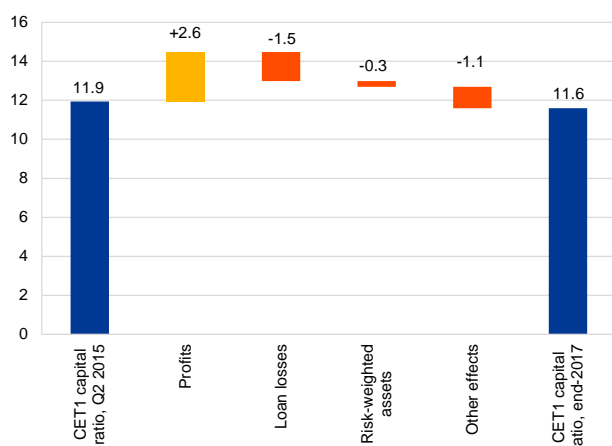
<sup>76</sup> The exercise is based on a sample of banks participating in the ECB's 2014 comprehensive assessment. Interbank exposure networks are generated randomly on the basis of banks' interbank placements and deposits, taking into account the geographical breakdown of banks' activities. Two limitations on the maximum exposure that is allowed vis-à-vis an individual counterparty are embedded into the network simulators, following the prescriptions in Article 395(1) of Regulation (EU) No 575/2013 and in Article 111(3) of Directive 2006/48/EC. First, an interbank exposure of each bank cannot exceed 25% of its regulatory capital. Second, the sum total of the interbank exposures of a bank, individually exceeding 10% of its capital, cannot be higher than 800% of its capital. For a more detailed description of the methodology, see Halaj, G. and Kok, C., "Assessing interbank contagion using simulated networks", *Working Paper Series*, No 1506, ECB, 2013, and *Computational Management Science*, Vol. 10(2), 2013, pp. 157-186.

Among the four scenarios, the sovereign and private debt crisis scenario would have the strongest adverse impact on euro area banks' solvency positions. It is followed closely by the global risk aversion scenario and the shadow banking spillover scenario. The impact on banks' solvency positions at the end of 2017 under the adverse scenarios is illustrated in Chart 3.43. The limited variability in the impact of the scenarios is, to some extent, driven by the significant contribution from other effects, mainly related – as under the baseline scenario – to the transition to the CRD IV capital regime. In addition, the methodological assumptions of this exercise are largely consistent with the EBA's EU-wide stress-test exercise, which implies that several items in the banks' profit and loss accounts are projected using historical values.<sup>77</sup>

**Chart 3.42**  
Under the baseline scenario, the euro area bank solvency position would slightly weaken

Average contribution of changes in profits, loan losses and risk-weighted assets to the CET1 capital ratios of euro area banking groups under the baseline scenario

(percentage of CET1 capital ratio and percentage point contribution)

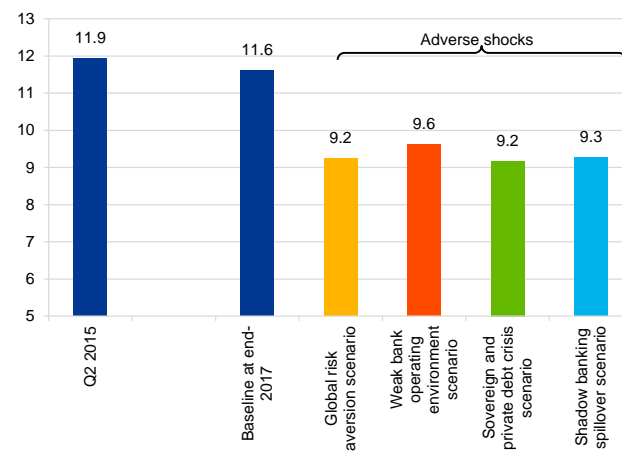


Sources: Individual institutions' financial reports, EBA, ECB and ECB calculations.

**Chart 3.43**  
The sovereign and private debt crisis scenario would have the strongest impact on bank solvency

Average CET1 capital ratios of euro area banking groups under the baseline and adverse scenarios

(2015-2017; percentages, average of euro area banking groups)



Sources: Individual institutions' financial reports, EBA, ECB and ECB calculations.

The drop in the capital ratio in comparison to the result of the baseline scenario is explained mainly by the reduction of pre-provision profits, higher loan loss provisions, and an increase in risk-weighted assets. On aggregate, each of these three factors would contribute about 0.7 to 1.0 percentage point to the decrease in bank capital ratios projected under the adverse scenarios, compared with the baseline. Operating profits contribute between 1.5 and 1.8 percentage points to the change in the aggregate level of the CET1 capital ratio, significantly less than under the baseline scenario. Loan losses are projected to increase to between 2.2 and 2.3 percentage points of the CET1 capital ratio,<sup>78</sup> and an increase in risk-weighted

<sup>77</sup> For example, cumulative net trading income is projected as an average net trading income over the most recent five years, less two standard deviations of net trading income. Similarly, operating expenses are held constant over the projection horizon.

<sup>78</sup> This result is, to some extent, driven by the assumption in the credit risk benchmark methodology employed in the EBA stress-test exercise that the probabilities of default would not decrease over the stress-test horizon, even if the model result would suggest otherwise.

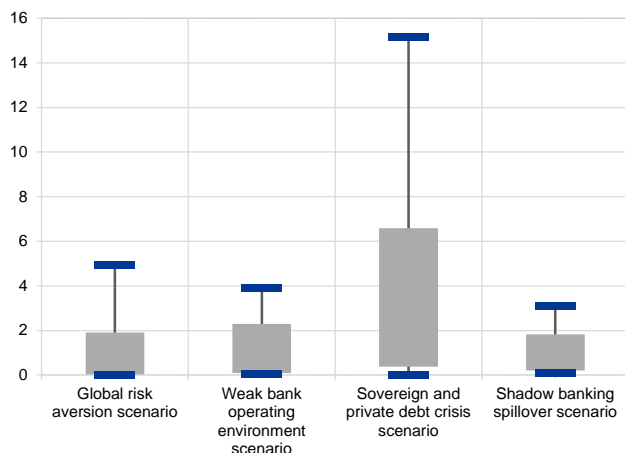


### Chart 3.44

#### Interbank contagion moderately increases total losses

##### Reduction of the CET1 capital ratio of euro area banks due to interbank contagion: dispersion across simulations

(basis points of CET1 capital ratio; box: interquartile range, bars: 10th-90th percentile range)



Sources: Individual institutions' financial reports, EBA, ECB and ECB calculations.

assets would reduce the CET1 capital ratio by between 1.0 and 1.2 percentage points.

The impact of interbank contagion on bank solvency is projected to be the strongest under the sovereign and private debt crisis scenario, albeit still moderate (see Chart 3.44). For the simulated networks with the strongest contagion effects, the system-wide CET1 capital ratio would fall by about 0.15 percentage point in some countries under the sovereign and private debt crisis scenario. Contagion effects would be more muted under the other three scenarios, in the worst case not greater than 0.05 percentage point of the aggregate capital ratio. Although the aggregate capital levels recorded under the four scenarios are similar, the group of vulnerable banks that fuel the propagation of interbank contagion differs, leading to these material differences in the contagion effects.

## Assessing the resilience of euro area insurers

The assessment of the impact of the main euro area financial stability risks on large euro area insurers is conducted using publicly available data for 11 major euro area insurance groups up to the fourth quarter of 2014. It relies on a market-consistent approach to the quantification of risks, and is applied to insurance corporations, to both assets and liabilities. Due to the lack of sufficiently granular data, this impact assessment aims to spell out the main risks in economic terms, rather than trying to gauge the impact in terms of prudential solvency ratios.

The following market, credit and underwriting risks are assessed: (i) an increase in interest rates; (ii) a fall in equity and property prices; (iii) a deterioration of the creditworthiness of borrowers through a widening of credit spreads for marketable instruments; (iv) an increase in lapse rates;<sup>79</sup> and (v) an increase in loss rates on loan portfolios. This assessment uses the same four scenarios that were presented earlier in this section. **Table 3.1** summarises the key aspects of the scenarios used in this exercise.

Against this background, the risks for insurance companies are transmitted through three channels, namely through: (i) valuation effects on financial securities and liabilities owing to changes in sovereign yields and swap rates; (ii) sales of assets due to unforeseen redemptions resulting from increased lapse rates; and (iii)

<sup>79</sup> The lapse rate is defined as the proportion of contracts terminated prematurely by policyholders.

changes in the credit quality of loan portfolios. In this context, a number of simplifying assumptions had to be made for this exercise (see [Table 3.4](#)).<sup>80</sup>

**Table 3.4**

**Technical assumptions regarding the individual risk drivers of insurers' balance sheets**

Risk drivers	Technical assumptions
Credit risk	Credit risk assessment carried out using: (i) breakdowns by rating or region, depending on data availability; and (ii) loss rate starting levels, which are stressed using the same methodology as that applied for assessing the resilience of euro area banks.
Interest rate risk transmission	Sensitivities to interest rate changes are computed for each interest-rate-sensitive asset and liability exposure. Relevant yield curves are used to project asset and liability cash flow streams, to calculate internal rates of return, and to discount the cash flows using yield curve shocks.
Market valuations of securities	Haircuts for debt securities are derived from changes in the value of representative securities implied by the increase in interest rates under each shock and are uniformly applied across the sample of large euro area insurers. Valuation haircuts applied to government bond portfolios are estimated on the basis of representative euro area sovereign bonds across maturities. Haircuts for corporate bonds are derived from a widening of credit spreads.
Lapse risk	Lapse risk is quantified by projecting insurers' cash flows over a two-year horizon, assuming a static composition of contracts and the reinvestment of maturing assets without a change in the asset allocation. Lapse rates are linked to macroeconomic variables <sup>81</sup> . The unexpected component of lapses <sup>82</sup> leads to surrender payments <sup>83</sup> . In the case of negative cash flows from surrender payments, the insurer is obliged to use cash reserves or sell assets to meet obligations. Lapse risk equals the cash or other assets needed to cover surrender payments.
Other assumptions specific to the sensitivity of investment income	Investment income earned from reinvested assets is shocked on the basis of investment income earned at the beginning of the simulation horizon. All other assets are assumed to earn the initial investment income throughout the simulation horizon. Maturing fixed income assets are reinvested retaining the initial asset composition. The underwriting business component of operating profit is assumed to remain constant throughout the simulation horizon. It is assumed that there is no distribution of dividends.

Source: ECB.

The global risk aversion scenario is projected to have the strongest adverse impact on insurance companies (see [Chart 3.45](#)). It is followed by the shadow banking spillover scenario, with average total declines amounting, respectively, to 2.9% and 1.5% of total assets of euro area insurers.

Credit risk appears to be the most important driver of the decline in net asset values under all the considered scenarios except the weak growth scenario. Although the degree of vulnerability to the materialisation of macro-financial risks differs across individual insurance groups, the impact of a widening of credit spreads is similar across the three scenarios where a significant credit-related impact is observed, i.e. the global risk aversion, the shadow banking spillover, and the sovereign and private debt crisis scenarios. Indeed, under each of these three scenarios, credit risk implies a decline of about 1.5% in net asset values expressed as a percentage of total assets. This outcome is driven mainly by corporate credit risk.

The impact on insurers of the increase in reference interest rates largely depends on the change in the slope of the yield curve and on the nature of the maturity mismatch between companies' assets and liabilities. Under the global risk aversion scenario, the rise in interest rates, combined with a simultaneous flattening of the yield curve and a shorter average duration of insurance companies' assets with respect to the

<sup>80</sup> For a comprehensive explanation of the underlying assumptions, please refer to Section 3.2 of the May 2015 FSR.

<sup>81</sup> Sensitivities of lapse rates to GDP and unemployment were derived by taking the mean of a number of elasticity values, collected from the literature (e.g. Honegger, R. and Mathis, C., "Duration of life insurance liabilities and asset liability management", *Working Paper*, Actuarial Approach for Financial Risks (AFIR), 1993; Kim, C., "Report to the policyholder behaviour in the tail subgroups project", *Technical Report*, Society of Actuaries, 2005; and Smith, S., "Stopping short? Evidence on contributions to long-term savings from aggregate and micro data", *Discussion Paper*, Financial Markets Group, London School of Economics, 2004) and from ECB calculations.

<sup>82</sup> The unexpected component of lapses is defined as the difference between the projected lapse rate and the average lapse rate reported by large European insurers.

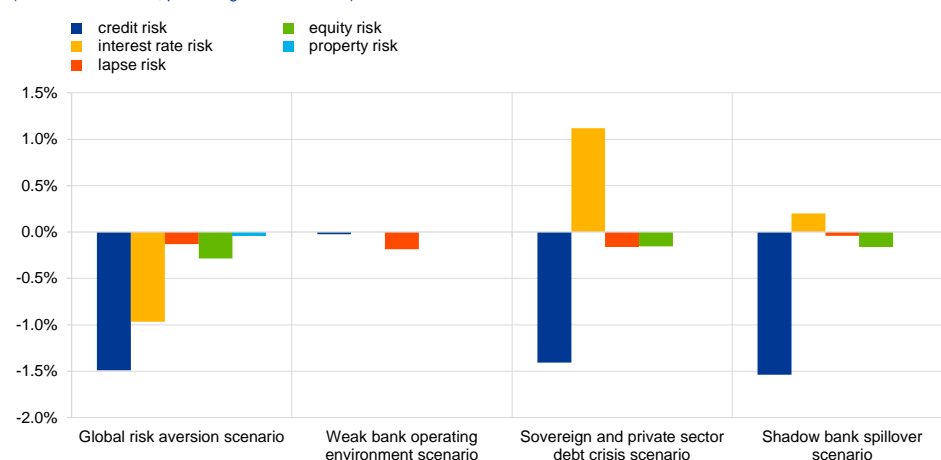
<sup>83</sup> It is assumed that 50% of the total amount represented by the extra lapse rates has to be paid (due to the existence of penalties in the contracts, which lower the insurers' risk).

duration of their liabilities, would lead to a decline in their net asset values as a percentage of total assets. Indeed, these factors would cause insurers' assets to decrease faster than their liabilities and, thus, would lead to a decline in their net asset value as a percentage of total assets. Instead, under the sovereign and private debt crisis scenario, the rise in interest rates combined with the steepening of the yield curve produces the opposite outcome, i.e. a positive effect on insurers' net asset value as a percentage of total assets that almost fully compensates for the adverse impact of marking sovereign and corporate debt securities to market.

### Chart 3.45

#### Change in the net asset values of large euro area insurers under different scenarios

(Q3 2015 – Q4 2017; percentage of total assets)



Sources: Individual institutions' financial reports and ECB calculations.

Variations in equity price losses would be moderate. The negative impact of the adverse equity price shocks would reach, at most, 0.3% of total assets under the global risk aversion scenario, and would be weaker under the other scenarios, reflecting the relative strength of equity price shocks.<sup>84</sup> Finally, lapse risk-related losses would be higher under the weak growth scenario, reflecting the lower real GDP growth exhibited by the euro area economy under this scenario and amounting to about 0.2% of total assets.

In addition to the scenarios considered here, which correspond to the main risks to financial stability in the euro area, euro area insurers would also be vulnerable to a low interest rate environment. This risk has a somewhat longer horizon than the horizon for the assessment made in this issue of the FSR. Special Feature B analyses in detail the impact of a low interest rate environment on euro area insurers. It concludes that, while the impact on individual firms may differ markedly depending on individual circumstances and business models, on aggregate, a protracted period of low interest rates may have an adverse material impact on the solvency of euro area insurers.

<sup>84</sup> Owing to data availability, gross equity exposures (gross of unit-linked exposures) were used and, consequently, the equity risk may be overestimated.

## 3.3 Continued progress in regulatory and macroprudential policy implementation

### 3.3.1 Macroprudential policy measures

This section considers the macroprudential measures that have been implemented or announced in euro area countries since May 2015. The measures introduced by the countries concerned can be broadly grouped into three categories: real estate measures, structural capital buffers and setting the counter-cyclical capital buffer rate.

#### Real estate measures

Real estate measures have been adopted with the aim of limiting undesirable developments in domestic property markets. Real estate typically represents a large proportion of banks' credit exposures, and of households' assets, thus making imbalances in this sector particularly important in terms of financial stability. In this regard, Lithuania amended the debt service-to-income (DSTI) limit; the German Financial Stability Committee (Ausschuss für Finanzstabilität) issued a recommendation to create a legal foundation for a set of macroprudential tools related to residential real estate; and the Dutch Financial Stability Committee issued a recommendation to continue the tightening of the loan-to-value (LTV) limit beyond 2018.

In May 2015 Lietuvos bankas decided to modify borrower-based macroprudential requirements. The existing DSTI requirement of 40% was deemed insufficient to prevent households from assuming excessive housing debt, as low interest rates and resulting small monthly loan repayments were leaving households vulnerable to a potential increase in predominantly floating lending rates. Against this background, an interest rate test was introduced in order to ensure that the DSTI ratio would not exceed 50% with an assumed 5% lending interest rate. In addition, the maximum loan term was reduced from 40 to 30 years, thereby further limiting the maximum possible loan amount. Finally, in order to allow more flexibility in loan provision and to avoid any potential negative impact on aggregate mortgage lending flows, credit institutions were allowed to apply a higher DSTI requirement of up to 60% for up to 5% of new loans (in terms of value) issued during a calendar year. These changes entered into force on 1 November 2015. They are considered to be of a precautionary nature and should not lead to material cross-border spillovers or leakages of lending to the non-bank sector.

In June 2015 the German Financial Stability Committee issued a recommendation to the German Federal Government on new macroprudential instruments for the real estate sector. It also recommended that the Federal Government initiate the creation of a legal foundation giving the Federal Financial Supervisory Authority (BaFin) the authority to impose restrictions on commercial lenders with regard to mortgage loans to build or acquire domestic residential real estate, such as caps on loan-to-value

ratios, an amortisation requirement, as well as caps on debt servicing ratios, debt service coverage ratios and debt-to-income ratios.

The Dutch Financial Stability Committee issued a recommendation to future Cabinets in May 2015 to continue lowering the LTV limit beyond 2018, reducing it by 1 percentage point per year until it reaches 90% in 2028. The measure currently in place aims to reduce the LTV limit by 1 percentage point per year, until it reaches 100% in 2018. The rationale behind the proposal is that a 100% LTV ratio is still very high by international standards, which might undermine confidence in the Dutch banking system in crisis times, potentially resulting in limited access to market funding.

### Structural capital buffers based on the CRR/CRD IV

Since May 2015 a number of additional euro area countries have implemented structural buffers introduced by the Capital Requirements Regulation (CRR) and/or the Capital Requirements Directive (CRD IV). These measures aim to increase the resilience of systemically important banks, in order to reduce the “too big to fail” subsidy and effectively improve the stability of the whole financial system, as well as to mitigate structural, non-cyclical risks in the banking system. In this regard, Slovakia introduced the systemic risk buffer (SRB) and buffers for other systemically important institutions (O-SIIs); Austria issued a recommendation to introduce the SRB and O-SII buffers; Germany implemented the buffer for global systemically important institutions (G-SIIs); and Belgium and Finland implemented the O-SII buffer for a set of banks. Following the EBA’s guidelines on the criteria for identifying O-SIIs, all EU Member States are expected to publish a list of the institutions designated as O-SIIs by 1 January 2016 at the latest.<sup>85</sup>

**Table 3.5**  
Systemic risk buffers and buffers for other systemically important institutions recommended for Slovakian banks (as a percentage of risk-weighted assets)

Bank	1 January 2016	1 January 2017	1 January 2018
Všeobecná úverová banka	1% O-SII	2% O-SII	2% O-SII + 1% SRB
Slovenská sporiteľňa	1% O-SII	2% O-SII	2% O-SII + 1% SRB
Tatra banka	1% O-SII	1.5% O-SII + 0.5% SRB	1.5% O-SII + 1% SRB
Československá obchodná banka	1% O-SII	2% O-SII	2% O-SII
Poštová banka	1% O-SII	2% O-SII	2% O-SII

Source: Národná banka Slovenska.

In May 2015 Národná banka Slovenska introduced a combination of O-SII and systemic risk buffer requirements for the five largest banks. The buffers aim to increase the resilience of systemic institutions. The combination of O-SII buffers and the SRB was introduced because the maximum O-SII buffer rate of 2% was

<sup>85</sup> Guidelines on the criteria to determine the conditions of application of Article 131(3) of Directive 2013/36/EU (CRD) in relation to the assessment of other systemically important institutions (O-SIIs) (EBA/GL/2014/10).

considered insufficient for some banks.<sup>86</sup> The buffer requirements will be phased in from 1 January 2016 until 1 January 2018.

In June 2015 the Austrian Financial Market Stability Board (Finanzmarktstabilitätsgremium) recommended introducing SRBs and O-SII buffers to the Austrian Financial Market Authority. This recommendation was then amended in September. The final recommendation was that an SRB requirement (1% or 2%) be introduced for 12 institutions and that the buffer requirements become applicable from 1 January 2016, with a transitional period until January 2019 for those banks that are directly supervised by the ECB. If both buffer requirements are applicable, banks must meet the higher of the SRB and the O-SII buffer.

**Table 3.6**  
Systemic risk buffers and buffers for other systemically important institutions recommended for Austrian banks (as a percentage of risk-weighted assets)

Bank	1 January 2016	1 January 2017	1 January 2018	1 January 2019
Erste Group Bank	0.25%	0.50%	1.00%	2.00%
Raiffeisen Zentralbank	0.25%	0.50%	1.00%	2.00%
Raiffeisen Bank International	0.25%	0.50%	1.00%	2.00%
UniCredit Bank Austria	0.25%	0.50%	1.00%	2.00%
Raiffeisenlandesbank Oberösterreich	0.25%	0.50%	1.00%	1.00%
Raiffeisen-Holding Niederösterreich-Wien	0.25%	0.50%	1.00%	1.00%
BAWAG P.S.K.	0.25%	0.50%	1.00%	1.00%
Niederösterreichische Landesbank-Hypothekenbank	1.00%	1.00%	1.00%	1.00%
Vorarlberger Landes- und Hypothekenbank	1.00%	1.00%	1.00%	1.00%
Hypo Tirol Bank	1.00%	1.00%	1.00%	1.00%
Landesbank Oberösterreich	1.00%	1.00%	1.00%	1.00%
Sberbank	0.25%	0.50%	1.00%	1.00%

Source: Finanzmarktstabilitätsgremium (FMSG).

In May 2015 BaFin decided to classify Deutsche Bank AG as a G-SII in Germany and apply a capital surcharge of 2.0%, subject to a three-year phase-in period beginning on 1 January 2016. The additional common equity Tier 1 requirement will be increased by 0.5 percentage point each year, until the buffer is fully activated in January 2019. The measure aims to reduce the likelihood of failure and is seen as an important measure to reduce the negative externalities for Germany, the global economy and financial market stability were Deutsche Bank AG to default.

In July 2015 the Finnish Financial Supervisory Authority (Finanssivalvonta) decided to classify four financial institutions as O-SIIs and made these institutions subject to the O-SII buffer requirement. The new capital requirements must be fulfilled as of 7 January 2016. The capital adequacy in the newly designated O-SIIs is sufficiently high that they have not needed to adjust their capital structures to meet the requirement.

<sup>86</sup> See Article 131(15) of CRD IV: "Notwithstanding paragraph 14, where the systemic risk buffer applies to all exposures located in the Member State that sets that buffer to address the macroprudential risk of that Member State, but does not apply to exposures outside the Member State, that systemic risk buffer shall be cumulative with the O-SII or G-SII buffer that is applied in accordance with this Article".

**Table 3.7****Buffer for other systemically important institutions in Finland**

Bank	7 January 2016
Nordea Pankki Suomi Oyj	2.0%
OP Ryhmä	2.0%
Danske Bank Oyj	0.5%
Kuntarahoitus Oyj	0.5%

Source: Finanssivalvonta.

In October 2015 the Nationale Bank van België/Banque Nationale de Belgique decided to set O-SII buffers for eight Belgian banks. The decision was motivated by the high economic and social costs that would be incurred by the failure of any of those institutions. The Belgian O-SIIs, identified in accordance with the EBA's guidelines, have been prescribed buffers of 1.5% and 0.75%. The O-SII buffer requirements will become applicable on 1 January 2016 and will be phased in over a three-year period.

**Table 3.8****Buffers for other systemically important institutions in Belgium (as a percentage of risk-weighted assets)**

Bank	1 January 2016	1 January 2017	1 January 2018
BNPP Fortis	0.5%	1%	1.5%
KBC Group	0.5%	1%	1.5%
Belfius Bank	0.5%	1%	1.5%
ING Belgium	0.5%	1%	1.5%
Euroclear	0.25%	0.5%	0.75%
Axa Bank Europe	0.25%	0.5%	0.75%
The Bank of New York Mellon	0.25%	0.5%	0.75%
Argenta	0.25%	0.5%	0.75%

Source: Nationale Bank van België/Banque Nationale de Belgique.

### Counter-cyclical capital buffer

Some euro area countries (Finland, Latvia, Lithuania and Slovakia) have already implemented counter-cyclical capital buffers, ahead of the CRD requirement to implement counter-cyclical buffers from the beginning of 2016. However, given the subdued credit growth, which results in negative or low credit-to-GDP gaps, the buffer rate has been set at 0% in all of these countries.

In September 2015 the Austrian Financial Market Stability Board also issued a recommendation to set the counter-cyclical buffer rate at 0% from January 2016.

### 3.3.2 Regulatory framework

This section provides an overview of a number of regulatory initiatives in the banking, insurance and market spheres that are of primary importance for enhancing financial stability in the EU. Importantly, in addition to strengthening the resilience

and loss-absorption capacity of the whole financial system, the finalisation of the ongoing initiatives will significantly reduce the regulatory uncertainty regarding capital and liquidity rules for banks and other financial institutions as well.

## Regulatory initiatives for the banking sector

A key element of the prudential standards for credit institutions and investment firms in the EU is the Capital Requirements Regulation/Capital Requirements Directive IV (CRR/CRD IV) package. The CRR and CRD IV play a key role in strengthening the resilience of the EU banking sector. Empirical evidence clearly indicates that a substantial capital increase above previous levels was necessary and desirable. The benefits of robust capital requirements include: reducing bank moral hazard and thereby improving the quality of lending decisions; increasing banks' ability to lend through the cycle; and insulating taxpayers and society from having to bear banks' unexpected losses. The CRR/CRD IV package was an important step forward in correcting the suboptimal capital regulation that existed before the crisis, and thus also in ensuring that the aforementioned benefits are reaped. It is important that the significant long-run welfare gains of strong capital requirements and the role that a healthy and resilient banking system plays in facilitating growth over the whole financial cycle are appropriately acknowledged in future policy developments.

At this early stage following the implementation of the CRR/CRD IV rules, it is difficult to make firm conclusions as to their impact on the financing of the real economy. This is especially true given the other significant influences on banks' capital levels, notably government intervention, supervisory action and market pressures that applied during this time.

Empirical work undertaken by the ECB on the impact of higher bank capital requirements on the euro area economy identifies some adverse effects on loan supply in the short run, though it appears to be relatively limited in terms of magnitude from an economic perspective. This finding holds both at the country and euro area level for different portfolio segments. The analysis finds that the impact of the CRR/CRD IV was stronger for less capitalised banks and for banks with lower average risk weights. Banks with higher non-performing loan ratios (i.e. weak credit portfolios) have also been more strongly affected by the CRR/CRD IV. This said, both the theoretical and empirical work suggest that net positive effects will prevail in the long term – with the adverse loan supply effects concentrated in a short-term transitional phase, as banks adjust to the new requirements.

The Basel Committee on Banking Supervision (BCBS) is currently undertaking a strategic review of the Basel capital framework in response to concerns about excessive variation in capital requirements across banks and jurisdictions. In this regard, a dedicated task force has been set up to develop an approach that would limit the use of banks' internal models to a set of portfolios designated by the BCBS as being suitable for modelling. This approach would apply additional restrictions to the modelling of those portfolios, including by eliminating the modelling of particular parameters. It would also require that regulatory capital for all remaining portfolios be



calculated using a method other than an internal model. The objective of the review is to improve the balance between simplicity, comparability and risk sensitivity, as well as to better meet the Committee's objectives of adequacy, robustness and consistency in implementation.

In parallel, work is ongoing to reform the standardised approach for credit risk as well. This reform will seek to reduce the mechanistic reliance on external ratings in the standardised approach, while also seeking to ensure standardised risk weights are risk sensitive and accurate. The package of reforms will allow the calibration of risk weights across asset classes to reflect the experience of the financial crisis. It is expected that the BCBS will also use the updated standardised approach as a basis to provide a simple floor for banks' capital requirements using internal models. Together, these measures should ensure that the risk-weighted capital framework is robust and credible for all banks.

With regard to the implementation of the international framework for **liquidity regulation, the liquidity coverage ratio** entered into force in October 2015, with a starting level of 60%, and will be phased in gradually to reach 100% in 2018.<sup>87</sup> The European Banking Authority (EBA) is currently finalising the remaining issues related to the guidelines on the disclosure of the liquidity coverage ratio. On the basis of data available at the end of 2014 under the EBA monitoring exercise, the majority of banks already have a liquidity coverage ratio above 100% and only a few banks still needed to improve their ratio to meet the 60% requirement.<sup>88</sup> As regards the net stable funding ratio (NSFR), the BCBS finalised the work on the calibration of the NSFR in October 2014. The BCBS is conducting some additional quantitative analysis in view of the ongoing implementation of regulatory requirements for the margining of derivatives. In the EU, the EBA is conducting a comprehensive impact and calibration assessment of the NSFR, which it will submit to the European Commission by the end of 2015. The impact assessment will allow the Commission to develop a legislative proposal on how to ensure that credit institutions use stable sources of funding.<sup>89</sup> In this context, the EBA received a call for advice from the Commission in August 2015, asking it to conduct further analysis on the NSFR and in particular with regard to the need for proportionate implementation taking into account the impact of the NSFR on different business models.<sup>90</sup> Based on the EBA monitoring exercise, reporting banks have continuously increased the level of the NSFR since 2011, reducing the shortfall in stable funding to reach the 100% ratio. The majority of reporting banks have already achieved an NSFR of 100%.

Work on the **leverage ratio** is progressing on various fronts. The BCBS is currently working on the final aspects of the leverage ratio and will review the calibration by next year. A minimum Tier 1 leverage ratio of 3% is currently being tested until 1

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<sup>87</sup> Under the Basel agreement, the liquidity coverage ratio would need to reach 100% as of 1 January 2019. However, the European Commission may delay full implementation by one year, subject to a report by the EBA in June 2016 (see Article 461 of the CRR).

<sup>88</sup> *CRD IV–CRR/Basel III monitoring exercise report*, EBA, September 2015.

<sup>89</sup> See Article 510 of the CRR.

<sup>90</sup> See <https://www.eba.europa.eu/-/eba-to-conduct-further-analysis-on-net-stable-funding-requirements-and-leverage-ratio>

January 2017, by which point any final adjustments must be made to the framework with a view to migrating to a Pillar 1 treatment on 1 January 2018. At the European level, the EBA has started work on its report on the impact and calibration of the leverage ratio. The report will provide an impact assessment for the leverage ratio, taking into account potential behavioural implications of a leverage ratio requirement, its interaction with other prudential requirements and cyclicalities. The report will also consider different business models and include an assessment on the question as to whether the leverage ratio should differ for institutions following different business models. Based on the results of this report, the European Commission will submit a report on the impact and effectiveness of the leverage ratio to the European Parliament and the Council by the end of 2016. If introduced as a binding requirement in Pillar 1 and calibrated correctly, the leverage ratio will be a useful complementary measure reinforcing risk-based capital requirements. While concern has been raised that the risk insensitivity of the leverage ratio may induce increased risk-taking, the special feature in this issue of the FSR entitled “The leverage ratio, risk-taking and bank stability” presents theoretical and empirical evidence to show that any additional risk-taking by EU banks is likely to be limited and the effects should be more than outweighed by the increase in loss-absorbing capacity, thus resulting in more stable banks.

With regard to **securitisation**, the work to make the securitisation framework more risk sensitive has reached a major milestone, following the European Commission’s publication of two proposals at the end of September: (i) one for an umbrella regulation creating the regulatory framework under which simple, transparent and standardised (STS) securitisations can be issued; and (ii) one for a CRR update that implements both the Basel 2014 securitisation and the STS frameworks. The Commission’s proposals are based on an EBA recommendation on the prudential treatment of STS securitisations in banking regulation, as well as on the BCBS/IOSCO work on the identification of simple, transparent and comparable (STC) securitisations which represent a key building block of the capital markets union. The Commission’s proposal aims at striking the right balance between the need to revive the European securitisation markets and the need to preserve a prudent regulatory framework. By distinguishing between simple and transparent securitisations and other structures, and by applying a differentiated capital treatment based on the fulfilment of a number of criteria that include structural and governance requirements, the proposed framework has the potential to also enhance the robustness of the European securitisation markets by stimulating the issuance of simple and transparent instruments.

Internationally, the work on simple and transparent securitisations has also progressed significantly. In November the BCBS published a consultation paper, with the consultation running until February 2016, on how best to incorporate STC securitisations into the bank capital framework.

Furthermore, the BCBS is working on a review of the regulatory framework for **sovereign exposures**. The sources and channels of sovereign risk can pose significant challenges to fiscal and monetary policy-makers and financial regulators alike. These risks have once again been brought to the fore by the recent financial

crisis. The ECB supports the potential revision of the regulatory framework by the BCBS in a careful, holistic and gradual manner, while being mindful that the work should be coordinated at the global level so that policies are applied in a homogeneous way across jurisdictions. The work should also assess the broader issues related to the role of sovereign debt markets and the impact that potential changes in the regulatory framework may have on this role and on certain market segments. Potential policies currently under discussion at the BCBS include – in addition to the option of leaving the regulatory framework unchanged – the options of stricter capital requirements for sovereign exposures, diversification requirements and enhanced Pillar 2 and enhanced Pillar 3 disclosure requirements. Given the widespread reach and impact of any policy option, these policy options should be carefully assessed.

**Table 3.9**  
Selected new legislation and proposals for legislative provisions for the banking sector in the EU

Initiative	Description	Current status
Bank Recovery and Resolution Directive (BRRD)	The BRRD sets out a framework for the resolution of credit institutions and investment firms, with harmonised tools and powers relating to prevention, early intervention and resolution for all EU Member States.	The BRRD should have been transposed into national legislation by 31 December 2014. However, several Member States have still not completed the transposition. Notably, the bail-in provisions will also be applicable as of 1 January 2016.
Deposit Guarantee Scheme Directive (DGS Directive)	The DGS Directive deals mainly with the harmonisation and simplification of rules and criteria applicable to deposit guarantees, a faster pay-out, and improved financing of schemes for all EU Member States.	The DGS Directive should have been transposed into national legislation by 3 July 2015. However, several Member States have still not completed the transposition.
Single Resolution Mechanism Regulation (SRM Regulation)	The SRM Regulation establishes a single system, with a Single Resolution Board (SRB) and a Single Resolution Fund (SRF), for an efficient and harmonised resolution of banks within the SSM. The SRM is governed by two main legal texts: the SRM Regulation, which covers the main aspects of the mechanism, and an Intergovernmental Agreement (IGA) relating to some specific aspects of the SRF.	The SRM Regulation came into force on 1 January 2015. The SRB has been set up and is operational. However, most resolution functions (including the SRF, subject to entry into force of the IGA) will apply as from 1 January 2016. The IGA was signed by all Member States (except the United Kingdom and Sweden) on 21 May 2014. However, some Member States still need to have it ratified by the national parliament. As the operations of the SRB rely to some extent on the national implementation of the BRRD, any delay in the BRRD's transposition could affect the SRB's functioning.
Regulation on structural measures	The proposed regulation would introduce restrictions on certain activities and sets out rules on structural separation, with the aim of improving the resilience of EU credit institutions.	The European Commission's proposal was published on 29 January 2014. Discussions are ongoing in the European Parliament and the EU Council. The ECB's legal opinion on the proposal was published on 19 November 2014.

The **Bank Recovery and Resolution Directive** (BRRD) establishes common and efficient tools and powers for managing failures of credit institutions and investment firms in an orderly manner throughout the EU. In particular, the BRRD introduces the bail-in tool<sup>91</sup>, which will be of paramount importance for shifting the cost of bank failures from the taxpayer to, first and foremost, the shareholders and creditors of the failing bank.

One key reform on the regulatory agenda is addressing the too-big-to-fail problem of global systemically important banks (G-SIBs). On 9 November, the Financial Stability Board (FSB) issued the final total loss-absorbing capacity (TLAC) standard for G-SIBs. The new TLAC standard will help increase the resolvability of G-SIBs, so that authorities can implement an orderly resolution when a G-SIB is failing, which minimises the impact on financial stability, maintains the continuity of critical functions, and avoids exposing public funds to loss. The TLAC standard defines a minimum requirement for the instruments and liabilities that should be readily

<sup>91</sup> Member States need to apply the bail-in tool as of 1 January 2016 at the latest.

available for bail-in within resolution at G-SIBs, but does not limit authorities' powers under the applicable resolution law to expose other liabilities to loss through bail-in or the application of other resolution tools.

The TLAC standard involves a two-stage phase-in of the requirement. As of 1 January 2019, G-SIBs must have TLAC of an amount corresponding to at least 16% of risk-weighted assets and 6% of the Basel III leverage ratio denominator, whichever is the highest. As from 1 January 2022, they must have TLAC of an amount corresponding to at least 18% of risk-weighted assets and 6.75% of the Basel III leverage ratio denominator, whichever is the highest.<sup>92</sup> Given that the TLAC standard is designed as a minimum requirement to ensure a global level playing field for large and internationally active banks, the relevant authorities have the option to increase the TLAC requirement on a case-by-case basis, whenever deemed necessary to achieve orderly resolution.

In the EU, a requirement for own funds and eligible liabilities (MREL) has been set out in the BRRD.<sup>93</sup> While the TLAC requirement will only apply to G-SIBs, MREL is applicable to all banks. Although some features of MREL and the TLAC requirement differ, the introduction of the TLAC requirement would, in the ECB's view, not be inconsistent with the provisions of the BRRD. The BRRD allows the introduction of a harmonised minimum requirement that takes account of, inter alia, international standards. It will thus be possible to address differences between the TLAC requirement and MREL via the BRRD review clause in 2016. This will also help to ensure consistency and reduce the regulatory uncertainty regarding bail-in requirements and minimum requirements for loss-absorbing capacity in banks.

Significant progress has been made in the setting-up of a banking union in Europe. The first pillar of the banking union, the **Single Supervisory Mechanism** (SSM) became operational on 4 November 2014, while the second pillar of the banking union, the **Single Resolution Mechanism** (SRM), became operational on 1 January 2015. In this context, the Single Resolution Board (SRB) has been established and has started to work on the elaboration of resolution plans and related tasks. It should be noted, however, that most of the provisions in the SRM Regulation only apply as from 1 January 2016. During the course of 2015 the ECB and the SRB have cooperated on a number of issues, and one ECB Executive Board member, the Vice-Chair of the Supervisory Board, has also been designated by the ECB to be its permanent observer at the meetings of the SRB.

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<sup>92</sup> G-SIBs headquartered in emerging market economies will get a longer conformity period. These G-SIBs will be required to meet the 16% RWA and 6% Basel III leverage ratio denominator no later than 1 January 2025, and the 18% RWA and 6.75% Basel III leverage ratio denominator no later than 1 January 2028. This conformity period will be accelerated if, in the next five years, corporate debt markets in these economies reach 55% of the emerging market economy's GDP.

<sup>93</sup> Under the BRRD, Member States are required to ensure that institutions meet an MREL for bail-ins. The main differences between the TLAC proposal and MREL were described in the November 2014 FSR.

## Regulatory initiatives for financial markets and infrastructures

In addition to initiatives in the area of banking regulation, several steps have also been taken to strengthen the resilience of financial infrastructures.

The **ECB Regulation on oversight requirements for systemically important payment systems** entered into force on 12 August 2014. Four payment systems are subject to this Regulation: TARGET2 (operated by the Eurosystem), EURO1 and STEP2-T (both operated by EBA Clearing), and CORE (FR) (operated by STET). These systemically important payment systems had to comply with the requirements of the Regulation by August 2015. All of the systems are currently being assessed against the Regulation.

**Table 3.10**

### Selected new legislation and legislative proposals for financial markets and infrastructures in the EU

Initiative	Description	Current status
ECB Regulation on oversight requirements for systemically important payment systems	The aim of the Regulation is to ensure the efficient management of all types of risk that systemically important payment systems (SIPs) face, together with sound governance arrangements, objective and open access, as well as the efficiency and effectiveness of SIPs.	The Regulation entered into force on 12 August 2014.
European Market Infrastructure Regulation (EMIR)	The aim of the Regulation is to bring more safety and transparency to the over-the-counter derivatives market and to set out rules for, inter alia, central counterparties and trade repositories.	The Regulation entered into force on 16 August 2012.
Regulation on improving the safety and efficiency of securities settlement in the EU and on central securities depositories (CSD Regulation)	The Regulation introduces an obligation of dematerialisation for most securities, harmonised settlement periods for most transactions in such securities, settlement discipline measures and common rules for central securities depositories.	The Regulation entered into force on 17 September 2014. Implementation and drafting of technical standards is in progress.
Markets in Financial Instruments Directive and Regulation (MiFID II/MiFIR)	The legislation applies to investment firms, market operators and services providing post-trade transparency information in the EU. It is set out in two pieces of legislation: a directly applicable regulation dealing, inter alia, with transparency and access to trading venues, and a directive governing the authorisation and the organisation of trading venues and investor protection.	Directive 2014/65/EU on markets in financial instruments (MiFID II) and Regulation (EU) No 600/2014 on markets in financial instruments (MiFIR) were both published in the Official Journal of the EU on 12 June 2014.
Proposal for a Money Market Fund Regulation (MMF Regulation)	The proposal addresses the systemic risks posed by this type of investment entity by introducing new rules aimed at strengthening their liquidity profile and stability. It also sets out provisions that seek, inter alia, to enhance their management and transparency, as well as to standardise supervisory reporting obligations.	The European Commission's proposal was published in September 2013. The ECON Committee of the European Parliament adopted its position on 26 February, while discussions are still ongoing in the Council. The ECB adopted its position on 21 May 2014.
Proposal for a Regulation on reporting and transparency of securities financing transactions	The proposal contains measures aimed at increasing the transparency of securities lending and repurchase agreements through the obligation to report all transactions to a central database. This seeks to facilitate regular supervision and to improve transparency towards investors and on re-hypothecation arrangements.	The European Commission's draft proposal was published in January 2014. The ECB expressed its support, in principle, for the proposal in its legal opinion of 24 June 2014. The EU Council adopted its general approach on 14 November 2014, and the ECON Committee of the European Parliament adopted its report on 24 March 2015. A political agreement was reached in June 2015.

In the aftermath of the financial crisis, the leaders of the G20 issued a declaration at the 2009 Pittsburgh meeting that called for improvements to over-the-counter (OTC) derivatives markets. One of the EU's main legislative initiatives to implement the G20 mandate is the **European Market Infrastructure Regulation (EMIR)**, the implementation of which has continued to make progress. In September 2015 the ECB published its response to the Commission's consultation on the review of EMIR. The ECB proposes amending the Regulation in order to fully recognise the role taken up by the ECB in the field of banking supervision, to address issues related to the quality and availability of derivatives data, and to further enhance the requirements for mitigating pro-cyclicality. Moreover, the ECB supports the inclusion of macroprudential intervention tools in EMIR, in order to prevent the build-up of systemic risk resulting, in particular, from excessive leverage, and to further limit the pro-cyclicality of margins and haircuts.

The **Regulation on improving securities settlement in the EU and on central securities depositories** (the CSD Regulation) entered into force on 17 September 2014. The aim of the Regulation is to increase the safety and efficiency of securities settlement and settlement infrastructures (i.e. central securities depositories) in the EU. It harmonised settlement periods for most transactions in such securities as from 1 January 2015 (T+2) and introduced, inter alia, settlement discipline measures and common rules for CSDs. On 28 September the European Securities and Markets Authority (ESMA) submitted the technical standards relating to CSD requirements and internalised settlement to the Commission. The technical standards relating to settlement discipline measures have not yet been finalised as discussions on the buy-in process are ongoing.

The EBA is in the process of finalising its technical standards. Following submission, the Commission has three months for approval. Once endorsed by the Commission, both the European Parliament and the Council have an objection period.

In the field of **shadow banking**, the FSB has continued with its work on the deliverables laid out in the roadmap on “Transforming shadow banking into resilient market-based financing”, published on 14 November 2014.<sup>94</sup>

Over the last six months, the FSB has been working on the identification of risks associated with market liquidity and asset management activities in the current market conditions, as well as potential structural sources of vulnerability associated with asset management activities. On the basis of this work, the FSB and IOSCO will develop policy recommendations, where necessary, in the first half of 2016. The ECB actively supports this work, given the growing importance of this part of the financial system and the need to extend the regulatory toolkit to mitigate risks to stability in other parts of the financial system.

## Regulatory initiatives for the insurance sector

The Solvency II Directive will come into force in January 2016, marking a major change in the regulation of insurance firms in the European Economic Area. With the publication of the Implementing Technical Standards (ITSs) and Guidelines on Solvency II, the European Insurance and Occupational Pensions Authority (EIOPA) has ensured the timely implementation of Solvency II. To develop the Solvency II framework further, EIOPA advised<sup>95</sup> the European Commission to create a new asset class for high-quality infrastructure investments. Furthermore, the European

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<sup>94</sup> See the FSB’s press release of 14 November 2014 (available at: <http://www.financialstabilityboard.org/2014/11/progress-report-on-transforming-shadow-banking-into-resilient-market-based-financing/>).

<sup>95</sup> See the Final Report on Consultation Paper No 15/004 on the Call for Advice from the European Commission on the identification and calibration of infrastructure investment risk categories, 29 September 2015 (available at: <https://eiopa.europa.eu/Publications/Consultations/EIOPA-BoS-15-223%20Final%20Report%20Advice%20infrastructure.pdf>).

Commission announced<sup>96</sup> that it will change the Solvency II Delegated Regulation regarding the treatment of securitisations once the Securitisation Regulation has been adopted.

At the international level, the International Association of Insurance Supervisors (IAIS) has developed a higher loss absorbency (HLA) requirement for global systemically important insurers (G-SIIs)<sup>97</sup>, which will be applied as from 2019. The IAIS will make further refinements to the HLA if the outcome of the public consultations on the G-SII assessment methodology and the definitions of non-traditional and non-insurance activities (NTNIs) shows them to be necessary. The final goal is to develop risk-based, group-wide, global insurance capital standards.

**Table 3.11**

**Selected legislative proposals for the insurance sector in the EU**

Initiative	Description	Current status
Solvency II Directive/Omnibus II Directive	The Solvency II Directive is the framework directive that aims to harmonise the different regulatory regimes for insurance corporations in the European Economic Area. Solvency II includes capital requirements, supervision principles and disclosure requirements. The Omnibus II Directive aligns the Solvency II Directive with the legislative methods introduced by the Lisbon Treaty, incorporates new supervisory measures given to EIOPA and makes technical modifications.	The Solvency II Directive was adopted by the EU Council and the European Parliament in November 2009. It is now scheduled to come into effect on 1 January 2016. The Delegated Act on Solvency II was published in the Official Journal of the EU on 17 January 2015. A first set of Implementing Technical Standards (ITSs) and Guidelines on approval processes was published in February 2015. The second set of ITSs on Pillar 1 (quantitative basis), Pillar 2 (qualitative requirements), Pillar 3 (enhanced reporting and disclosure) and supervisory transparency as well as Guidelines relevant for Pillar 2 and Pillar 3 was published in July 2015.

### Other initiatives

The European Commission published its action plan on a **capital markets union** (CMU) on 30 September following the publication of a consultation to which the Eurosystem contributed on 21 May 2015. CMU has the potential to complement banking union and strengthen Economic and Monetary Union by improving cross-border risk-sharing and making the financial system more resilient. CMU will also support European growth by diversifying sources of funding and increasing companies' access to financing. In general, however, support for SMEs and banks' ability to contribute to the financing of the economy should not be accomplished at the expense of watering down the robust regulatory framework resulting from post-crisis reforms.

The ECB welcomes the early actions which accompany the action plan, notably the proposed European framework for securitisation, which also includes differentiated prudential treatment for simple, transparent and standardised (STS) securitisation, including reduced bank capital charges.

<sup>96</sup> See the Proposal for a Regulation of the European Parliament and of the Council laying down common rules on securitisation and creating a European framework for simple, transparent and standardised securitisation and amending Directives 2009/65/EC, 2009/138/EC, 2011/61/EU and Regulations (EC) No 1060/2009 and (EU) No 648/2012, 30 September 2015 (available at: [http://ec.europa.eu/finance/securities/docs/securitisation/com-2015-472\\_en.pdf](http://ec.europa.eu/finance/securities/docs/securitisation/com-2015-472_en.pdf)).

<sup>97</sup> See the IAIS press release of 5 October 2015 (available at: <http://iaisweb.org/index.cfm?event=getPage&nodeId=25295>).

However, a long-term vision accompanied by an ambitious agenda for further action is necessary in order to achieve the final goal of CMU. This was the view taken by the Eurosystem in its contribution to the Commission's Green Paper on CMU<sup>98</sup>, where it signalled the importance of achieving a situation where all market participants with the same relevant characteristics face a single set of rules, have equal access to markets and are treated equally when they are active in these markets.

Moreover, the ECB supports the Commission's assessment that there is a need to review the macroprudential framework to cater for potential financial stability effects and needs resulting from CMU. Better data collection, increased coordination among macroprudential authorities and an enhanced toolkit to deal with the build-up of risks in market-based activities and entities outside the regulated banking sector should form part of the CMU agenda. This requires a wider regulatory framework that also captures systemically important non-banks.

In sum, achieving CMU will require a combination of early "quick wins" to maintain momentum as well as sustained efforts over a number of years in a wide range of areas which are key for the functioning of capital markets. The ECB will remain engaged in the next steps of the process.

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<sup>98</sup> See *Building a Capital Markets Union – Eurosystem contribution to the European Commission's Green Paper, 2015* (available at: [http://www.ecb.europa.eu/pub/pdf/other/150521\\_eurosystem\\_contribution\\_to\\_green\\_paper\\_-\\_building\\_a\\_cmuen.pdf](http://www.ecb.europa.eu/pub/pdf/other/150521_eurosystem_contribution_to_green_paper_-_building_a_cmuen.pdf)).



# Special features

## A The impact of the Basel III leverage ratio on risk-taking and bank stability<sup>99</sup>

*The Basel III leverage ratio aims to constrain the build-up of excessive leverage in the banking system and to enhance bank stability. Concern has been raised, however, that the non-risk-based nature of the leverage ratio could incentivise banks to increase their risk-taking. This special feature presents theoretical considerations and empirical evidence for EU banks that a leverage ratio requirement should only lead to limited additional risk-taking relative to the induced benefits of increasing loss-absorbing capacity, thus resulting in more stable banks.*

### Introduction

As a response to the global financial crisis, the Basel Committee on Banking Supervision (BCBS) decided to undertake a major reform of the regulatory framework of the banking system. Under the new Basel III banking regulations, a non-risk-based leverage ratio (LR) requirement will be introduced alongside the risk-based capital framework with the aim to “restrict the build-up of excessive leverage in the banking sector to avoid destabilising deleveraging processes that can damage the broader financial system and the economy”.<sup>100</sup> However, this move away from a solely risk-based capital requirement has raised some concern about possible increased bank risk-taking potentially offsetting the benefits gained from requiring banks bound by the LR to hold more capital.

This special feature addresses precisely this trade-off between additional loss-absorbing capacity and higher bank risk-taking associated with an LR requirement in both a theoretical and empirical setting. Using a simple theoretical model, it is shown that the increased incentive to take risk is more than outweighed by the increase in loss-absorbing capacity from higher capital, thus leading to more stable banks. These results are confirmed within an empirical analysis on a large sample of EU banks. The empirical estimates suggest that banks bound by the LR increase their risk-weighted assets to total assets ratio by around 1.5-2 percentage points more than they otherwise would, i.e. without an LR requirement. Importantly, this small increase in risk-taking is more than compensated for by the substantial increase in capital positions for highly leveraged banks, which results in significantly lower estimated distress probabilities for banks bound by the LR.

<sup>99</sup> This special feature was prepared by Michael Grill, Jan Hannes Lang and Jonathan Smith. It is based on the analysis contained in Grill, M., Lang, J. H. and Smith, J. (2015), “The Leverage Ratio, Risk-Taking and Bank Stability”, mimeo. (See EBA 4th Annual Research Workshop Website).

<sup>100</sup> See the BCBS press release of 12 January 2014 on BCBS (2014a), *Basel III leverage ratio framework and disclosure requirements*, January (available at <http://www.bis.org/publ/bcbs270.htm>). The Basel III regulations also include a strengthened risk-based capital framework and two new liquidity requirements, the Liquidity Coverage Ratio (LCR) and the Net Stable Funding Ratio (NSFR).

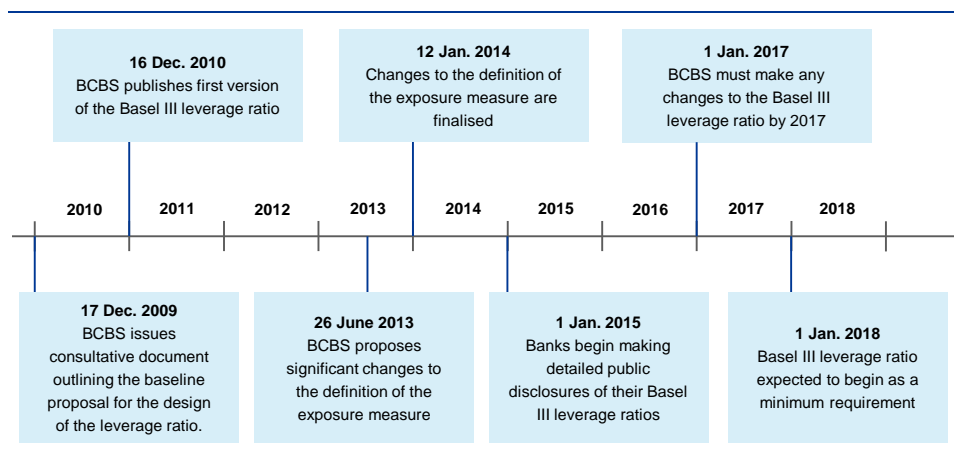
The next section outlines the Basel III LR framework and associated key regulatory milestones. The second section presents theoretical results on the trade-off between higher loss-absorbing capacity and additional risk-taking induced by an LR requirement. The final section presents empirical evidence from EU banks that the introduction of the LR requirement into the regulatory framework should lead to more stable banks, despite slightly higher bank risk-taking.

## The leverage ratio in the Basel III capital framework

The build-up of excessive leverage (both on and off-balance sheet) was identified as a major driver in the recent global financial crisis. The BCBS envisages the LR playing a key role in avoiding such adverse developments in the future. The LR is a non-risk-based capital measure and is defined as Tier 1 capital over a bank's total exposure measure, which consists of both on and off-balance-sheet items.<sup>101</sup> It is widely expected that the LR will become a Pillar 1 requirement for banks under Basel III, ever since the BCBS issued a consultative document in December 2009<sup>102</sup> outlining a baseline proposal for the design of the LR. Following further public consultations and revisions to the design, the BCBS issued the (almost) final LR framework in January 2014. The BCBS is currently testing a minimum Tier 1 LR of 3% until 1 January 2017 with a view to migrating to a Pillar 1 requirement on 1 January 2018.<sup>103</sup> Chart A.1 summarises the key regulatory milestones related to the LR which will be used in the empirical analysis to motivate the econometric set-up to identify the impact of an LR requirement on bank risk-taking.

### Chart A.1

Key dates on the introduction of the Basel III leverage ratio



Source: Grill, Lang and Smith (2015).

<sup>101</sup> See BCBS (2014a). For on-balance-sheet items, the exposure measure generally relies on accounting values, whereas it uses a specific treatment for derivatives and securities financing transactions.

<sup>102</sup> BCBS (2009), *Strengthening the resilience of the banking sector, Consultative Document*, December.

<sup>103</sup> See BCBS (2014a). The BCBS will review the calibration of a minimum LR requirement and make any final adjustment to it by 2017. In Europe, the EBA is currently preparing a report on the impact and the potential calibration of the LR. Based on the results of the report, the European Commission is to submit a report on the impact and effectiveness of the LR to the European Parliament and the Council by the end of 2016.

## The benefits and (potential) costs of a leverage ratio constraint

There are various reasons why an LR requirement may be beneficial. Most importantly, highly leveraged banks have lower loss-absorbing capacity and are arguably less resilient to shocks. This is of particular concern if the build-up of excessive leverage concerns the entire banking sector, as witnessed in the run-up to the financial crisis. By capping the total amount of leverage banks can achieve, an LR requirement ensures that banks with a large share of low risk-weighted assets hold additional loss-absorbing capacity. The LR may therefore present a better measure for containing aggregate risk and protecting against rare (and highly correlated) losses in the financial system which are not fully covered under the risk-based capital framework.<sup>104</sup>

During the financial crisis, it was also observed that highly leveraged banks that experienced failure or distress were still showing strong risk-based capital ratios.<sup>105</sup> Thus, by providing a simple non-risk-based capital requirement, the LR can potentially alleviate issues surrounding model risk in the calculation of risk-weights or even the outright manipulation of risk-weights.<sup>106</sup> Indeed, the crisis has shown that there can be circumstances under which sophisticated concepts for risk measurement fail and there are also indications of deliberate optimisation of risk-weighted assets by banks (“gaming”).<sup>107</sup>

Notwithstanding these potential benefits, the LR has been criticised by market participants and other stakeholders. The main concern relates to the risk-insensitivity of the LR: assets with the same nominal value but of different riskiness are treated equally and face the same capital requirement under the non-risk-based LR.<sup>108</sup> Given that an LR requirement has a skewed impact, binding only for those banks with a large share of low risk-weighted assets on their balance sheets, the move away from a solely risk-based capital requirement may thus induce these banks to increase their risk-taking, potentially offsetting the benefit gained from requiring them to hold more capital.<sup>109</sup> While these concerns are generally valid, they need to be

<sup>104</sup> See BCBS (2014b), *Capital floors: the design of a framework based on standardised approaches*, Consultative document, December.

<sup>105</sup> See BCBS (2014a).

<sup>106</sup> Kiema and Jokivuolle (2014) show that an LR requirement can improve bank stability in the presence of model risk. See Kiema, I. and Jokivuolle, E. (2014) “Does a leverage ratio requirement increase bank stability?”, *Journal of Banking & Finance*, Vol. 39(1), pp. 240-254. In addition, Blum (2008) shows in an adverse selection model that a non-risk-based capital ratio can improve bank stability by reducing the incentive to conceal true risk levels. See Blum, J. (2008), “Why ‘Basel II’ may need a leverage ratio restriction”, *Journal of Banking & Finance*, Vol. 32(8), pp. 1699-1707.

<sup>107</sup> See Behn, M., Haselmann, R. and Vig, V. (2014), *The limits of model-based regulation*, Working Paper, August.

<sup>108</sup> See, e.g. ESRB (2015), *The ESRB Handbook on Operationalising Macroprudential Policy in the Banking Sector – addendum on macroprudential leverage ratios*.

<sup>109</sup> This concern has been voiced predominantly by banks. For example, the ex-chief executive of Barclays, Antony Jenkins, expressed concern about LRs, saying they needed “to be interpreted with care to avoid unintended consequences such as credit restriction and asset quality dilution” (available at <http://www.theguardian.com/business/2013/jun/28/barclays-warns-on-new-capital-rules>). Other examples include the Swedish financial supervisory authority (Finansinspektionen) noting that, “If non-risk-sensitive capital requirements – such as a leverage ratio requirement or standardised floor – are set at a level that makes them the binding capital restriction, Sweden may end up with a smaller, but riskier banking system ... A high leverage ratio requirement could consequently result in less financial stability” (available at [http://www.fi.se/upload/90\\_English/95\\_Supervision/framtida-kapitalkrav-juni-2015-eng.pdf](http://www.fi.se/upload/90_English/95_Supervision/framtida-kapitalkrav-juni-2015-eng.pdf)).

assessed in the context of the overall prudential framework (rather than in isolation): increased risk-taking should raise banks' risk-weighted assets, provided that the risk weights are properly determined, so that at some point the risk-weighted capital framework becomes binding again. Hence, the potential for a marginal increase in risk-taking owing to an LR requirement should be limited as long as both approaches to capital regulation are mutually reinforcing.

The above discussion therefore suggests that a trade-off from imposing an LR requirement should exist, even when abstracting from model risk and risk-weight manipulations. On the one hand, it should enhance banks' loss-absorbing capacity and their resilience; on the other hand, there is a potential incentive to increase risk. To analyse this trade-off between risk-taking and higher loss absorption more formally, it is useful to consider a simple micro model of bank risk-taking similar in spirit to Dell'Ariccia et al. (2014).<sup>110</sup> The proposed model explicitly considers a situation in which there exists both a risk-weighted capital requirement and an LR requirement, and hence banks are subject to the maximum of the two capital charges. The box describes the theoretical set-up of the model in more detail.

The model yields two key results. First, imposing an LR constraint incentivises banks to modestly increase risk-taking. This occurs because the non-risk-based nature of the LR effectively reduces the marginal cost of risk-taking. Nevertheless, this increase in risk-taking is not unbounded. On the one hand, the risk-based capital framework underlies the LR constraint, such that if the bank takes on too much additional risk it will simply move back into the risk-based capital framework. On the other hand, an offsetting effect on risk-taking incentives exists because banks are required to hold more capital, as this to some extent makes them more cautious (banks have more "skin in the game"). Consequently, the second key result from the model suggests that imposing an LR requirement should be beneficial for bank stability as the positive effect of additional loss-absorbing capacity of banks dominates the negative effect of increased risk-taking. In particular, the model suggests that if the LR requirement is not set at an excessive level, adding an LR constraint to the risk-based capital framework will both weakly decrease banks' probability of failure and, if the distribution of banks is not such that the majority of banks are concentrated around the LR minimum requirement, which is arguably the case in reality, strictly decrease expected losses.<sup>111</sup> The model therefore suggests two empirically testable hypotheses.

1. Introducing an LR requirement incentivises those banks bound by it to modestly increase risk-taking.
2. Obliging banks to hold greater capital via an LR requirement is beneficial for bank stability.

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<sup>110</sup> Dell'Ariccia, G., Laeven, L. and Marquez, R. (2014), "Real interest rates, leverage, and bank risk-taking", *Journal of Economic Theory*, Vol. 149, pp. 65-99.

<sup>111</sup> A weak decrease includes circumstances in which there is neither an increase nor a decrease. A strict decrease includes only those circumstances in which there is a decrease.

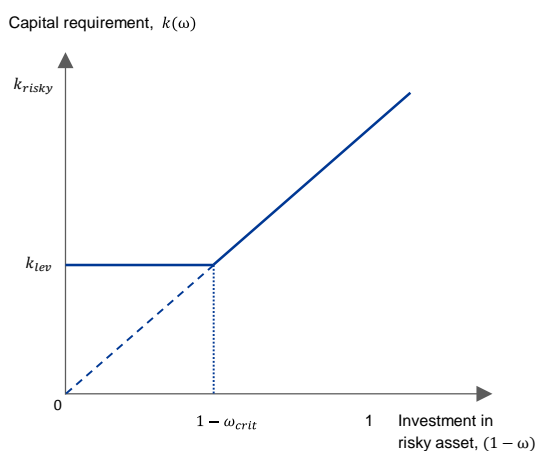
## Box

### Theoretical considerations on the leverage ratio: risk-taking vs. loss-absorbing capacity<sup>112</sup>

Consider a one-period economy with three types of agent: banks, investors and depositors. Banks raise funds from both depositors and equity holders (who both have outside options), and use these funds to invest in a portfolio of assets. Banks can choose between two assets: a (relatively) safe asset and a risky asset. Denote by  $\omega$  investment in the safe asset and  $(1 - \omega)$  investment in the risky asset.<sup>113</sup> The risky asset is termed as such since, although it offers a greater expected return and has the potential for a larger payoff, it is more likely to fail (and thus result in a loss) than the safe asset. In particular, there exist two possible states of nature: state  $s_1$  can be thought of as a good state and occurs with probability  $\mu$ , while state  $s_2$  can be thought of as a bad state and occurs with probability  $(1 - \mu)$ . The safe asset returns  $R_1 \geq 1$  if state  $s_1$  occurs and  $(1 - \lambda_1) \in (0,1)$  if state  $s_2$  occurs. On the other hand, in state  $s_1$ , the risky asset returns  $R_2^h > R_1$  with probability  $\pi$  and  $(1 - \lambda_2) \in (0,1)$  with probability  $(1 - \pi)$ , while in state  $s_2$  the risky asset returns  $(1 - \lambda_3) \in (0,1)$  with probability  $\pi$ , and 0 otherwise.<sup>114</sup> The key friction inherent in the model is that there is the chance of a correlated system-wide shock in state  $s_2$ . While it has a small probability of occurring, it hits both the safe and the risky asset.<sup>115</sup> Therefore, as discussed above, the assumed friction relates to one of the key reasons for the introduction of an LR requirement in Basel III.<sup>116</sup>

#### Chart A.2

##### The kinked nature of capital requirements



Source: Grill, Lang and Smith (2015).

Now consider a situation in which there exists both a risk-weighted capital requirement and an LR requirement, and hence banks are subject to the maximum of the two capital charges. The risk-weighted requirement, denoted  $k(\omega)$ , depends on the risk choice of the bank. The risky asset, since it is more likely to incur losses, requires a higher capital charge under the risk-based requirement. Thus the more the bank invests in the risky asset, the higher its capital requirement. By contrast, under the LR, denoted  $k_{lev}$ , the capital requirement is independent of how much the bank invests in the safe or the risky asset: banks are required to hold this capital independent of the riskiness of their portfolio. This capital framework leads to a kinked capital requirement as depicted in Chart

A.2. Since the risk-based requirement increases in holdings of the risky asset, at low-risk holdings, the risk-based capital requirement lies below the LR requirement (see the dotted line). As holdings of the risky asset increase, the risk-based requirement increases until at some level, denoted  $(1 - \omega_{crit})$  in the chart, it starts to exceed the LR requirement.

<sup>112</sup> For a more detailed exposition, see Grill, Lang and Smith (2015).

<sup>113</sup> The size of the bank's balance sheet is normalised to one.

<sup>114</sup> It is assumed that the losses are greater in the risky asset, so  $\lambda_1 < \lambda_2 < \lambda_3$ .

<sup>115</sup> The term  $(1 - \mu)$  is therefore assumed to be small.

<sup>116</sup> Concerns related to gaming of risk-weights and model risk are abstracted from; including these considerations in the analysis would merely strengthen the argument since the risk-based framework is inherently susceptible to them. Instead, the analysis concentrates on the LR's ability to cover risks not fully captured under a solely risk-based framework.

As noted in the main text, the model yields two key results. First, imposing an LR requirement incentivises banks to increase risk-taking. This can be seen by comparing the first order condition (FOC) when the model is solved under a solely risk-based capital requirement, and when an LR constraint is added. Under a solely risk-based capital requirement, the FOC characterising the optimal risk-choice is:<sup>117</sup>

$$\mu[\pi R_2^h + (1 - \pi)(1 - \lambda_2) - R_1] = -\rho k'(\omega) - \mu k'(\omega) - c'(\omega)$$

The FOC shows that banks increase risk-taking until the marginal return from greater investment in the risky asset (i.e. the left-hand side of the equation) equals the marginal cost (i.e. the right-hand side). What should be noted is that the marginal cost incorporates the need to increase capital when taking on further risk. This can be seen in the terms containing  $k'(\omega)$ . This is by definition of the risk-based capital requirement in the model, as it is a function of the bank's risk level. Since capital is a relatively costly source of funds, this to some extent disincentivises risky investment. Indeed, there is a trade-off which the bank can exploit: by choosing to hold less risk, the bank somewhat offsets this lower return by its ability to lower expensive capital.

With a non-risk-based LR as the binding constraint, all terms related to the risk-weighted capital requirement,  $k(\omega)$ , disappear, since increasing risk no longer requires the bank to increase capital. Formally, the FOC becomes:<sup>118</sup>

$$\mu[\pi R_2^h + (1 - \pi)(1 - \lambda_2) - R_1] + (1 - \mu)Y = -c'(\omega)$$

Removing this dependence on risk means that banks can shift into the risky asset without having to hold additional capital. In other words, the marginal cost of risk-taking declines. At the same time, since banks now survive slightly larger shocks, they start to internalise and attach value to these returns they otherwise would have ignored. This can be seen via the addition of  $Y$  in the above FOC and can be seen as what is termed in the literature as a “skin-in-the-game” effect. There are thus two opposing effects. The first effect (i.e. removing the link between risk and capital), incentivises greater risk-taking, whereas the second effect reduces this incentive. Yet this skin-in-the-game effect is small and the first effect dominates.

Nevertheless, this is an isolated analysis and leads to the second key result. Although banks are taking on greater risk, they are at the same time holding a greater capital buffer which means that they can absorb greater losses. Taking these considerations together, the model suggests that if the LR is not set excessively high, imposing an LR will both weakly decrease banks' probability of failure and, if the distribution of banks is not such that the majority of banks are concentrated around the LR minimum, strictly decrease expected losses.<sup>119</sup> Therefore, the increase in loss-absorbing capacity outweighs the increase in risk-taking. Chart A.3 illustrates how expected losses and the

<sup>117</sup> Where  $\rho$  is equal to the opportunity cost of equity holders, and  $c(\omega)$  is a convex investment cost à la Allen and Gale. See Allen, F. and Gale, D. (2000), “Bubbles and Crises”, *The Economic Journal*, Vol. 110, Issue 460, pp. 236-255.

<sup>118</sup> Where  $Y$  can be equal to 0,  $\pi(\lambda_3 - \lambda_1)$  or  $[\pi(\lambda_3 - \lambda_1) + (1 - \pi)(1 - \lambda_1)]$  depending on the parameter values, and particularly the exact value of the LR, since with higher capital, banks may survive larger losses and, as a result, take this return into consideration.

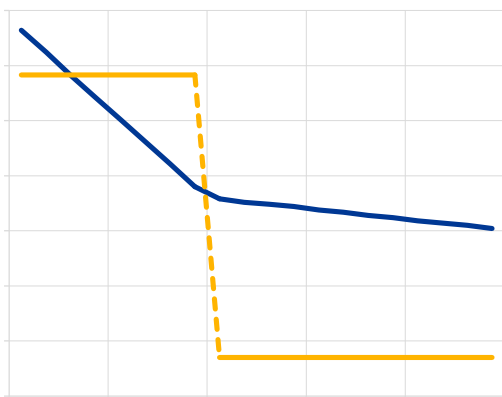
<sup>119</sup> The caveat on excessively high levels of the LR arises due to the outside option available to equity investors. This outside option is larger than that of depositors. Since investors require a higher return, at some point, obliging banks to hold so much capital will force them to go beyond their optimal risk choice just to meet equity holders' requirements. The model therefore issues a warning about the absolute level of the LR, since if risk-taking is not sufficiently constrained because banks are forced to go beyond their optimal risk choice, the LR can cease to be beneficial.

### Chart A.3

#### Leverage ratio, expected losses and default

(x-axis: leverage ratio)

- Expected losses (left-hand scale)
- Probability of default (right-hand scale)



Source: Grill, Lang and Smith (2015).

Notes: There exists a discrete jump in both series owing to the discrete nature of the asset payoff structure. The jump occurs at the point where the bank starts to survive larger shocks in the bad state  $s_2$ .

probability of default depend on the level of the LR. As the LR requirement increases and starts to bind, both expected losses and the probability of default decline.

The above result is obtained because although banks increase their risk-taking, this increase is not unbounded. It was already noted that an offsetting effect exists by obliging banks to hold greater capital – the skin-in-the-game effect – but there is also a limit to how much additional risk a bank can take on. Despite the LR requirement, the risk-based framework still underlies the capital framework. Thus, if the bank takes on too much additional risk, it will simply move back into the risk-based framework. Hence, as long as the risk-based requirement applies alongside the LR, it acts to constrain the risk-taking incentive.

### Empirical evidence: higher risk-taking but more stable banks

The empirical analysis follows in three stages. First, the joint effects of the LR and risk-taking on bank distress probabilities are estimated in order to quantify the risk/stability trade-off. Second, it is examined whether there is any evidence that banks with low LRs started to increase their risk-taking after the announcement of the new Basel III regulatory regime. Finally, the results from the first two stages of the empirical analysis are combined in a counterfactual simulation to gauge whether an LR requirement is beneficial for bank stability, i.e. whether the estimated increase in risk-taking is dominated by the benefits of increasing loss-absorbing capacity.

The dataset for the empirical analysis consists of a large unbalanced panel of more than 500 EU banks covering the years 2005-14. The dataset has three main building blocks: (i) a large set of bank-specific variables based on publicly available financial statements from SNL Financial; (ii) a unique collection of bank distress events that covers bankruptcies, defaults, liquidations, State aid cases and distressed mergers from various publicly available data sources and; (iii) various country-level macro-financial variables from the ECB's Statistical Data Warehouse. The dataset builds upon and expands the dataset described in Betz et al. (2014).<sup>120</sup>

In a first step, the unique dataset of EU bank distress events is used in a discrete choice modelling framework to analyse the joint effects of the LR and risk-taking on bank stability, while controlling for other relevant bank-specific and country-level

<sup>120</sup> Betz, F., Oprica, S., Peltonen, T. and Sarlin, P. (2014), "Predicting distress in European banks", *Journal of Banking & Finance*, Vol. 45, pp. 225-241.

variables. Since data for the Basel III definition of the LR is unavailable, as the LR proxy, the ratio of Tier 1 equity to total assets is used, which has been shown to correlate very highly with the Basel III regulatory definition of the LR. As a measure of bank risk-taking, the ratio of risk-weighted assets to total assets is taken.<sup>121</sup> Various versions of the following logit model with time and country fixed effects are estimated, where the left-hand-side variable is the binary distress indicator for bank  $i$ , located in country  $j$ , in year  $t + 1$ ;  $\gamma_j$  and  $\lambda_{t+1}$  are country and time fixed effects respectively; and  $X_{i,j,t}$  and  $Y_{j,t}$  are vectors of bank-specific and country-specific control variables that may also include lags and differences:<sup>122</sup>

$$Pr(I_{i,j,t+1} = 1) = \frac{\exp(\alpha + X'_{i,j,t}\theta + Y'_{j,t}\varphi + \gamma_j + \lambda_{t+1})}{1 + \exp(\alpha + X'_{i,j,t}\theta + Y'_{j,t}\varphi + \gamma_j + \lambda_{t+1})}$$

Table A.1 shows the results of the first stage empirical exercise.<sup>123</sup> As can be seen, the LR is a very important indicator for determining bank distress probabilities; both economically and statistically. For example, consider models 1 and 2. Quantitatively they suggest that a 1 percentage point increase in a bank's LR is associated with around a 35-39% decline in the relative probability of distress to non-distress (the odds ratio).<sup>124</sup> This is much larger than the marginal impact from taking on greater risk. The coefficient estimates suggest that increasing a bank's risk-weighted assets ratio by 1 percentage point is associated with an increase in its relative distress probability of only around 1-3.5%. This demonstrates the relative importance of the LR in determining bank distress probabilities. The other models in Table A.1 show that the results are robust to introducing non-linear effects in the LR and risk-weighted assets ratio and to different bank samples. Chart A.4 illustrates the estimated non-linear effects from model 4 graphically. Increasing the LR from low levels seems to be of considerable benefit to bank stability, but as a bank's LR reaches around 5% the benefits of increasing it further start to diminish slightly. This suggests that there may be considerable benefit in introducing the LR requirement with a modest calibration, but advises caution about raising the LR requirement too high as suggested by our theoretical model, since the benefit starts to tail off.

<sup>121</sup> While the ratio of risk-weighted assets to total assets is an imperfect measure of true risk-taking, it is the most direct measure, and it is the risk-taking measure that should be affected by the introduction of an LR requirement. In addition, control variables for the calculation method of risk weights are included in the empirical models, which should partly account for the fact that risk-weight levels appear to differ systematically between the standardised approach and the internal ratings-based approach for determining risk-weights.

<sup>122</sup> A logit model is used instead of a probit model because the fatter-tailed error distribution better matches the empirical frequency of bank distress events. See van den Berg, J., Candelon, B. and Urbain, J. (2008), "A cautious note on the use of panel models to predict financial crises", *Economic Letters*, Vol. 101, pp. 80-83. While the early-warning literature has commonly used a pooled logit approach (see, e.g. Lo Duca, M. and Peltonen, T. (2013), "Assessing systemic risks and predicting systemic events", *Journal of Banking & Finance*, Vol. 37(7), pp. 2183-2195), here, both time and country fixed effects are also controlled for since in-sample fit and unbiased coefficient estimates are more important for the analysis than optimising out-of-sample predictive performance.

<sup>123</sup> The following bank-specific variables are controlled for: non-performing loans (NPLs) to total assets, reserves to impaired loans, pre-tax return on assets (ROA), interest expenses to liabilities, the loan-to-deposit ratio, bank size (via the log of total assets), the relevant Basel regulatory regime at the time and the method used by the bank to calculate risk-weighted assets. The following macro-financial variables are controlled for: change in ten-year yield spread relative to the Bund, gross government debt to GDP, the unemployment rate, real GDP growth, the inflation rate, private sector credit flow to GDP, the credit to GDP ratio, the change in issued bank debt to total liabilities, and the stock market growth rate. All variables are lagged by one year to avoid endogeneity.

<sup>124</sup> For a detailed discussion on the interpretation of logit coefficients, see Cameron, A. and Trivedi, P. (2005), *Microeconometrics: methods and applications*, Cambridge University Press.



**Table A.1**

**Estimated impact of the leverage ratio and risk-taking on bank distress probabilities**

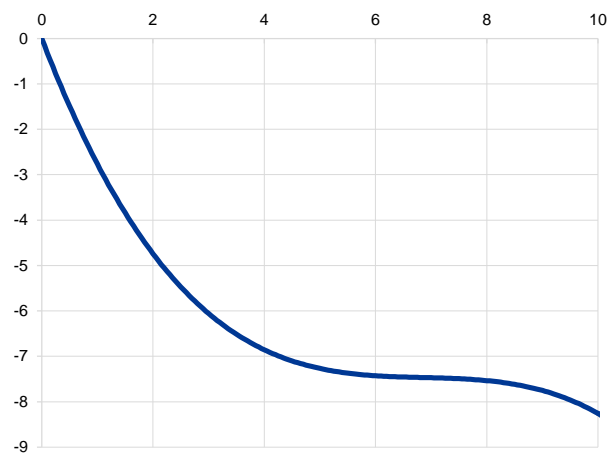
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Leverage ratio proxy	-0.510***	-0.427***	-1.046***	-3.206***	-2.865***	-3.957***	-5.188**
Leverage ratio proxy, squared			0.054***	0.463***	0.420**	0.580***	0.465
Leverage ratio proxy, cubed				-0.023**	-0.021**	-0.028***	-0.014
RWA/total assets	0.035***	0.011	0.166***	0.202***	0.188***	0.251***	0.406**
RWA/total assets, squared			-0.001***	-0.002***	-0.002***	-0.002***	-0.002
Sample	All	All	All	All	Euro area	Western Europe	W. Europe excl. GIIPS
# Observations	1,661	1,661	1,661	1,661	1,234	1,334	674
Pseudo R2	0.284	0.410	0.430	0.437	0.431	0.408	0.559
AUROC	0.870	0.926	0.929	0.930	0.926	0.918	0.961
Country and time fixed effects	No	Yes	Yes	Yes	Yes	Yes	Yes
Bank-specific and macro-financial controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Source: Grill, Lang and Smith (2015) based on data from SNL Financial, ECB Statistical Data Warehouse, and bank distress events defined as in Betz et al. (2014).  
 Notes: Logit model estimates obtained on binary bank distress variable. The numbers in the table are logit coefficients. \*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level. Significance based on clustered robust standard errors. "RWA" refers to risk-weighted assets. "All" means the estimation is based on the entire sample. Euro area includes only those banks which are based in the euro area. Western Europe includes only banks from the following countries: Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden and the United Kingdom. "W. Europe excl. GIIPS" refers to the Western Europe sample excluding banks based in Greece, Ireland, Italy, Portugal and Spain.

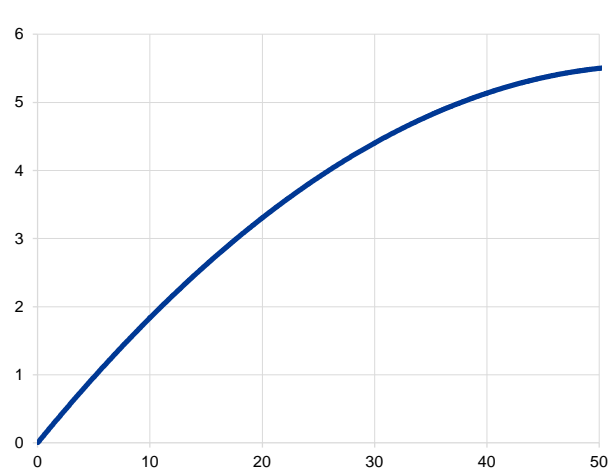
**Chart A.4**

**Illustration of the non-linear effects of the leverage ratio and risk-taking on bank distress probabilities**

(x-axis: leverage ratio; y-axis: log relative distress probability)



(x-axis: RWA/total assets; y-axis: log relative distress probability)



Source: Grill, Lang and Smith (2015) based on data from SNL Financial, ECB Statistical Data Warehouse, and bank distress events defined as in Betz et al. (2014).  
 Notes: The log relative distress probability is equal to the log of the probability of distress divided by the probability of non-distress. Specifically, denote the probability of distress by  $p$ , it is equal to  $\log\left(\frac{p}{1-p}\right)$ . For illustrative purposes, in generating these charts, all variables except the specified variable are set to zero. "RWA" refers to risk-weighted assets.

To identify the impact of an LR requirement on banks' risk-taking behaviour, the panel dimension of the dataset is used in combination with the timing of the Basel III LR announcements, as described above. To achieve identification, the announcement of the LR requirement is considered as a treatment that only affects a subset of banks, i.e. only banks below the LR requirement. The econometric approach is therefore a difference-in-difference type analysis in which the effect of the LR constraint on risk-taking is estimated through a treatment dummy, while controlling for a large set of bank-specific and country-level variables that capture systematic differences in bank behaviour pre- and post-treatment. Specifically, various versions of the following general panel model are estimated, where the left-

hand-side variable is the ratio of risk-weighted assets to total assets (either in levels or first differences) for bank  $i$ , located in country  $j$ , in year  $t$ ;  $\mu_i$  represents bank fixed effects;  $\varepsilon_{i,j,t}$  is an error term; and the other variables are defined as in the model to estimate bank distress probabilities:

$$y_{i,j,t} = \alpha + \beta T_{i,j,t} + X'_{i,j,t}\theta + Y'_{j,t}\varphi + \mu_i + \lambda_t + \varepsilon_{i,j,t}$$

In the risk-taking model above,  $T_{i,j,t}$  is the treatment dummy of interest. It is set to 1 for a given bank and year if its LR in the previous year was below the (planned) regulatory minimum LR, but only for the years following the first announcement of the Basel III LR. The treatment dummy is set to 0 otherwise.<sup>125</sup> Thus, the coefficient of interest for the second stage of the empirical analysis is  $\beta$ , which measures how the announcement of an LR constraint has affected the risk-taking behaviour of banks. 2010 is set as the treatment start date in reference to the December 2009 BCBS consultative document (BCBS (2009)) that outlined the baseline proposal for the LR (see the timeline presented in Chart A.1). Moreover, 3% is taken as the relevant LR threshold since the BCBS is currently testing a minimum 3% LR until 1 January 2017.

Table A.2 presents the results of the second stage empirical analysis.<sup>126</sup> As can be seen from the table, the results confirm that since the Basel III LR framework was announced, EU banks with low LRs have slightly increased their risk-taking, as measured by their risk-weighted assets to total assets ratio. In terms of the quantitative impact, the point estimates for the treatment effect of a 3% LR requirement suggest that banks bound by the LR requirement increased their risk-weighted assets ratio by around 1.5 to 2 percentage points more than they otherwise would have. Furthermore, while the LR requirement seems to slightly incentivise risk-taking, the strengthening of the risk-based capital framework under Basel III seems to have the opposite impact.<sup>127</sup> Therefore the small estimated effects on bank risk-taking of the LR requirement are not a result of strengthening the risk-based capital framework since this effect is controlled for. Table A.2 further illustrates that the results are robust to the introduction of bank and time fixed effects, different bank samples and whether the dependent variable is modelled in differences (columns 1-

<sup>125</sup> A crucial assumption underlying the empirical approach is that banks already started to adjust their risk-taking behaviour after the announcement of the LR constraint, i.e. before it actually migrates to a binding Pillar 1 regulatory requirement. However, there is ample anecdotal evidence that supports this assumption.

<sup>126</sup> In the models, the following bank-specific variables are controlled for: bank size (via the log of total assets), net interest margin, pre-tax ROA, NPLs to total assets, the loans to total assets ratio, the relevant Basel regulatory regime at the time and the method used by the bank to calculate risk-weighted assets. The following macro-financial variables are also controlled for: real GDP growth, inflation, the change in the unemployment rate, stock market growth, financial sector debt, the credit to GDP ratio, the ten-year yield spread relative to the Bund, gross government debt to GDP and house price growth.

<sup>127</sup> The risk-weighted capital dummy is set similarly to the LR dummy. It is set equal to 1 for a given bank and year if its Tier 1 ratio in the previous year was below 10%, but only for years after 2009 in reference to the Basel III regulatory overhaul. The treatment dummy is set to 0 otherwise.

4) or levels (columns 5-7).<sup>128</sup> Furthermore, the results remain robust to various other tests, both quantitatively and in terms of significance, which are not reported here for the sake of brevity.<sup>129</sup>

**Table A.2**

Estimated impact of a leverage ratio constraint on bank risk-taking

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LR dummy	1.748***	1.678***	2.217***	1.713**	1.340**	1.657*	1.973**
Risk-weighted capital dummy	-2.335***	-2.394***	-2.556***	-2.212***	-1.023**	-0.687	-0.363
Sample	All	W. Europe	SSM	All	All	All	All
# Observations	2,711	2,325	646	2,550	2,795	1,801	1,801
# Banks	617	529	107	583	571	474	474
R-squared	0.076	0.086	0.111	0.092	0.535		
Bank and time fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank-specific and macro-financial controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Dependent variable	Differenced	Differenced	Differenced	Differenced	Level	Level	Level
Lagged dependent	No	No	No	Yes	Yes	Yes	Yes
Estimation method	FE	FE	FE	FE	FE	GMM	GMM
AR1-p						0.000	0.000
AR2-p						0.785	0.790
Hansen-p						0.495	0.192

Source: Grill, Lang and Smith (2015) based on data from SNL Financial and ECB Statistical Data Warehouse.

Notes: The dependent variable is the risk-weighted assets to total assets ratio either in differences (columns 1-4) or levels (columns 5-7). "All" means the estimation is based on the entire sample. "W. Europe" includes only banks from the following countries: Belgium, Denmark, Germany, Ireland, Greece, Spain, France, Italy, Luxembourg, Netherlands, Austria, Portugal, Finland, Sweden and the United Kingdom. The sample SSM includes only significant banks that are supervised directly by the ECB under the Single Supervisory Mechanism. Columns 6-7 are estimated using GMM. In column 6, instruments are the previous and further lags of the dependent variable and bank-specific characteristics. In column 7, instruments are the previous lag to the fifth lag of the same variables. Macro variables and Basel regime variables are viewed as exogenous. \*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level. Significance based on clustered robust standard errors.

To shed more light on banks' reactions to the Basel III LR announcement, the risk-taking regressions were also re-estimated with the change in a bank's LR as the dependent variable to see if treated banks were increasing their LRs at the same time as taking on further risk. This indeed seems to have been the case, with estimates of around a 0.5-1 percentage point greater increase in a bank's LR than otherwise would have happened.<sup>130</sup> This finding also provides support for the assumption that banks already started to react to the LR announcement. To summarise, while treated banks may have increased their risk-weighted assets ratios by around 1.5-2 percentage points more, they also increased their LRs by around

<sup>128</sup> Fixed effects (FE) regression and generalised method of moments (GMM) are both estimated since a lagged dependent variable is introduced in the model. In the FE regressions all variables are lagged by one period to avoid endogeneity issues. In the GMM estimation, contemporaneous variables are used but those that are considered as endogenous are instrumented. In particular, the GMM estimation takes macro variables and the Basel regime variable indicators as exogenous; all other variables are instrumented using lags of the variable in question.

<sup>129</sup> In particular, the following exercises were performed. First, a regression discontinuity design was performed such that only banks around the 3% LR minimum were included in the regression (bandwidth determined via the Imbens and Kalyanaraman (2012) algorithm. See Imbens, G. and Kalyanaraman, K. (2012), "Optimal Bandwidth Choice for the Regression Discontinuity Estimator", *Review of Economic Studies*, Vol. 79(3), pp. 933-959). This goes some way to addressing the potential concern that banks with vastly different LRs are fundamentally different and that this is not adequately captured via fixed effects and control variables. Second, banks with LRs between 3-5% were dropped as these banks are potentially fuzzy when it comes to classifying them as treated or control group banks, given that the LR requirement is not guaranteed to be at 3%. The analysis was then rerun on this subsample. Third, different LR threshold levels (up to 5%) were also tested for. The results are robust to all exercises.

<sup>130</sup> Table omitted for the sake of brevity.

0.5-1 percentage point more than they otherwise would have done over the period under consideration. This is a considerably higher increase in a bank's capital position than what would be required under the risk-based capital framework to cover the estimated increase in risk-weighted assets.

The two previous empirical exercises thus suggest that while bound banks slightly increase risk-taking with an LR requirement, the increase in their Tier 1 to assets ratio appears more important from a bank stability perspective. To analyse this more formally, the results from specification 4 of the bank distress model (the most complete model) are combined with the estimated increase in risk-taking from the second-stage empirical exercise in a counterfactual simulation. Using the coefficient estimates, the change in distress probabilities for all banks below the LR minimum (or target level) are simulated, assuming that these banks increase their LRs by the required amount to reach the minimum (or target level), but at the same time increase their risk-weighted assets by the estimated amount. To allow for a conservative assessment, the upper range of the estimated increase in risk-taking is assumed, i.e. a 2 percentage point increase in the risk-weighted assets ratio. For robustness purposes, a 4 and 6 percentage point increase in the risk-weighted assets ratio is also tested. The simulation is performed for a 3%, 4% and 5% LR minimum (or target level).

**Table A.3**

Estimated reduction in distress probabilities from the introduction of a leverage ratio constraint

LR requirement:	3%	4%	5%	4%	5%	5%
<b>Banks with an LR of:</b>	<b>Less than 3%</b>			<b>Between 3-4%</b>		<b>Between 4-5%</b>
$\Delta(RWA/TA) = 2$	-7.698***	-10.532***	-10.681***	-3.312***	-6.236***	-3.001***
$\Delta(RWA/TA) = 4$	-6.593**	-10.456***	-10.678***	-2.203*	-6.151***	-1.868*
$\Delta(RWA/TA) = 6$	-5.187*	-10.344***	-10.674***	-0.784	-6.026***	-0.442

Source: Grill, Lang and Smith (2015) based on data from SNL Financial, ECB Statistical Data Warehouse, and bank distress events defined as in Betz et al. (2014).

Notes: Average simulated change in distress probability for the relevant banks in the sample. The numbers represent the average percentage point change in distress probability from increasing a bank's LR to the stated percentage while at the same time increasing its risk-weighted assets to total assets ratio by the stated amount. This is done separately for the sample of banks with an LR less than 3%, between 3-4% and between 4-5%. Significance is based on bootstrapped standard errors on 10,000 replications. "RWA" refers to risk-weighted assets. "TA" refers to total assets. \*\*\* indicates significance at the 1% level, \*\* at the 5% level, and \* at the 10% level.

Table A.3 reports mean estimated figures from the simulations, so the numbers can be read as the average percentage point change in distress probability for the relevant sample of banks between 2005 and 2014. Since increasing the LR minimum (or target level) increases the sample of banks below this minimum (or target level), in order to ensure comparability across simulations, results are reported separately for the sample of banks with an LR less than 3%, between 3-4% and between 4-5%. The results demonstrate that bank distress probabilities should significantly decline with an LR requirement, even when taking into account much higher increases in risk-taking than were estimated. For example, Table A.3 shows that assuming a 3% LR target and an increase in the risk-weighted assets ratio of 2 percentage points, the average decline in distress probabilities would be 7.7 percentage points for the given sample. If the increase in the risk-weighted assets ratio is assumed to be 6 percentage points, the average decline in distress probabilities would still be 5.2 percentage points. The simulation results therefore illustrate that the beneficial impact of higher capital holdings from an LR requirement should more than outweigh the negative impact of increased risk-taking, thus leading to more stable banks.

## Concluding remarks

Theoretical considerations and empirical evidence for EU banks suggest that the introduction of an LR requirement into the Basel III regulatory framework should lead to more stable banks. This special feature has shown that although there is indeed an increased incentive to take risk once banks become bound by the LR, this increase is more than outweighed by the synchronous increase in loss-absorbing capacity attributable to higher capital. The analysis therefore supports the introduction of an LR requirement alongside the risk-based capital framework. The analysis further suggests that the LR and the risk-based capital framework are mutually reinforcing as they each cover risks which the other is less able to capture; ensuring banks do not operate with excessive leverage and, at the same time, have sufficient incentives to keep risk-taking in check.

## B Euro area insurers and the low interest rate environment<sup>131</sup>

*The current environment of protracted low interest rates poses major challenges to euro area insurance companies. This special feature discusses how a prolonged low-yield period might affect the profitability and the solvency of euro area insurers. In the article, it is argued that if interest rates were to stay low for a long time, this could have material implications for the profitability and the solvency of many insurers. However, it is also shown that the impact of low interest rates is likely to differ markedly across insurance companies depending on their business model and balance sheet structure. In particular, the impact is expected to be highest for small and medium-sized life insurers with large government bond portfolios and high guarantees to policyholders that reside in countries where these guarantees are rigid and where contracts embed a long time to maturity.*

### Introduction

There is a general consensus that the current low interest rate environment constitutes the main risk for the European insurance industry.<sup>132</sup> This is mainly due to two generic characteristics of insurers' business models: (i) the large amount of fixed-term investments that insurers have on their balance sheet; and (ii) the strong influence of long-term interest rates on the discount rate of insurance liabilities. Moreover, in Europe, the life insurance business is often characterised by the presence of products embedding financial guarantees, i.e. instruments granting a minimum rate of return to policyholders. In times of low interest rates, this business model might represent a threat to the profitability and the solvency of life insurance companies, especially in countries where products with relatively high guaranteed returns sold in the past still represent a prominent share of the total portfolio.

It is, however, important to keep in mind that European insurers differ substantially in their investments and in the maturity structure of their liabilities, depending on their business strategy and geographical location. In particular, the underwriting of insurance policies constitutes the core activity of any particular company, and the investment strategy is subordinated to underwriting needs, typically in the form of asset-liability management or matching techniques. Taking all these factors into account, it is difficult to have a clear picture of the final impact of low (long-term) interest rates, and this impact may, in any case, differ substantially across insurance companies and countries.

Given the generally long-term nature of life insurance liabilities and the ensuing possibility to wind down assets over a reasonably long time should problems arise,

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<sup>131</sup> Prepared by Elia Berdin, Christoffer Kok, Katri Mikkonen, Cosimo Pancaro and Josep Maria Vendrell Simon.

<sup>132</sup> For recent evidence, see, for example, past editions of the ECB's Financial Stability Review and the EIOPA Financial Stability Report, as well as the EIOPA 2014 insurance stress test.

low yields by themselves are unlikely to cause a major disruption in the sector.<sup>133</sup> However, a persistent situation would require major adjustments in business models, especially for life insurers (as discussed below).

This special feature seeks to gauge how a prolonged low-yield period might affect the profitability and solvency of European insurers. Starting from a few stylised facts, a regression analysis of European insurers' profitability is presented, demonstrating a strong significant relationship between long-term bond yields and insurers' profitability. Next, a model-based scenario analysis is conducted to assess the potentially adverse impact of a prolonged period of low long-term interest rates on the profitability and solvency position of the life insurance sector in the four largest euro area countries.

## How do low yields affect insurers?

Insurers are affected by low yields mainly through two channels.

First, there is a slow-moving so-called "income channel" whereby owing to the sector's high exposure to long-term fixed income assets (see Chart B.1) investment income will suffer as the net cash flow from paid premiums and maturing investments needs to be gradually re-invested at lower rates. Data from the EIOPA 2014 insurance stress test show that the average duration of government bonds on the balance sheets of insurers participating in the low yield exercise amounted to 8.6 years at the end of 2013.<sup>134</sup> The degree of vulnerability to the income channel is dependent on the business model of individual firms. Small and medium-sized, non-diversified life insurers are typically more exposed, in particular if they have sold policies with high levels of guarantees.

Second, the so-called "balance sheet channel" reflects that low interest rates will tend to have an impact on the balance sheet via a valuation effect, as low rates induce increases in the values of both assets and liabilities. A market-consistent valuation of assets and liabilities, such as prescribed in Solvency II, typically results in higher increases in the value of the latter when long-term yields decline because the magnitude of the assets invested in fixed-term instruments is a fraction of the total liabilities (see Chart B.2). In addition, the duration of the liabilities is often longer than that of the assets. Thus, whereas the impact on profitability through the investment income channel takes time, a low-yield environment can affect the solvency of the insurers directly and immediately through the balance sheet channel,

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<sup>133</sup> The situation might, however, change in interaction with other factors. See, for example, Box A on the experiences in Japan in this special feature and Section 3.1.2 on the risks related to a potential sudden increase in yields.

<sup>134</sup> See EIOPA 2014 insurance stress test, available at <https://eiopa.europa.eu/Publications/Surveys/Stress%20Test%20Report%202014.pdf>. Participants in the United Kingdom had the highest average duration of 13.3 years, whereas in the euro area, the highest average duration (12.4 years) was in the Netherlands. High asset durations are typically matched with high liability durations, indicating attempts on the part of the firms to reduce asset-liability mismatches.

with those insurers with large duration mismatches being the most vulnerable to this channel.<sup>135</sup>

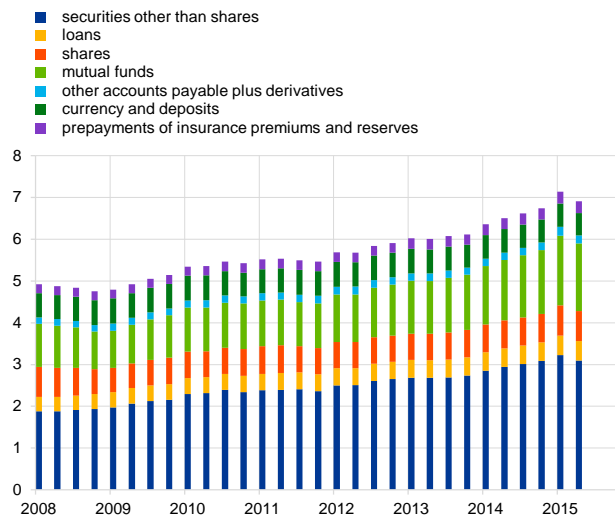
Gauging the impact of the switch to the forthcoming Solvency II regime on the size of liabilities is complicated, although on average the size of liabilities is expected to increase. Most importantly, the impact will depend on the valuation rules currently in place, which differ across jurisdictions. In addition, the measures in the so-called long-term guarantee package are expected to reduce the volatility and – for most insurers – also the size of liabilities.<sup>136</sup> Some participants in the EIOPA 2014 insurance stress test chose the option to present results using the long-term guarantee measures. The estimate of the impact calculated this way indeed showed that the measures can significantly improve the Solvency II capital ratio. Finally, many large insurers are expected to use internal models for solvency calculations.

**Chart B.1**

Insurers invest predominantly in fixed-term securities

**Assets of euro area insurance corporations**

(2008-2015; EUR trillions)

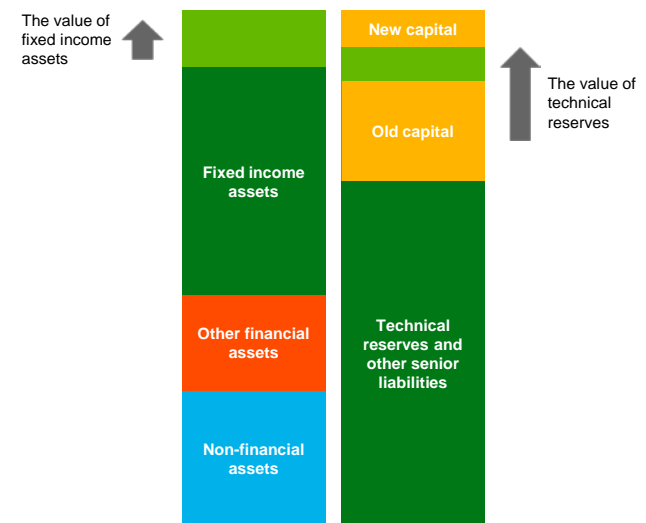


Source: ECB data on the balance sheets of insurance corporations and pension funds.

**Chart B.2**

As interest rates decrease, the increase in the value of fixed income assets is typically dominated by the increase in the value of technical reserves

**Impact of a decrease in long-term interest rates on a stylised life insurance balance sheet**



Source: ECB.

Note: The graph is a simplistic depiction of the direct impact of a decrease in interest rates and excludes all indirect effects.

<sup>135</sup> The average duration mismatch for the European insurers participating in the low yield module of the EIOPA 2014 stress test amounted to 4.2 years in the baseline scenario. In the euro area, participants from Germany and Austria had the highest duration mismatches of around 10 years.

<sup>136</sup> The long-term guarantee package measures aim to mitigate artificial volatility in balance sheets that does not reflect changes in the financial position or risk exposure of an insurer. These measures include volatility and matching adjustments to discount rates, the extrapolation of the long-term risk-free interest rate, transitional measures for the calculation of liabilities and the possibility for an extension of the recovery period under exceptional market conditions. See Directive 2014/51/EU of 16 April 2014 in respect of the powers of the European Supervisory Authority (European Insurance and Occupational Pensions Authority) and the European Supervisory Authority (European Securities and Markets Authority).



Empirical evidence on the impact of long-term interest rates on the performance of insurers is scarce. But where tested, it seems that it is the volatility, rather than the low levels per se, of long-term interest rates that can increase the financial fragility of insurers.<sup>137</sup>

A few studies have also conducted more forward-looking analyses under the assumption of a continued and prolonged period of low interest rates. While the majority of these studies on the impact of low interest rates on insurers have been mainly of a qualitative nature,<sup>138</sup> a few recent studies have quantitatively investigated the impact of low yields on the performance of life insurers.<sup>139</sup> The studies all point to the likely negative effects that a protracted period of low interest rates would have on the solvency position of insurers.

Intuitively, slow-moving insurance balance sheets suffer in times of rapid movements in interest rates, as any adjustment will necessarily take time. In the long term, insurers can resort to diverse adjustment mechanisms. In this regard, EIOPA's low interest rate environment stock-taking exercise conducted in 2014 provided evidence that European insurers have, in particular, resorted to diversification into non-life and asset management businesses, lowered the guaranteed rates on new policies and increased the use of interest rate derivatives.<sup>140</sup> The experience of insurers in Japan during the late 1990s and early 2000s provides the most compelling evidence to date of the potential impact of low long-term interest rates for an extended period, in particular if adjustment is slow (see Box A).

## Box A

### Japanese life insurers' experience with a period of prolonged low interest rates

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The Japanese life insurance industry offers a real-world example of what can happen when interest rates suddenly decrease and stay low for an extended period of time.<sup>141</sup> The yield on Japanese

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<sup>137</sup> See, for example, Browne, M.J., Carson, J.M. and Hoyt, R.E. (1999), "Economic and market predictors of insolvencies in the life-health insurance industry", *Journal of Risk and Insurance*, Vol. 66, No 4, pp. 643-659; and Cheng, J. and Weiss, M.A. (2012), "The role of RBC, Hurricane Exposure, Bond Portfolio Duration, and Macroeconomic and Industry-Wide Factors in Property-Liability Insolvency Prediction", *Journal of Risk and Insurance*, Vol. 79, No 3, pp. 723-750.

<sup>138</sup> See, for example, Tower, I. and Impavido, G. (2009), "How the financial crisis affects pensions and insurance and why the impacts matter", *IMF Working Papers*, No 151; and Antolin, P., Schich, S. and Yermo, J. (2011), "The economic impact of protracted low interest rates on pension funds and insurance companies", *OECD Journal: Financial Markets Trends*, No 01/2011.

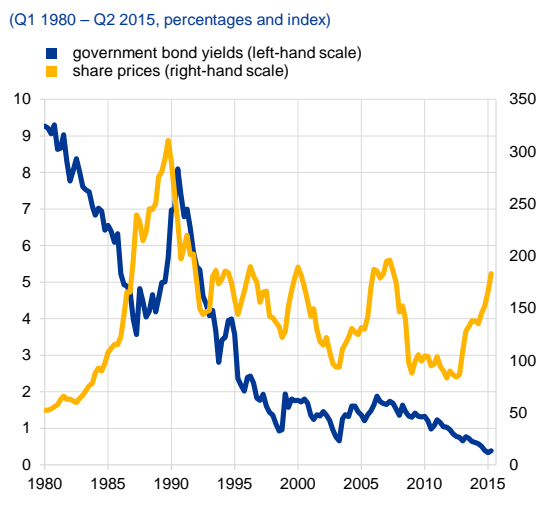
<sup>139</sup> See Berdin, E. and Gruendl, H. (2015), "The effects of a low interest rate environment on life insurers", *The Geneva Papers*, 40; Kablau, A. and Weiss, M. (2014), "How is the low-interest-rate environment affecting the solvency of German life insurers?", *Deutsche Bundesbank Discussion Papers*, No 27/2014; and Wedow, M. and Kablau, A. (2011), "Gauging the impact of a low-interest rate environment on German life insurers", *Deutsche Bundesbank Discussion Papers*, No 02/2011.

<sup>140</sup> The study is available at <https://eiopa.europa.eu/financial-stability-crisis-prevention/financial-stability/insurance-stress-test/insurance-stress-test-2014>

<sup>141</sup> See, for example, Fukao, M. (2002), "Financial Sector Profitability and Double-Gearing", *National Bureau of Economic Research Working Papers*, No 9368, December; Hoshi, T. and Kashyap A.K. (2004), "Japan's Financial Crisis and Economic Stagnation", *Journal of Economic Perspectives*, Vol. 18, No 1, pp. 3-26; SwissRe (2012), "Facing the interest rate challenge", *sigma*, No 4; Geneva Association (2015), "U.S. and Japan Life Insurers Insolvencies Case Studies – Lessons learned from resolutions", edited by Baranoff, E., January; and J.P.Morgan Cazenove (2015), "European and Japanese life insurance", February.

government bonds decreased rapidly in the course of the 1980s and again at the beginning of the 1990s, and has decreased further since 2006 (see Chart A).

**Chart A**  
Japanese government bond yields and stock market prices



Sources: IMF International Financial Statistics.  
 Notes: Government bond yield refers to one or more series representing yields to maturity of government bonds or other bonds that would indicate longer-term rates. Indices shown for share prices relate to common shares of companies traded on the national stock exchange.

Altogether, eight life insurance companies were liquidated or taken over between 1997 and 2003.<sup>142</sup> The causes of the failures include macroeconomic factors, but also industry-wide business practices that became detrimental once the economic environment changed. The rapid decline in the interest rate in the 1980s induced companies to invest in stock markets, which subsequently also faced a downturn when the stock market bubble burst in 1989 (see Chart A). The insurers also faced significant losses in foreign currency holdings in the mid-1980s, following a large appreciation of the yen. At the same time, insurers continued to offer guarantees to policyholders in the order of 5.5% until the mid-1990s, amid fierce competition from government-sponsored financial institutions. The combined effect of the low government bond yields, stock market returns and foreign currency holdings made it very difficult to meet these guarantees in a profitable way.

Insurers eventually started decreasing their guaranteed rates. This in turn led to a loss of policyholder confidence and a surge in surrenders, which at that time were not penalised through any value decrease.<sup>143</sup> As a consequence, bankruptcy became inevitable for seven of the eight above-mentioned life insurers, whereas one received a capital injection from a foreign company.

The Japanese life insurance case can be characterised as having had systemic causes, and it had a significant impact on the Japanese life insurance industry. The assets of the seven failed companies amounted to 8.6% of total life insurance assets in Japan in 2000. Yet, the overall impact on the financial markets and on the real economy remained contained. Altogether, the seven failed insurers had negative equity of JPY 2.68 trillion, or 0.5% when measured in terms of Japan's GDP in the year 2000. No public money was used to bail out the companies; however, policyholders faced an average 10% loss in savings, and the rest was borne by the industry-funded Policyholder Protection Fund.

The Japanese insurance sector has since recovered, partly owing to price developments in the stock markets and returns on investments in very long-term bonds. In addition, companies have adjusted their business models away from dependence on investment income and savings-type

<sup>142</sup> Seven companies failed and one company received a capital injection from a foreign company.

<sup>143</sup> A surrender refers to a full cancellation of a life insurance policy. Most insurers in Europe nowadays attach penalty fees to surrenders. This feature makes life insurance distinct from taking sight deposits that can be redeemed at any time without penalty. The fact that insurance runs have been rare can indeed be attributed to the existence of surrender fees.

policies towards a larger focus on earnings from underwriting mortality and longevity risks. Finally, in terms of policy, the Japanese Insurance Act was revised in 2003, allowing the renegotiation of guarantees with policyholders without the insurer having to declare bankruptcy first.

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All in all, both from a conceptual perspective and judging from actual experiences, prolonged low interest rates should be expected to exert a negative influence on insurers' profit generation capacity and on their solvency. This is further explored below with the help of quantitative analysis.

### The impact of low yields on insurers' profitability: an empirical analysis

In the following, a regression analysis is conducted in order to gauge the impact of interest rate levels on the financial performance of a sample of 127 European insurers over the period 2005-14.<sup>144</sup> We regress a measure of insurers' profitability (measured by institution-specific return on assets<sup>145</sup>) on the level and volatility<sup>146</sup> of long-term interest rates (measured as the ten-year sovereign benchmark bond yields), while controlling for other key driving factors of profitability, such as institution-specific developments in underwriting performance (here measured as annual growth in gross premiums written) as well as country-specific macroeconomic factors including real GDP growth and inflation.

We use a system generalised method of moments<sup>147</sup> dynamic panel estimation approach in order to account for the potential time persistence of profitability via the inclusion of the lagged dependent variable among the regressors of the estimated model and to address the potential endogeneity of the firm-specific variables. Acknowledging the impact of different insurance business models and strategies, balance sheet and income data for individual insurers are included in the regression alongside the macroeconomic variables at the country level. In order to further account for heterogeneity, we run regressions for sub-samples of companies,

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<sup>144</sup> We use an unbalanced panel of annual data from 2005 to 2014 for a sample of European insurers established in 15 European countries; namely in Germany (37), the United Kingdom (16), France (13), Denmark (11), Spain (9), Sweden (9), Italy (8), the Netherlands (5), Austria (4), Ireland (4), Belgium (3), Finland (3), Poland (2), Slovenia (2) and Portugal (1). The selection of insurance companies was constrained by limited data availability. More specifically, insurers with less than five years of observations for selected variables were dropped from the sample. Company-specific data is taken from SNL Financial. Macroeconomic data is taken from the ECB and Eurostat.

<sup>145</sup> This is computed as the return on average assets, i.e. net profit as a share of average assets over a given period. The results hold when using other measures of profitability such as return on equity.

<sup>146</sup> Volatility is defined as the yearly average of the annualised moving 20-day standard deviation of price changes. First differences are taken for long-term interest rates and their volatility to ensure stationarity.

<sup>147</sup> Linear dynamic panel-data models include  $p$  lags of the dependent variable as covariates and contain unobserved panel-level effects, fixed or random. By construction, the unobserved panel-level effects are correlated with the lagged dependent variables, making standard estimators inconsistent. Arellano and Bond (1991) derived a consistent generalised method of moments (GMM) estimator for this model; for a more detailed description of the empirical methodology applied, see Special Feature B in the May 2015 FSR. See also the EIOPA Financial Stability Report May 2015, Part II - Thematic Articles: Insurance Sector Profitability and The Macroeconomic Environment.

segregated according to the size<sup>148</sup> of the company (*large versus small and medium-sized*) and the business lines (*multiline, property and casualty or life and health*).

Table B.1 shows the regression results for these different sub-samples on the explanatory variables discussed above. Throughout the different regressions, most of the estimated coefficients display the expected signs when significant.<sup>149</sup>

**Table B.1**  
Regression results – determinants of EU insurers' return on assets

		Full sample	Large insurers	Small and medium insurers	Multiline	Property & casualty	Life & health
<b>Insurance-specific factors</b>	Return on assets (lagged one period)	-0.215*** (0.076)	-0.087* (0.046)	-0.216*** (0.075)	0.061** (0.025)	0.120 (0.131)	-0.326*** (0.032)
	Growth in gross premiums written	0.021* (0.013)	0.007 (0.011)	0.015 (0.012)	-0.006 (0.007)	0.003 (0.009)	0.008 (0.016)
<b>Macroeconomic factors</b>	Real GDP growth	0.043 (0.035)	0.048* (0.029)	0.037 (0.039)	0.028 (0.027)	-0.049 (0.097)	0.170** (0.483)
	Inflation rate	-0.136 (0.138)	-0.354* (0.199)	-0.084 (0.137)	-0.221 (0.140)	-0.104 (0.083)	-0.134 (0.089)
	Long-term interest rate	0.419** (0.219)	0.022 (0.030)	0.465** (0.244)	0.046* (0.026)	0.035 (0.104)	1.311* (0.741)
	Long-term interest rate volatility	-0.035* (0.021)	-0.006 (0.010)	-0.039* (0.023)	-0.007 (0.007)	-0.010 (0.011)	-0.022 (0.028)
	Number of observations	857	134	723	274	224	359
	Number of insurance companies	127	19	108	39	34	54
	Heteroskedasticity and autocorrelation robust standard errors in parentheses						
	* p<0.10; ** p<0.05; *** p<0.01						

As expected, long-term interest rates are found to exert a positive impact in all specifications, having a bigger (and more statistically significant) impact on small and medium-sized insurers and the life and health sector. However, the impact of domestic long-term interest rates is not significant for large insurers (which tend to be better diversified in terms of businesses, asset classes and geographies) or for the property and casualty sector, which may reflect the fact that non-life insurance typically has a short pay-out pattern, and contracts are made on a yearly basis, with the possibility to increase prices at renewal. Therefore, the sector is less dependent on financial market developments.<sup>150</sup> This contrasts with the life insurance sector which faces the challenge of long-term liabilities and the need to match them with suitable assets, typically long-term bonds. Thus, not surprisingly, the positive impact of long-term interest rates on profitability appears to be the largest for the life and health sector.

The impact of interest rate volatility is less clear-cut: although the signs are negative, the impact is only weakly significant, except for small and medium-sized insurers.

<sup>148</sup> A "large" company is defined as having total assets in excess of €80 billion in December 2014.

<sup>149</sup> All regressions have been tested for over-identification restrictions and for serial correlation in the first-differenced errors of order higher than one. Time-fixed effects are considered in the regressions to ensure the absence of correlation across insurance companies in their idiosyncratic error terms.

<sup>150</sup> See also SwissRe (2012), "Facing the interest rate challenge", *sigma*, No 4.

Taken together, these results highlight the complexity of channels through which long-term interest rates affect the profitability of insurers. In times of interest rate volatility, the balance sheet channel transmits unrealised gains (if interest rates decrease) or losses (if interest rates increase); at the same time, the income channel transmits the opposite impact for assets that are being reinvested at the time. In the end, it seems that the negative effect prevails for the least diversified small and medium-sized firms in times of interest rate change.

The institution-specific and macroeconomic control variables tend to have the expected, and statistically significant, signs. Thus, focusing on the “full sample” regression, increasing economic activity tends to increase profitability, while higher inflation tends to have a negative effect.<sup>151</sup> Growth in premiums has a positive effect on profitability.<sup>152</sup>

Finally, the lagged dependent variable is found to have a negative impact in all but two specifications, suggesting weak persistence of profitability over time.

This regression analysis highlights the importance of long-term interest rates for the profitability of European insurers. However, the impact of a prolonged period of low interest rates also needs to be assessed in a forward-looking manner. The next section seeks to do this.

## The impact of low yields on euro area life insurers’ profitability and solvency: a scenario analysis

In the following, a stochastic simulation model of the insurance sector is employed with the aim of assessing and quantifying the effects of a prolonged period of low interest rates on the solvency and profitability of a representative life insurer in the four largest euro area insurance markets<sup>153</sup>, i.e. Germany, France, Italy and the Netherlands. For a description of the modelling strategy, see Box B.

### Box B

#### A stress test model of the insurance sector<sup>154</sup>

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The stylised model of the insurance sector used in this analysis relies on country-specific calibrations, encompassing different asset allocations, liability structures, duration mismatches between assets and liabilities, and regulatory requirements. In this context, the balance sheet of a representative life insurer in each of the four considered countries is projected seven years ahead

<sup>151</sup> Domestic real GDP growth has the expected positive sign in all but one specification. The inflation rate is found to have a negative coefficient suggesting that it negatively affects profitability by hindering demand for new business and increasing non-life insurance claims and expense ratios.

<sup>152</sup> The impact of premium growth is found to be generally positive but rather small, which might reflect the effects on profitability of competition, pricing and the initial expenses associated with new business.

<sup>153</sup> Measured in terms of total gross written premiums; source: Insurance Europe, Statistics N°50 European Insurance in Figures, 2014.

<sup>154</sup> The model presented here is based on Berdin, E., Kok, C. and Pancaro, C. (2015), “A stress test model to assess the solvency and profitability of European insurers in a low interest rate environment”, unpublished *working paper*. The model is an extension of the work by Berdin and Gruendl (op.cit.).

and the evolution of its profitability and solvency is investigated. In particular, the analysis focuses on a marked-to-market balance sheet in line with the forthcoming Solvency II regulatory regime.<sup>155</sup>

More specifically, the modelling approach aims to reproduce the liability structure and asset allocation for the life insurance sector in each of the four countries.<sup>156</sup> Moreover, the balance sheet of each country's representative life insurer is calibrated to feature a duration gap in line with those reported by EIOPA, thereby providing an additional source of heterogeneity in the business models.

The liability structure only considers business at shareholders' risk, and consequently excludes unit-linked business. As a result, only two representative products are modelled; namely, an endowment policy with financial guarantees and mandatory profit distribution (where applicable) and a term life contract that pays upon death. For each country, the local regulatory framework, the level of outstanding guarantees in 2014 and the dynamics of the underlying population are also taken into consideration. Prices of products are computed alike in each country, thereby allowing for a fair degree of comparability. The level of guarantees given to policyholders plays a prominent role: in order to create a realistic set of guarantees, it is assumed that each year the insurer issues one cohort of contracts with fixed time to maturity (from 15 to 25 years, depending on the country) at the maximum allowed guarantee at the moment of inception. Consequently, at the start of the simulation period, the insurer holds different cohorts of guarantees with different maturities.<sup>157</sup> This feature helps reproduce the typical situation that life insurers currently face, i.e. portfolios consisting, at least partly, of old guarantees which have become increasingly expensive to fund as interest rates remain low.

The asset portfolio comprises four asset classes: sovereign bonds, corporate bonds, stocks and real estate. Bonds are differentiated either by reference country or issuer. Stocks and real estate are proxied by indexes representing the corresponding relevant markets.<sup>158</sup> Overall, the asset portfolio is tailored for each country to reproduce: i) the typical asset allocation and ii) the typical duration.

Furthermore, the initial solvency ratio is set equal to 165% for all countries' representative life companies, in line with EIOPA (2011)<sup>159</sup>, to ensure cross-country comparability and to allow for a better assessment of the riskiness of the different business models.<sup>160</sup>

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<sup>155</sup> Although relevant metrics are at market values, the book values (or historical cost) balance sheet still plays a role in life business since the amount of profit to be distributed to policyholders is still often computed on the book value balance sheet.

<sup>156</sup> The modelling approach aims to capture the legacy business, which can be a major source of financial distress for life insurers in certain financial scenarios. This is done by calibrating a representative balance sheet for life insurance companies with an existing back book of contracts and an asset portfolio at time  $t$  created by accumulating backward-in-time underwritten contracts (for the liability side) and available coupons (for the asset side). At the beginning of the simulation period, a fixed number of cohorts of insurance contracts is obtained, matched by cohorts of bonds with a residual time to maturity which ranges between one year and their expected time to maturity (i.e. maximum 20 years).

<sup>157</sup> At each point in time one cohort of contracts matures and a new one enters the portfolio: this implies that at the beginning of the simulation, one cohort is still running for one year, whereas all others run from two years up to the time to maturity chosen for the country.

<sup>158</sup> While for sovereign bonds, the calibration relies fully on the data reported by EIOPA (2014), in the case of stocks and real estate, since detailed information is not available, a synthetic stock and real estate portfolio featuring a strong home bias (as reported by EIOPA (2014)) is built; in particular, 60% of the return computed yearly on both stocks and real estate is indexed to the home index for stocks and real estate, whereas the residual is spread equally among the other countries in the sample.

<sup>159</sup> See EIOPA (2011), *EIOPA Report on the fifth Quantitative Impact Study (QIS5) for Solvency II*.

<sup>160</sup> The initial solvency capital requirement has been set equally across countries also owing to the lack of information on the insurers' solvency positions under the Solvency II regime.

Finally, the model features a set of simplified managerial rules: in every period the insurer pays out dividends<sup>161</sup> upon reaching a minimum solvency level computed according to the standard formula applied under Solvency II; the model also rebalances the portfolio in order to keep the asset allocation fixed and the duration gap fixed over the seven-year period. In this context, as time progresses in the simulation, old contracts get liquidated and new contracts with new (lower) guarantees enter the portfolio. A specific regulator's reaction function, which sets the maximum allowed level of guarantee (or technical discount rate), is built into the model and tailored at country level.

Against this backdrop, for the scenario analysis, a stochastic term structure of interest rates as well as stochastic stock market and real estate returns are generated to simulate the investment returns of a stylised life insurance business portfolio in a multi-period setting. In addition, the analysis incorporates stochastic mortality.

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For the purpose of assessing the vulnerability of insurance sector business models across countries to a prolonged period of low interest rates, two adverse scenarios featuring different stochastic term structures of interest rates and diverse stochastic stock, corporate bond and real estate returns are calibrated.

The first scenario, or adverse scenario, encompasses a situation in which interest rates remain low for a protracted period of time, while bond, stock and real estate returns revert to pre-2008 trends.<sup>162</sup> The second scenario, or severely adverse scenario, encompasses a situation in which interest rates remain low for a protracted period of time and the bond, stock and real estate returns are calibrated on the period 1999-2014, i.e. are also affected by the financial crisis. Using this different time period for the calibration mainly implies that the volatility of the interest rates and the returns is, on average, higher under the severely adverse scenario than under the adverse scenario.

Under the adverse scenario, there is a general reduction in the return on assets.<sup>163</sup> The pace of the reduction is consistent with the business model of life insurers which typically hold fixed income assets (which constitute the majority of their holdings) to maturity in order to match their liabilities. Indeed, life insurers have a relatively low asset turnover, which implies a gradual adjustment of portfolio returns to the new interest rate level.

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<sup>161</sup> It is assumed that, in each period, insurers cannot pay out more than 7% of their equity as dividends.

<sup>162</sup> More specifically, under the adverse scenario, future realisations of the AAA euro-denominated term structure of interest rates are simulated assuming a median (target) value for the 10-year yield to maturity of 1%. In this respect, the models for interest rates and for returns are calibrated for the period from January 1999 to December 2007. During the first three to four periods of the simulation, there is a positive probability of negative interest rates in the short end of the term structure, which is in line with some bond market developments observed in 2015.

<sup>163</sup> In this context, the return on assets is defined as the sum of coupons, dividends and rents collected during the period, divided by the book value of assets. It therefore excludes capital gains. This definition makes it possible to replicate the typical profit-sharing mechanism used in Europe, which in turn provides an indication of the future expected return that policyholders might expect, as well as the returns that shareholders might expect.

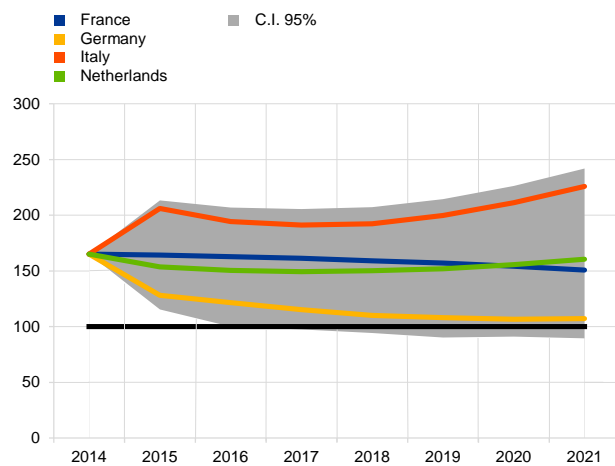
Moreover, it is important to mention that the liability portfolio typically adjusts more slowly owing to its higher duration, especially in countries where contracts embed a long time to maturity. The natural implication of this characteristic is that financial guarantees sold in the past stay in the portfolio for longer periods and, therefore, the adjustment to the prevailing interest rate regime is slower for the liabilities than for the assets. This feature largely drives the impact of the low yield scenario on the solvency ratio of life insurers.

### Chart B.3

Insurers would be able to cope with the “adverse” scenario in most of the simulations...

#### Projection of solvency ratios under the “adverse” scenario

(2014-2021; solvency capital requirement ratio)



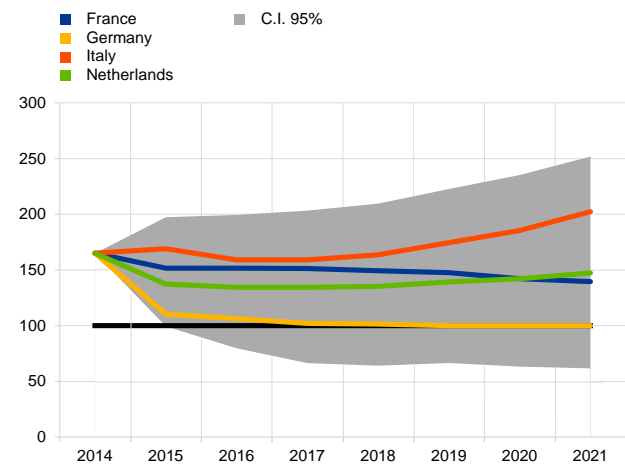
Sources: ECB calculations.  
Notes: The black solid line represents the solvency capital requirement of 100%. The other solid lines represent the median solvency ratios, defined as own funds over solvency capital requirements. C.I. is the confidence interval containing 95% of the simulated solvency ratios for the considered countries.

### Chart B.4

...whereas under the “severely adverse” scenario, the likelihood of insurers falling below the solvency capital requirement would be higher.

#### Projection of solvency ratios under the “severely adverse” scenario

(2014-2021; solvency capital requirement ratio)



Sources: ECB calculations.  
Notes: The black solid line represents the solvency capital requirement of 100%. The other solid lines represent the median solvency ratios, defined as own funds over solvency capital requirements. C.I. is the confidence interval containing 95% of the simulated solvency ratios for the considered countries.

Under the adverse scenario, the German, French and Dutch representative life insurers experience a decline in their solvency ratios (see Chart B.3). The German insurer displays a material decline in its solvency ratio (which, over the medium term, in some cases, falls under the solvency capital requirement of 100%) owing to the high cost of the guarantees still in its portfolio and to the relatively wide maturity mismatch. However, the French and Dutch insurers are not strongly affected under this scenario owing to the more rapid adjustment of their liability portfolios to the prevailing interest rate regime, to the relatively lower cost of their guarantees and to the different regulation on guarantees and profit participation. Finally, the Italian insurer, which displays the best duration match, experiences an increase in the



solvency ratio, mainly owing to the revaluation of its asset portfolio, and the highest return on assets.<sup>164</sup>

Under the severely adverse scenario, the reduction in the return on assets is slightly faster and the effect on solvency is much stronger (see Chart B.4). The combination of a protracted period of low interest rates and higher volatility in credit spreads, stock and real estate returns can be highly deleterious for the modelled representative life insurers. The German insurer experiences a strong reduction in the solvency ratio at a very early stage of the simulation period. In particular, in the last three years of the scenario, the solvency capital requirement is breached in about 50% of the simulations. The Italian insurer also experiences a reduction in its solvency ratio, mainly owing to the high home bias in sovereign holdings in its asset portfolio, which, under this scenario, experience higher volatility. In the middle of the simulation period, the solvency capital ratio falls below the requirement in some simulations. The French and the Dutch insurers are also more adversely affected by this harsher scenario. However, the solvency capital requirement is not breached in any of the simulations.

Overall, the results of this analysis suggest that a prolonged period of low interest rates would affect the profitability and the solvency situation of life insurers. Should the low interest rate environment be accompanied by high volatility in financial returns, the effect on life insurers' solvency ratios would be even more pronounced. However, the extent of these effects would be heterogeneous across companies and would largely depend on their specific features, such as their asset allocation, duration mismatch and level of guarantees provided.<sup>165</sup>

## Concluding remarks

The qualitative and quantitative analyses presented in this article confirm that the level of long-term interest rates has a significant impact on the profitability and, in a market-consistent valuation regime, on the solvency of insurance companies.

These findings should nevertheless be interpreted with due caution. In particular, the scenario-based stress test analysis, although based on the market-consistent valuation used under Solvency II, assumes no changes in asset allocations or portfolios. In reality, Section 3.1.2 on large euro area insurers in this and previous editions of the FSR has showed that such adjustments have already been taking place for some time, and they are likely to continue. Additionally, the analysis does not take into account the long-term guarantee measures, which are an important part

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<sup>164</sup> The Italian insurer has the highest return on assets owing to its large reliance on its own country's sovereign bonds, which benefit from higher returns and do not suffer from a higher solvency capital requirement.

<sup>165</sup> In this context, it is worth mentioning that the results of this analysis rely on a set of simplifying assumptions which heavily influence the results through the calibration of the model. In particular, underlying assumptions on the portfolios of assets and liabilities, as well as on the dynamics of policyholders and shareholders' decisions are strong determinants of the results presented here.

of the Solvency II package. These measures, intended to reduce unhelpful balance sheet volatility, have been shown to have a significant impact.<sup>166</sup>

The long-term guarantee package also includes transitional measures that smoothen the move to Solvency II, the use of which requires supervisory approval. The firms using transitional measures are required to make their impact public. In this regard, it is important that the transition time is used effectively to ensure that business models are sustainable in the new regulatory regime and in the presence of a prolonged period of low interest rates.<sup>167</sup>

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<sup>166</sup> See the EIOPA 2014 insurance stress test, available at <https://eiopa.europa.eu>

<sup>167</sup> This statement was also made by Gabriel Bernardino, Chairman of EIOPA, in his keynote speech entitled "Milestones of preparation for Solvency II", given at the European Insurance Conference in London on 3 June 2015. See <https://eiopa.europa.eu/Publications/Speeches%20and%20presentations/2015-06-02%20European%20Insurance%20Conference.pdf>

## C Systemic risk, contagion and financial networks<sup>168</sup>

*This special feature proposes a methodology to measure systemic risk as the percentage of banks defaulting simultaneously over a given time horizon for a given confidence level. The framework presented here is applied to euro area banks. It is observed that since the announcement of the comprehensive assessment in October 2013 banks have significantly reshuffled their security portfolios. This has resulted in a decline in the probability of systemic events occurring.*

### Introduction

Although widely referred to, the concept of systemic risk remains elusive and hard to quantify (see, for instance, Hansen (2013)).<sup>169</sup> In an attempt to fill this gap, this special feature defines systemic risk as the risk that a “large” number of banks default simultaneously with negative reverberating effects on the real economy. In line with this definition, this article measures systemic risk as the systemic Value-at-Risk of a banking system, i.e. as the percentage of banks going bust simultaneously over a given time horizon for a given confidence level. By reverse engineering, this framework also allows us to evaluate the probability that a systemic event occurs: after setting a percentage of banks failing simultaneously, the probability associated with this event is estimated.

The estimates of the systemic Value-at-Risk and of the probability of a systemic event are derived from a distribution of the yearly number of bank defaults. In the proposed framework, contagion is the factor generating fat tails in this distribution, which allows us to capture systemic risk. In particular, the model characterises contagion through fire sales: if a bank defaults because of an idiosyncratic shock, this failure can contaminate other banks via their common exposures. Failing banks liquidate their security portfolios, transmitting shocks from one bank to another through fire sales.

The distribution of the number of bank defaults is generated with Monte Carlo simulation techniques using data relative to the network of banks’ common exposures. This enables the model to capture how the topology of a banking system network affects systemic risk: it is the architecture of such a network that determines how contagion propagates and how resilient the system is. Specifically, this distribution is derived by letting banks fail in line with their idiosyncratic shocks, which can trigger as a consequence a fire sale.

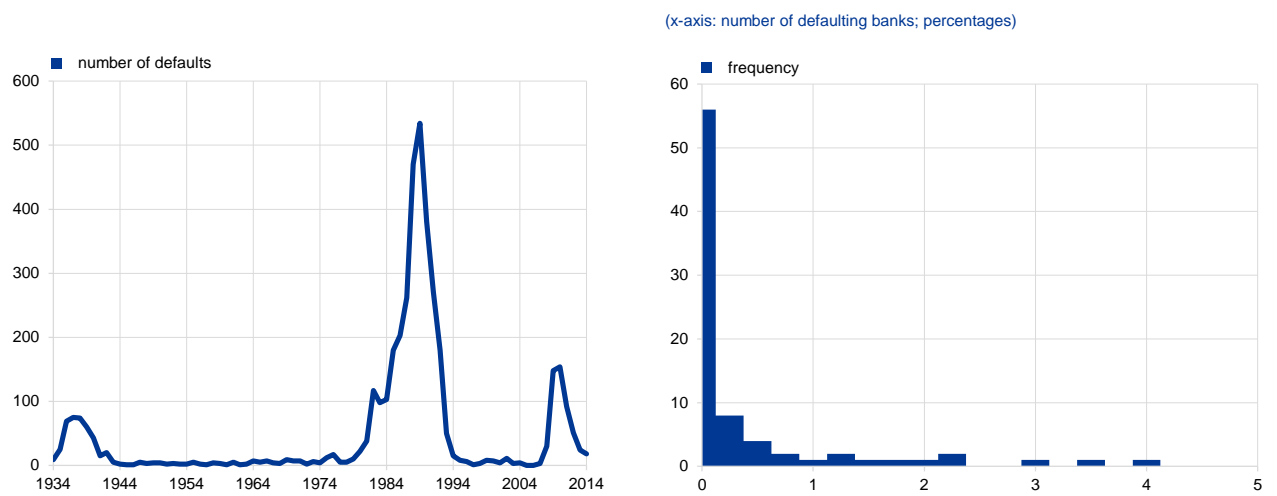
Empirical evidence supports the intuition that systemic risk materialises in parallel with a “large” number of banks failing at the same time and permits us to qualify the notion of “large”. When looking at the number of bank defaults in the United States from 1934 to 2014, three episodes stand out: the Great Depression in the 1930s, the

<sup>168</sup> Prepared by Lorenzo Cappiello, Linda Fache Rousová and Mattia Montagna.

<sup>169</sup> Hansen, L.P. (2013), “Challenges in Identifying and Measuring Systemic Risk”, in Brunnermeier, M.K. and Krishnamurthy, A. (eds.), *Risk Topography: Systemic Risk and Macro Modelling*, NBER Books Series.

savings and loan crisis in the 1980s and the 1990s, and the recent financial crisis in the second half of the 2000s (see the left-hand panel of Chart C.1). It can be safely argued that systemic risk materialised during these three episodes. Next, the yearly percentage of US failing banks is computed. This is done by dividing the number of bank defaults at the end of each year by the number of active banks at the beginning of the year. The right-hand panel of Chart C.1 reports the empirical distribution of this percentage of bank failures. Two key points are revealed by this distribution. First, since systemic events are defined as those episodes characterised by the simultaneous failure of a “large” number of banks, the distribution enables us to qualify the notion of “large”. The right-hand panel of Chart C.1 shows that when more than 3% of the total number of banks fail at the same time, a deep financial crisis ensues. Second, the shape of the distribution is fat tailed, which can only be explained by introducing non-zero correlations between banks’ default probabilities. Moreover, since the standard deviation of the distribution is equal to 0.8 but the probability mass in its tail is quite large, a Gaussian function cannot describe it. A Gaussian distribution of the number of bank defaults would imply that crises wiping out more than 3% of the US banking system would occur once every 700 years.

**Chart C.1**  
Historical distribution of bank defaults in the United States



Sources: Federal Deposit Insurance Corporation and ECB calculations.  
Notes: The left-hand panel reports the total number of defaults in the United States from 1934 to 2014. The right-hand panel reports the distribution of the yearly percentage of US failing banks computed as a fraction of the total number of active banks.

The approach proposed in this special feature has two main advantages over other methodologies. First, systemic risk is measured without relying on historical data. Instead, its estimate is based on the actual architecture of a banking network and on a simple contagion mechanism. Since systemic events are rare, historical data typically do not contain enough information to make proper inference. Similarly, measures of systemic risk based on past asset prices suffer from the drawback that price developments are cyclical. Asset prices do not necessarily convey information about vulnerabilities well in advance of a crisis, often collapsing just before a crisis

materialises.<sup>170</sup> Second, this framework enables us to isolate the role of contagion in generating systemic risk. Shedding light on the root factors of systemic risk has vast policy implications since it allows policy-makers to adopt the most efficient risk-mitigation measures. Finally, providing a measure to quantify systemic risk can contribute to increasing the accountability of the policies aimed at counteracting it.

Although the concepts discussed in this special feature are sufficiently general and can be applied to the whole financial system, this article focuses on banks. Similarly, although contagion materialises through fire sales for the purpose of the discussion, the framework is general enough to accommodate a variety of contagion models.

## Methodology

When deriving the distribution of the number of bank defaults, it is necessary to take into account that banks' default probabilities are correlated. Such correlations produce fat tails in the distribution and therefore constitute the key ingredient to capture systemic events. In this framework, contagion is the main factor generating non-zero correlations between the probabilities of banks' defaults (for a formal sketch of the methodology, see the box).

The specific contagion mechanism which is used in this special feature is a fire-sale model in the spirit of Greenwood et al. (2015)<sup>171</sup> and Eisenbach et al. (2015).<sup>172</sup> In such a model, after an idiosyncratic shock, banks sell off assets to restore their desired target leverage. But sales can depress asset prices, ultimately eroding other banks' capital, which may trigger another bout of sales and may further contract prices and reduce capital, until a new equilibrium is achieved.<sup>173</sup>

The distribution of the number of bank defaults is obtained by adopting the following simulation strategy. At each time  $t$ , banks are allowed to fail according to their idiosyncratic default probability. Then, it is assumed that each failing bank liquidates its security portfolio, depressing securities' prices and triggering fire sales, which can eventually produce further defaults. But there is more to it than that. In the framework proposed here, the propagation and amplification of shocks, and ultimately the stability of the banking system, will depend on the topology of the network of banks' overlapping portfolios. While shocks to individual banks are transmitted to the whole banking system via the contagion mechanism of the fire sales, such transmission varies according to the architecture of the network of banks' common asset exposures. Thanks to this intuition, the construction of the distribution of the number of bank defaults takes into account the topology of the interbank network.

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<sup>170</sup> For example, in the week before its demise, Lehman Brothers' senior bonds were rated A by Standard & Poor's and A2 by Fitch. See Giglio, S. (2014), "Credit Default Swap Spreads and Systemic Financial Risk", Working Paper.

<sup>171</sup> Greenwood, R., Landier, A. and Thesmar, D. (2015), "Vulnerable Banks", *Journal of Financial Economics*, Vol. 115, Issue 3, pp. 471-485, March.

<sup>172</sup> Eisenbach, T. and Duarte, F. (2015), "Fire-Sale Spillovers and Systemic Risk", Federal Reserve Bank of New York Staff Report, No 645, February.

<sup>173</sup> See also Capiello, L. and Supera, D. (2014), *Fire-sale externalities in the euro area banking sector*, *Financial Stability Review*, European Central Bank, November.

The idiosyncratic shocks to individual institutions are by definition uncorrelated. By analysing the effect of such shocks, the framework enables us to isolate the contribution of contagion to systemic risk, since the impact which may be due to other shocks hitting simultaneously all banks' balance sheets are removed.

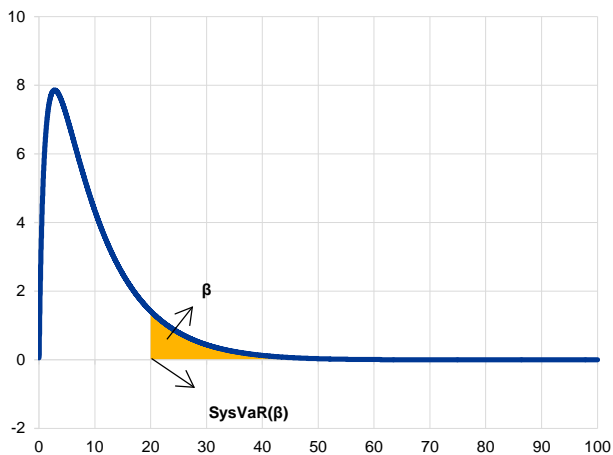
After constructing the distribution of the number of bank defaults it is possible to estimate the systemic Value-at-Risk and the probability of a systemic event. For instance, setting the probability that a systemic event occurs to a pre-specified probability  $\beta$  (e.g. 5%), the associated Value-at-Risk ( $SysVaR_t(\beta)$ ) indicates the percentage of banks (e.g. 20%) going bust in such an event (see the left-hand panel of Chart C.2 for illustration). By reverse engineering, if a systemic event is considered to occur where at least  $s\%$  of banks (e.g. 20% of banks) go bust simultaneously, the framework allows us to estimate the probability  $P_m(s)$  that such a systemic event occurs (see the right-hand panel of Chart C.2).

Once the systemic Value-at-Risk is estimated, it is necessary to evaluate whether it is indicative of a systemic event. In line with empirical evidence collected for the US banking system (according to which a simultaneous failure of more than 3% of banks is associated with a deep financial crisis – see Chart C.1), each time the systemic Value-at-Risk is larger than 3%, a systemic crisis can materialise with a probability larger than  $\beta$ .

**Chart C.2**  
Measuring systemic risk

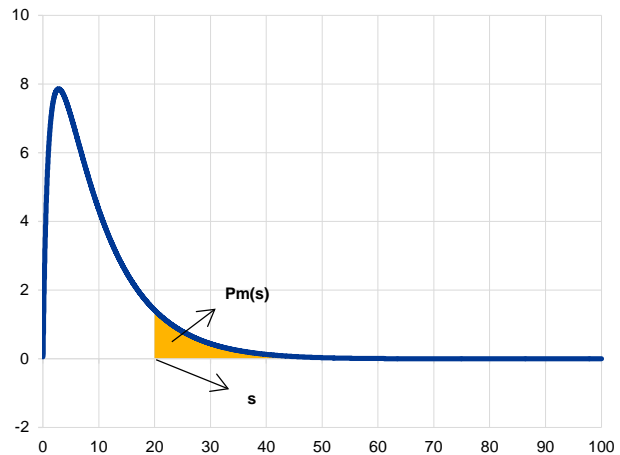
**Probability density function**

(x-axis: number of defaulting banks; percentages)



**Probability density function**

(x-axis: number of defaulting banks; percentages)



Source: ECB calculations.

Notes: The left-hand panel reports an example of the  $SysVaR(\beta)$ . Given a confidence level  $\beta$ ,  $SysVaR(\beta)$  represents the fraction of failing banks such that the probability of having more than  $SysVaR(\beta)$  defaults is equal to  $\beta$ . The right-hand panel reports the probability of having a systemic event. Given a threshold representing a number of bank defaults such that a systemic event occurs,  $P_m(s)$  represents the probability of such an event occurring.

**Box**  
Theoretical framework

This box shows that non-zero correlations between banks' default probabilities produce fat tails in the distribution of the number of bank failures. When such correlations are different from zero, the

probability that a given number of bank defaults is higher than a given threshold is larger than the case in which the same probability is computed under the assumption of zero correlations. As a consequence, looking at individual banks' default probabilities cannot guarantee financial stability.

Consider a set of  $N$  banks, indexed by  $i = 1, 2, \dots, N$ . Each bank  $i$  is characterised by a given level of equity  $e_i$ . It is assumed that at any point in time  $t \in [0, T]$  a bank defaults if its equity becomes negative. Regulators seek to ensure that the probability of banks' default remains below a given threshold by limiting the amount of risk which they can take on. Of course, regulators cannot reduce the probability of default to zero since this would mean that banks would not take any risk, including for example the risk deriving from lending to non-financial firms. For the banking system to play its role in the economy, the regulator has to tolerate that each bank bears a given risk of default. By imposing regulatory requirements, regulators decide the acceptable probability of failure  $\alpha$  of each bank (in Basel II  $\alpha$  is equal to 1/1000 and is defined over the time horizon (T) of one year).<sup>174</sup>

One can formalise these concepts as follows:

$$Pr\{e_i(t) \leq 0\} \leq \alpha, t \in [0, T], i = 1, 2, \dots, N.$$

#### Case A. Banks' probabilities of default are uncorrelated

Under the assumption that banks' probabilities of default are uncorrelated, the banking system as a whole is relatively stable and the possibility that a financial meltdown occurs is remote. This can be easily shown by computing the probability of systemic events, i.e. the probability of a simultaneous default of a large number of banks over the time horizon  $[0, T]$ . To this end, let us consider the set of stochastic variables  $\theta_1, \dots, \theta_i, \dots, \theta_N$  which take on value one if bank  $i$  defaults, and value zero otherwise:<sup>175</sup>

$$\theta_i(T) = \begin{cases} 1, & \text{if } e_i(t) \leq 0 \text{ at any time } t \in [0, T] \\ 0, & \text{otherwise} \end{cases}.$$

The total number of defaults over the considered time period is given by:

$$N_d(T) = \sum_{i=1}^N \theta_i(T).$$

To compute the distribution of  $N_d(T)$ , let us exploit the fact that each variable  $\theta_i(T)$  follows a Bernoulli distribution:

$$\theta_i(T) = \begin{cases} 1, & \text{with probability } \alpha \\ 0, & \text{with probability } (1 - \alpha) \end{cases}.$$

Since it is assumed that the pairwise default probabilities are uncorrelated – which is tantamount to assuming that the stochastic variables are independent – by the Central Limit Theorem (CLT), the distribution of  $N_d(T)$  tends, for  $N$  large enough, to a Gaussian distribution characterised by mean  $N\alpha$  and variance  $N\alpha(1 - \alpha)$ . When considering the percentage of the number of bank failures, the distribution of  $n_d$ , where  $n_d = N_d/N$ , will be:

<sup>174</sup> Note that this framework is a stylised version of the risk-based regulatory approach adopted, e.g. by the Basel Committee on Banking Supervision (BCBS). See Bank for International Settlements (2006), *Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework*, June. The BCBS assigns risk weights to assets to compute the amount of capital that banks have to hold. This enables banks to bear losses which could materialise for a given confidence level. This way, the regulator establishes the tolerable default probability for a bank.

<sup>175</sup> In this framework, we exclude the possibility of recoveries.

$$n_d(T) \sim g\left(\alpha, \frac{\alpha(1-\alpha)}{N}\right),$$

where  $g(\cdot)$  denotes a Gaussian probability density function.

In practice this result holds when  $N$  is larger than 50. Having defined the distribution of  $n_d(T)$ , it is now possible to compute the probability that systemic events occur. In this framework systemic risk is defined as the likelihood that more than  $N_s$  defaults occur over the time period  $[0, T]$ . For very large  $N$ , defining  $n_s = N_s/N$ , the probability that  $n_d$  is greater than  $n_s$  is:

$$Pr\{n_d > n_s\} = \int_{n_s}^1 g\left(x; \alpha, \frac{\alpha(1-\alpha)}{N}\right) dx.$$

To illustrate, let us assume that, in a banking system composed of  $N = 1000$  banks, the regulator sets a threshold for the default probability equal to  $\alpha = 0.001$ . Then the probability of having a systemic event with  $N_s = 20$  failures can be considered virtually inexistent.<sup>176</sup> In this framework, the soundness of each bank is enough to ensure financial stability.

### Case B. Banks' probabilities of default are correlated

Consider now the case in which banks' default probabilities are correlated and let us explore the impact that such non-zero correlations have on systemic risk. To this end, it is necessary to compute the distribution of  $N_d(T)$  when the assumptions for the CLT to hold are no longer valid. Following the approach of Vasicek (1987) for a loan portfolio,<sup>177</sup> now banks' equity levels are assumed to be correlated. This implies that the associated distribution of the percentage of the number of bank failures will be:

$$\tilde{n}_d(T) \sim \sqrt{\frac{1-\rho}{\rho}} \exp\left\{-\frac{1}{2\rho}\left(\sqrt{1-\rho}G^{-1}(n_d) - G^{-1}(\alpha)\right)^2 + \frac{1}{2}\left(G^{-1}(n_d)\right)^2\right\},$$

where  $G(\cdot)$  denotes the cumulative Gaussian distribution function and  $\rho$  is the pairwise (non-zero) correlation among banks' default probabilities. This probability density function denotes the distribution of the number of defaults (expressed as a percentage of the total number of banks  $N$ ) when the pairwise correlation between two banks' default probabilities is non-zero. Importantly, the default probability of each individual bank is still equal to  $\alpha$ , as it was in the case where correlations were equal to zero. However, the distribution of the total number of defaults is different. This result also holds when the correlations between banks' default probabilities are not pairwise the same. Note that when  $\rho = 0$ ,  $\tilde{n}_d(T)$  collapses to  $n_d(T)$ .

By way of illustration, in line with the previous example, one can assume that the regulator tolerates a default probability equal to  $\alpha = 0.001$  for each bank, and that the total number of banks is equal to  $N=1000$ . However, the correlation coefficient is now different from zero and equal to  $\rho = 0.3$ . In this case, the probability of having more than  $N_s = 20$  defaults is roughly equal to 0.007: systemic events become plausible.

<sup>176</sup> Specifically, the probability of 20 banks failing is equal to  $10^{-20}$ .

<sup>177</sup> See Vasicek O. (1987), *Probability of loss on loan portfolio*, KMV Corporation, February.



## Data

In order to capture the overlapping portfolios in the euro area banking system, this article uses two relatively new ECB datasets. These datasets are the individual monetary financial institutions' (MFI) balance sheet data and the securities holdings statistics (SHS) data. Furthermore, the SHS dataset is complemented with information about capital and leverage ratios obtained from the European Banking Authority (EBA).

Owing to their relatively large time coverage, a subset of the individual MFI balance sheet data is used to compute the development of systemic risk over time (see the section entitled "Systemic risk in the euro area: the time dimension"). Data include observations from 2007 to 2014 at monthly frequency and cover around one hundred euro area MFIs. The MFI balance sheet data, however, do not provide detailed information on banks' overlapping portfolios.

To overcome this limitation, this special feature also makes use of SHS data, which contain granular security-by-security information on the overlapping portfolios of individual banks (see the section entitled "Systemic risk in the euro area: recent snapshots"). More specifically, the SHS dataset includes individual securities' holdings by the 26 largest banking groups headquartered in the euro area at quarterly frequency (SHS Group data).

To construct overlapping portfolios for the full euro area banking system, the SHS Group data are combined with SHS Sector data, which provide information on security-by-security holdings by the aggregate banking systems of the 19 euro area Member States.<sup>178</sup> Currently, the SHS dataset covers only a short time period – it is available as of the fourth quarter of 2013.<sup>179</sup>

## Systemic risk in the euro area: the time dimension

By applying the methodology discussed in the previous section to the euro area banks covered in individual MFI balance sheet data, this section computes the dynamic evolution of the systemic Value-at-Risk when a contagion mechanism operates ( $\text{SysVaR}_t^c(\beta)$ ) and when it does not ( $\text{SysVaR}_t(\beta)$ ).<sup>180</sup> In particular, the systemic Value-at-Risk denotes the number of bank defaults (as a fraction of the total number of active banks) with a probability no larger than a given  $\beta$ . In this article  $\beta$  is set equal to 0.01.

When assuming no contagion,  $\text{SysVaR}_t(\beta)$  is constant over time and is equal to 2.8% (see the yellow line in the left-hand panel of Chart C.3). By contrast, the blue line reported in the same panel denotes the systemic Value-at-Risk when a contagion

<sup>178</sup> The security portfolios of the banks included in the SHS Group sample are subtracted from these banking system aggregates by country.

<sup>179</sup> For more information about SHS data, see ECB (2015), "Who holds what? New information on securities holdings", *Economic Bulletin*, Issue 2.

<sup>180</sup> The contagion mechanism is not operating if market liquidity is infinite, which implies that the price of securities does not change after a sale.

mechanism is operating. In particular,  $\text{SysVaR}_t^c(\beta)$  represents, at each time  $t$ , the Value-at-Risk of the distribution of the number of bank defaults – i.e. the percentage of bank failures with a confidence level equal to  $\beta = 0.01$ . Unlike the  $\text{SysVaR}_t(\beta)$ ,  $\text{SysVaR}_t^c(\beta)$  varies over time, since its computation takes into account a time-varying deleveraging process which reflects variations in banks' balance sheets. The distance between the blue line and the yellow line denotes the systemic risk which derives from contagion and, in particular, fire sales.

At the beginning of the sample, the systemic Value-at-Risk is computed under the assumption that there is contagion as high as 10%, which means that, with a probability of 1%, more than 10% of the banks in the sample could fail. The  $\text{SysVaR}_t^c(\beta)$  reaches its peak at the end of 2008, when more than 13% of the banks could go bust with a probability of 1%, to decline sharply thereafter. In the last part of our sample, the blue line and yellow line coincide, which implies that the contagion mechanism is not playing any role. Changes in the level of systemic risk can be due to changes in the banks' security portfolios or changes in banks' capital.

The left-hand panel of Chart C.3 provides an important policy message: when considering idiosyncratic default probabilities, it is necessary to take banks' interconnections into account in order to capture how a bank idiosyncratic shock can reverberate across the whole banking system and become systemic. Moreover, since the Value-at-Risk is computed at a relatively high confidence level (1%), and since there is an upper bound for the banks' default probabilities, under the assumption of no contagion, ensuring the stability of individual banks would be sufficient to guarantee the stability of the whole system – but since banks' default probabilities are positively correlated such an approach is, in fact, insufficient to preserve stability in the system as a whole.<sup>181</sup>

This framework can also be used to compute the probability that a systemic financial crisis occurs. By setting the percentage of banks going bust simultaneously – which here is set at 5% – it is possible to estimate the probability that such a systemic event occurs.<sup>182</sup> Such probability, which is depicted by the blue line in the right-hand panel of Chart C.3, increases sharply in the second half of 2007, reaching its peak in March 2008. As of 2010, this probability becomes negligible and it is indistinguishable from the probability of a systemic event when there is no contagion

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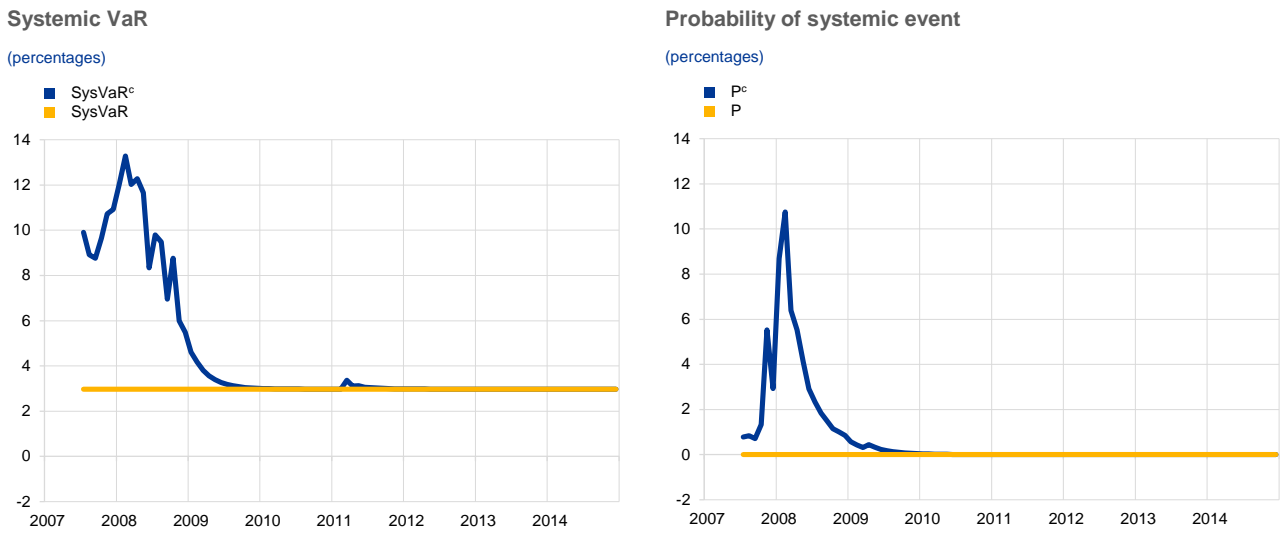
<sup>181</sup> In line with the regulatory framework, we assume that the idiosyncratic individual bank default probability is equal to 0.001, which is an upper bound. In principle, one should use the real banks' default probabilities. However, since such probabilities are pro-cyclical, it is preferred to keep them constant at their upper bound and study how variations in balance sheets affect the probability of systemic events. This allows us to isolate a particular contagion mechanism – the fire sales – from other factors which could influence systemic risk measures.

<sup>182</sup> Although the number of yearly bank defaults in the United States from 1934 to 2014 suggests that a deep financial crisis ensues when a fraction equal to or larger than 3% of the banking system fails simultaneously, the sample under consideration includes a relatively small number of banks (roughly one hundred). Therefore, a conservative approach is adopted, defining systemic events as those characterised by at least 5% of simultaneous bank defaults.

in the banking system. In the case no contagion takes place (yellow line), the probability that a systemic events occurs is constant and equal to zero.<sup>183</sup>

### Chart C.3

#### Systemic risk: the time dimension



Sources: ECB (individual MFI balance sheet items statistics) and ECB calculations.

Note: The left-hand panel reports the *SysVaR*(1%) and the right-hand panel represents the probability of having a systemic event  $P_m$ (5%), both in the case where contagion occurs (blue line) and in the case there is no contagion (yellow line).

### Systemic risk in the euro area: recent snapshots

In this section, the systemic Value-at-Risk is computed using a different dataset, the securities holdings statistics (SHS). Although the time length of this dataset is rather short – observations start in the fourth quarter of 2013 – its fine granularity enables us to obtain recent snapshots of systemic risk estimates, which account for the network of securities' overlapping portfolios.

The left-hand panel of Chart C.4 reports the systemic Value-at-Risk with a confidence level equal to 1% computed in two cases, i.e. the case in which a contagion mechanism operates, and the case in which no fire sales occur. Although the marginal default probabilities of banks are the same in the two cases, correlations induced by common exposures increase the fragility of the financial system. The right-hand panel of Chart C.4 reports the probability that a systemic

<sup>183</sup> The sovereign debt crisis is not captured by the measures of systemic risk proposed here. The reason is that these measures do not consider any price shock which is not generated by the financial system itself. After shocking the system by letting banks fail according to a probability specified by the regulator (1/1000), fire sales are triggered. The subsequent systemic Value-at-Risk only captures the amount of systemic risk attributable to fire sales, but not to other shocks such as the decline in the sovereign debt value. However, the framework is sufficiently general to accommodate further sources of shocks.

event occurs, defined as the failure of a fraction of the banking system larger than 5%.<sup>184</sup>

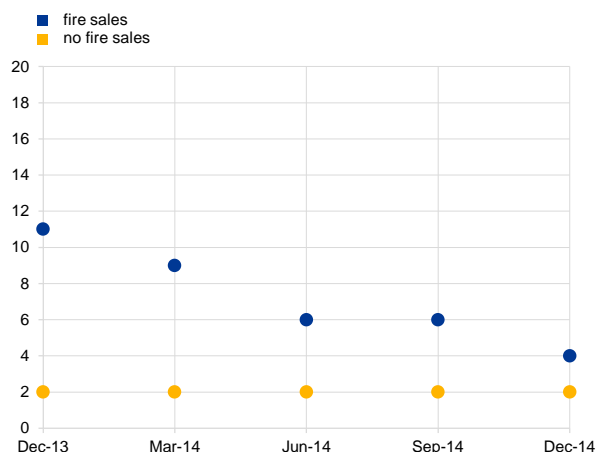
Under the assumption that contagion takes place, the systemic Value-at-Risk and the probability that a systemic crisis occurs contract significantly in the first quarter of 2014. This decrease is likely related to the announcement of the comprehensive assessment on 23 October 2013.<sup>185</sup> After the announcement, banks increased their capital and reshuffled their security portfolios. This contributed to reducing systemic risk.

### Chart C.4

#### Systemic risk: Q4 2013 – Q4 2014

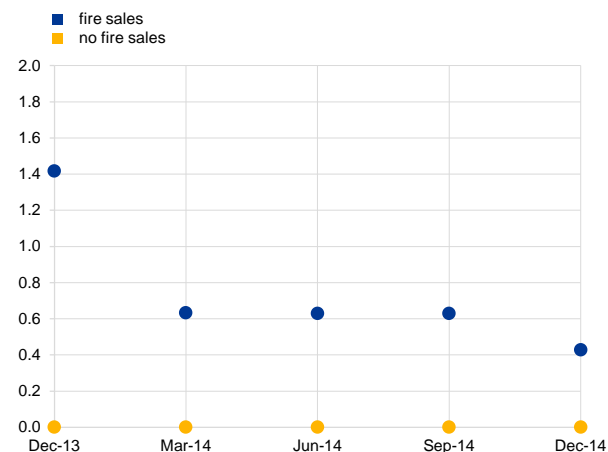
##### Systemic VaR

(percentages)



##### Probability of systemic event

(percentages)



Sources: ECB (SHS Group and SHS Sector), European Banking Authority, and ECB calculations.

Note: The left-hand panel reports the *SysVar*(1%) and the right-hand panel represents the probability of having a systemic event  $P_m$ (5%), both in the case where contagion occurs (blue dots) and in the case there is no contagion (yellow dots).

Finally, the left-hand panels of Charts C.5 and C.6 report the networks of overlapping portfolios. Each node represents a bank in the sample. Two nodes are connected if there is an overlap in the banks' tradable securities portfolios. Colour and size of the nodes highlight their centrality. By the same token, the colour and thickness of the links highlight how large the common exposure is. These charts illustrate how the topology of the banks' network changed after the announcement of the comprehensive assessment. The right-hand panels of Charts C.5 and C.6 instead report the distributions of the number of bank defaults in the fourth quarter of 2013 and in the fourth quarter of 2014, which also changed after the announcement of the comprehensive assessment. As a consequence, the systemic Value-at-Risk

<sup>184</sup> In this sample of 45 banks, 5% of failures correspond to roughly three banks going bust. With a larger sample this measure would produce a more realistic number of failures. However, since the article considers the 26 largest euro area banks and 19 bank aggregates by country, when more than three entities fail, this can certainly be associated with a systemic event.

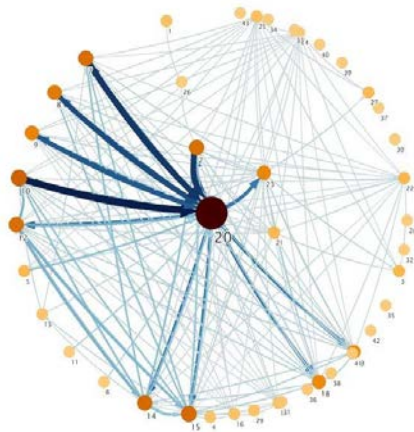
<sup>185</sup> The impact of other events cannot be ruled out. For instance, the European Banking Authority (EBA) published the results of the transparency exercise in December 2013 and banks have also improved their capital levels in advance of changes to the regulatory framework.

computed at a confidence level of 1% decreased from 11% in 2013 Q4 to 4% in 2014 Q4 (see the yellow areas).

### Chart C.5

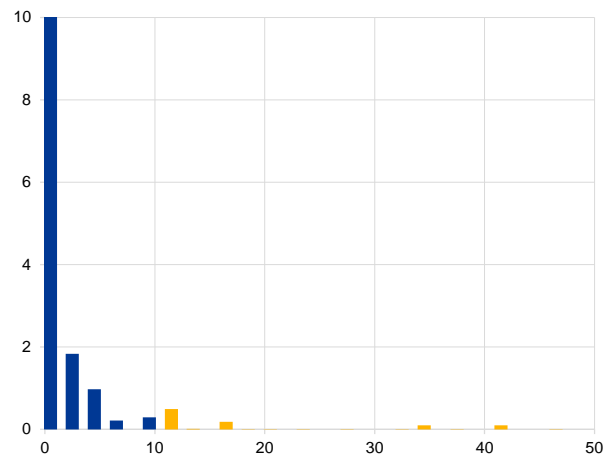
#### Systemic risk: Q4 2013

##### Network of overlapping portfolios



##### Simulated distribution of number of bank defaults

(x-axis: number of defaulting banks; percentages)



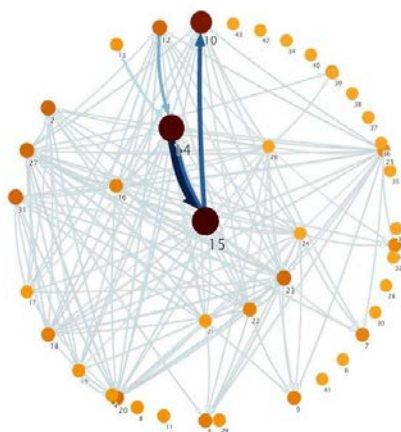
Sources: ECB (SHS Group and SHS Sector), European Banking Authority, and ECB calculations.

Notes: The left-hand panel reports the network of overlapping portfolios. Each node represents a bank in the sample or a banking system aggregate for a country. Two nodes are connected if there is an overlap in the banks' tradable securities portfolios. Colour and size of the nodes highlight their centrality. Colour and thickness of the links highlight how large the common exposure is. The right-hand panel reports the simulated distribution of the number of bank defaults in 2013 Q4. The yellow areas show the 1% quantile of the distribution.

### Chart C.6

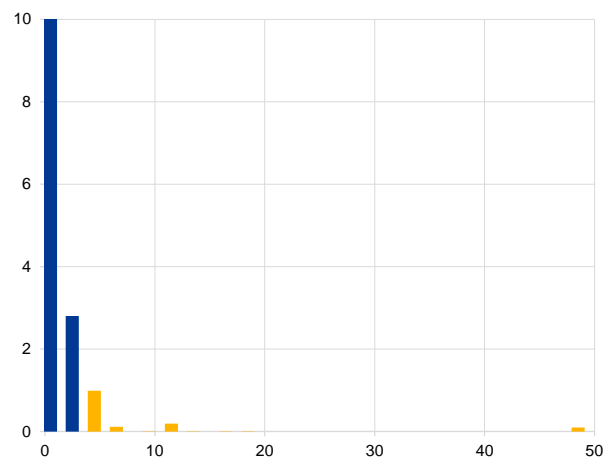
#### Systemic risk: Q4 2014

##### Network of overlapping portfolios



##### Simulated distribution of number of bank defaults

(x-axis: number of defaulting banks; percentages)



Sources: ECB (SHS Group and SHS Sector), European Banking Authority, and ECB calculations.

Notes: The left-hand panel reports the network of overlapping portfolios. Each node represents a bank in the sample or a banking system aggregate for a country. Two nodes are connected if there is an overlap in the banks' tradable securities portfolios. Colour and size of the nodes highlight their centrality. Colour and thickness of the links highlight how large the common exposure is. The right-hand panel reports the simulated distribution of the number of bank defaults in 2014 Q4. The yellow areas show the 1% quantile of the distribution.

## Concluding remarks

This special feature defines systemic risk as the simultaneous failure of a “large” number of banks. The notion of “large” is qualified by looking at disruptive financial crises in the United States from 1934 to 2014. In such crises more than 3% of banks defaulted at the same time. Exploiting this intuition, this article suggests a measure of systemic risk as the Value-at-Risk of a banking system, i.e. the percentage of banks going bust simultaneously over a given time horizon for a given confidence level. To estimate the systemic Value-at-Risk, the distribution of the number of bank failures is derived. In this framework, the mechanism generating fat tails in such a distribution and therefore leading to systemic risk is contagion. In particular, contagion materialises through fire sales and is affected by the topology of the network of banks’ common exposures. The framework is general enough to accommodate any contagion mechanism.

This special feature applies this framework to data on the euro area banking system. After the announcement of the comprehensive assessment in October 2013 banks reshuffled their security portfolios, which resulted in a decline in the probability of a systemic event occurring.

The framework proposed in this special feature has significant policy implications. In contrast to the monetary policy domain where extensive literature exists on the definition and measurement of price stability, no equivalent, quantifiable objective is available to macroprudential policy-makers. This special feature seeks to fill this gap. A clear definition and measurement of systemic risk can enhance the design of policies to contain it and contribute to the accountability of policy-makers.

The framework can also be extended to identify systemically important assets and banks and to track their systeminess over time. It therefore allows policy-makers to take appropriate measures to reduce the likelihood that systemic risk materialises and target the main factors responsible for driving systemic events.

## D Quantifying the policy mix in a monetary union with national macroprudential policies<sup>186</sup>

*In a monetary union, targeted national macroprudential policies can be necessary to address asymmetric financial developments that are outside the scope of the single monetary policy. This special feature discusses and, using a two-country structural model, provides some model-based illustrations of the strategic interactions between a single monetary policy and jurisdiction-specific macroprudential policies. Counter-cyclical macroprudential interventions are found to be supportive to monetary policy conduct through the cycle. This complementarity is significantly reinforced when there are asymmetric financial cycles across the monetary union.*

### Introduction

Macroprudential policy in the euro area is primarily conducted by designated national macroprudential authorities, with a central coordinating and horizontal role for the ECB – especially since the establishment of the Single Supervisory Mechanism (SSM) which granted the ECB some macroprudential powers.<sup>187</sup>

The predominantly decentralised organisation of macroprudential policy-making in the euro area reflects inter alia the still incomplete integration of national banking sectors and heterogeneous financial cycles across euro area countries. In addition, as the single monetary policy mandate is to deliver price stability over the medium term for the euro area as a whole, monetary policy may actually look through financial stability risks building up in specific market segments, jurisdictions or individual countries. Such risks could also have implications for financial stability at the area-wide level. Hence, in a monetary union setting such as the euro area, nationally oriented macroprudential policies have a role to play in ensuring financial stability for all jurisdictions and supporting monetary policy conduct through the cycle. This may be especially relevant in the current circumstances in which the prolonged period of low interest rates combined with non-standard monetary policy measures may have unintended and localised financial stability effects that targeted macroprudential policies could help to alleviate.<sup>188</sup>

Against this background, this article first surveys the ongoing debate regarding the roles of and interaction between monetary policy and macroprudential policy. Second, issues related to the interaction between the two policies in the specific situation of a monetary union are discussed. Third, using a structural macro model extended to a two-country set-up and calibrated to individual euro area countries, the special feature illustrates the importance of country-specific macroprudential policies in the context of monetary union.

<sup>186</sup> Prepared by Matthieu Darracq Paries, Elena Rancoita and Christoffer Kok.

<sup>187</sup> According to the SSM Regulation, the power to initiate and implement macroprudential measures will primarily remain with the national authorities, subject to a notification and coordination mechanism vis-à-vis the ECB; see Article 5 of Council Regulation (EU) No 1024/2013.

<sup>188</sup> See Draghi, M., "Hearing at the European Parliament's Economic and Monetary Affairs Committee", speech, Brussels, March 2015.

## The interaction of monetary policy and macroprudential policy

The global financial crisis revealed, among other things, that price stability may be a necessary condition but is not a sufficient condition for financial stability. At the same time, the recent years' crisis experiences have made it evident that financial instability can feed back to the real economy and hence impinge on the ability of monetary policy to secure price stability.

As a result, in the aftermath of the financial crisis, policy-makers have taken initiatives to establish adequate institutional policy set-ups that can help ensure the concomitant achievement of the price stability and financial stability objectives. One of the main innovations in this regard has been the establishment of a macroprudential policy function targeted at reducing systemic risks to financial stability. In Europe, macroprudential authorities have been set up at the national level across all EU countries, often – but not always – with the central bank in the leading role. At the multinational level in the EU, the European Systemic Risk Board (ESRB) was established in 2011 with the mission of macroprudential oversight of the EU financial system and the possibility to issue warnings and recommendations for remedial actions to relevant counterparts at the national and EU levels. In the context of the establishment of the SSM, the ECB was granted macroprudential powers concerning measures included in the EU legal texts (i.e. CRD IV and the CRR).<sup>189</sup>

Macroprudential policies aimed at increasing the resilience of the financial system as a whole and at mitigating the build-up of financial imbalances can be considered a complementary policy function to monetary policy, focused on price stability, and micro-prudential supervision, focused on the stability of individual financial institutions.<sup>190</sup>

Despite the establishment of macroprudential authorities in various jurisdictions in the advanced economies, there is still limited experience with the implementation and effectiveness of macroprudential policies, of how they should interact with monetary policy and of the synergies and potential trade-offs.<sup>191</sup> With regard to the

<sup>189</sup> See the special feature by Carboni, M., Darracq Pariès, M. and Kok, C. entitled “Exploring the nexus between macroprudential policies and monetary policy”, *Financial Stability Review*, ECB, May 2013. See also Cecchetti, S. and Kohler, M., “When capital adequacy and interest rate policy are substitutes (and when they are not)”, *Working Paper Series*, No 379, BIS, May 2012; Claessens, S., Habermeier, K., Nier, E., Kang, H., Mancini-Griffoli, T. and Valencia, F., “The Interaction of Monetary and Macroprudential Policies”, IMF Policy Paper, September 2013; and Habermeier, K., Mancini-Griffoli, T., Dell’Ariccia, G. and Haksar, V., “Monetary Policy and Financial Stability”, IMF Policy Paper, August 2015.

<sup>190</sup> This article focuses exclusively on the interaction between macroprudential policies and monetary policy, while noting that complementarities, synergies and trade-offs with respect to microprudential oversight are also an important dimension; see the special feature by Boissay, F. and Capiello, L. entitled “Micro- versus macro-prudential supervision: potential differences, tensions and complementarities”, *Financial Stability Review*, ECB, May 2014.

<sup>191</sup> The lack of a clear consensus should also be seen in the light of still limited practical experience with macroprudential policies in the advanced economies; see also the special feature by Kok, C., Martin, R., Moccero, D. and Sandström, M. entitled “Recent experience of European countries with macroprudential policy”, *Financial Stability Review*, ECB, May 2014 and the references quoted therein. See also Bruno, V., Shim, I. and Shin, H. S., “Comparative assessment of macroprudential policies”, *Working Paper Series*, No 502, BIS, 2015; and Cerutti, E., Claessens, S. and Laeven, L., “The use and effectiveness of macroprudential policies: new evidence”, *Working Paper Series*, No WP/15/61, IMF, 2015.



interaction between macroprudential and monetary policies, there are conflicting views about the extent to which in particular monetary policy should provide some support to help achieve financial stability objectives.<sup>192</sup> Owing to the strong mutual dependencies between the two policy functions and reflecting uncertainty about whether macroprudential policy will be able to fulfil all its objectives and get into all of the cracks of the financial system, arguments can be made for assigning some role for monetary policy to complement the new macroprudential policies.<sup>193</sup> According to Smets (2014)<sup>194</sup>, the need to incorporate a role (albeit secondary) for financial stability concerns in the monetary policy objectives hinges on: (i) the effectiveness of macroprudential policies (e.g. the ability to manage the financial cycle); (ii) the extent to which monetary policy (including conventional and unconventional measures) can be a source of financial instability, for example by incentivising bank risk-taking; and (iii) the extent to which monetary policy can avoid being drawn into financial stability concerns, especially in crisis times.<sup>195</sup>

The reputational risk to the central bank as a macroprudential authority also needs to be borne in mind. In cases where explicit financial stability targeting is part of the monetary policy mandate, the potential time-inconsistency problems between the two policy functions can trigger “financial (stability) dominance” and hence may result in inflation bias.<sup>196</sup> To mitigate such credibility concerns, an extensive degree of accountability and communication are needed when the central bank is responsible for both monetary policy and macroprudential policy.

## Macroprudential policies in a monetary union

Notwithstanding the general complexity of managing and coordinating macroprudential and monetary policy interactions, conducting macroprudential policies in a monetary union such as the euro area creates additional challenges.

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<sup>192</sup> Two opposing viewpoints call for either (i) keeping the two policy functions separate, which also implies that pre-crisis price stability-oriented monetary policy frameworks should remain largely unaffected, or (ii) fully merging the monetary policy and macroprudential policy objectives. For proponents of the former viewpoint, see e.g. Bean, C., Paustian, M., Penalver, A. and Taylor, T., “Monetary policy after the fall”, in “Macroeconomic Challenges: The Decade Ahead”, Proceedings of the Federal Reserve Bank of Kansas City Economic Policy Symposium, Jackson Hole, Wyoming, August 2010; and Svensson, L., “The relation between monetary policy and financial stability policy”, *International Journal of Central Banking*, Vol. 8 (Supplement 1), pp. 293-295, 2012. For proponents of the latter viewpoint, see e.g. Brunnermeier, M. and Sannikov, Y., “Reviving Money and Banking”, in Baldwin, R. and Reichlin, L. (eds.), *Is Inflation Targeting Dead?*, VoxEU e-book, 2013.

<sup>193</sup> See e.g. Borio, C., “Monetary policy and financial stability: what role in prevention and recovery?”, *Working Paper Series*, No 440, BIS, 2014; Woodford, M., “Inflation targeting and financial stability”, *Economic Review*, Sveriges Riksbank, pp. 7-32, 2012; and Stein, J., “Monetary policy as financial stability regulation”, *Quarterly Journal of Economics*, Vol. 127, No 1, pp. 57-95.

<sup>194</sup> See Smets, F., “Financial stability and monetary policy”, *International Journal of Central Banking*, Vol. 10, No 2, June 2014.

<sup>195</sup> To the extent that an extended monetary policy mandate including financial stability concerns, as a complement to macroprudential policies, can help prevent the build-up of excessive debt overhangs in pre-crisis periods, it could alleviate the need for monetary policy to engage in post-crisis resolution policies; see also Borio (op. cit.).

<sup>196</sup> See Smets (op. cit.) and Ueda, K. and Valencia, F., “Central bank independence and macroprudential regulation”, *Working Paper Series*, No WP/12/101, IMF, 2012. See also “The importance of macroprudential policy for monetary policy”, *Monthly Report*, Deutsche Bundesbank, March 2015.

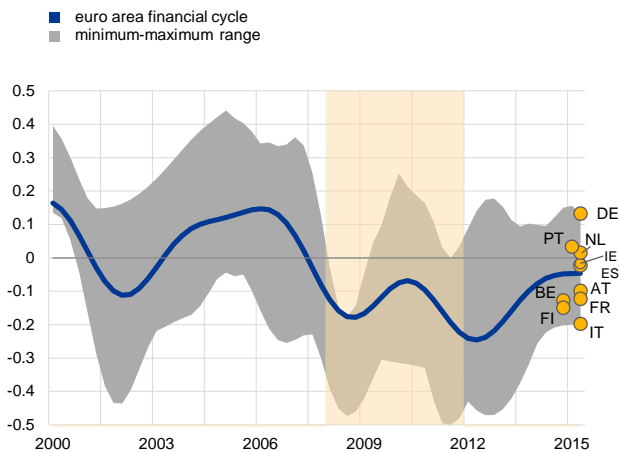
In a monetary union where monetary policy is focused on area-wide developments, macroprudential policies gain more importance in order to counteract possible adverse effects on financial stability of the “one-size-fits-all” monetary policy. In the same vein, the argument for proactive macroprudential policies may even be stronger in a monetary union than elsewhere due to their targeted nature and the fact that they can be adjusted to reflect the heterogeneous financial developments across countries within the monetary union.<sup>197</sup>

**Chart D.1**

Financial cycles in the euro area are non-synchronous

**The financial cycle in euro area countries**

(Q1 2000 – Q2 2015; y-axis: normalised deviation from historical median)



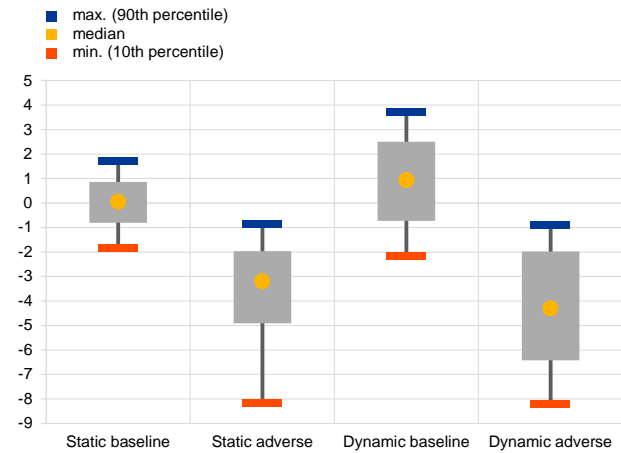
Sources: Bloomberg and ECB calculations.  
Notes: See Schüler, Y., Hiebert, P. and Peltonen, T., “Characterising the financial cycle: a multivariate and time-varying approach”, *Working Paper Series*, No 1846, ECB, 2015. The grey area marks the locations of financial cycles of ten euro area countries (AT, BE, DE, ES, FI, FR, IE, IT, NL and PT). The financial cycle is a filtered time-varying linear combination emphasising similar developments in underlying indicators (total credit, residential property prices, equity prices and bond prices). The yellow area indicates times of financial turmoil (Q1 2008 – Q4 2011). Figures for BE and FI refer to Q4 2014, while figures for PT refer to Q1 2015.

**Chart D.2**

Notable cross-country differences in banking sector resilience to adverse shocks

**Euro area banks’ resilience to stress: impact of the AQR and stress-test scenarios on CET1 ratios**

(end-horizon compared with end-2013; percentage change, percentiles, interquartile distribution and median)



Source: *Aggregate report on the comprehensive assessment*, ECB, October 2014.  
Notes: “Static” refers to banks for which the stress test was conducted under a static balance sheet assumption; “dynamic” refers to banks for which the stress test was conducted under a dynamic balance sheet assumption (i.e. banks undergoing restructuring plans).

Macroprudential policies are well suited to taking into account national factors, such as the build-up of financial imbalances and the financial system’s degree of resilience.<sup>198</sup> For example, within the euro area the lack of synchronicity of credit cycles points to a need for national macroprudential policies (see Chart D.1). In a similar vein, the finding (in the ECB’s 2014 comprehensive assessment) that banking sectors in different euro area countries substantially differ in their resilience to adverse shocks of a similar nature (see Chart D.2) likewise suggests that macroprudential (and micro-prudential) policies targeting banking groups in specific countries are warranted. Moreover, it is widely acknowledged that expansionary and unconventional monetary policies may have unintended side-effects on the financial

<sup>197</sup> See e.g. Constâncio, V., “Financial stability risks, monetary policy and the need for macroprudential policy”, speech at the Warwick Economics Summit, February 2015.

<sup>198</sup> See Deutsche Bundesbank (op. cit.).

system. Especially in the context of a monetary union with a single monetary policy and the introduction of new, unconventional policy measures (e.g. asset purchase programmes), any potential derived risks to euro area financial stability would most likely need to be addressed by targeted macroprudential policies.<sup>199</sup>

At the same time, macroprudential policies conducted by national authorities may generate cross-border spillover effects and leakages. To mitigate such spillovers, there will need to be a systematic coordination among national macroprudential authorities. Within the euro area, the ECB has a natural coordination role.<sup>200</sup> Furthermore, the ECB's ability to tighten macroprudential policy measures should help in reducing national "inaction bias".

Practical experience with macroprudential policies in advanced economies and how they interact with monetary policy is still relatively scarce, especially concerning operational macroprudential policies in a monetary union. Therefore, model-based simulations can be useful to help gauge the potential effectiveness of and calibration issues related to macroprudential policy implementation (see next section).

## The transmission mechanism of jurisdiction-specific macroprudential instruments

### Calibrating a two-country macro-financial model for the euro area

For the purpose of illustrating the role of national macroprudential policies in a monetary union, a dynamic stochastic general equilibrium (DSGE) model with various macro-financial linkages and consisting of two countries subject to a single monetary policy is employed.<sup>201</sup> The box provides a brief description of the modelling approach.

While a number of studies have analysed the macroprudential and monetary policy interactions in closed-economy settings<sup>202</sup>, there are only a few studies to date that extend the analysis to a multi-country monetary union setting.<sup>203</sup>

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<sup>199</sup> See e.g. Draghi (op. cit.).

<sup>200</sup> In practice, within the euro area the macroprudential policy interaction between national authorities and the ECB works through the Financial Stability Committee of the Eurosystem. This set-up relies on a coordinating role for the ECB to promote analytical tools and to put emphasis on cross-border spillovers and reciprocity; see e.g. Constâncio, V., "Strengthening macroprudential policy in Europe", speech at the conference on "The macroprudential toolkit in Europe and credit flow restrictions", Vilnius, July 2015; and Panetta, F., "On the special role of macroprudential policy in the euro area", remarks at De Nederlandsche Bank, Amsterdam, June 2014.

<sup>201</sup> See Darracq Pariès, M., Kok, C. and Rancoita, E., "Cross-border banking, macroprudential policy and monetary policy in a monetary union", *Working Paper Series*, ECB, forthcoming.

<sup>202</sup> See Carboni et al. (op. cit.) and the references therein. See also Gertler, M., Kiyotaki, N. and Queralto, A., "Financial crises, bank risk exposure and government financial policy", *Journal of Monetary Economics*, Vol. 59, Supplement, pp. S17-S34, 2012; Benes, J., Kumhof, M. and Laxton, D., "Financial crises in DSGE models: selected applications of MAPMOD", *Working Paper Series*, No WP/14/56, IMF, 2014; and Angelini, P., Neri, S. and Panetta, F., "Capital requirements and monetary policy", *Journal of Money, Credit and Banking*, Vol. 46, pp. 1073-1112, 2014.

## Box

### A brief model description

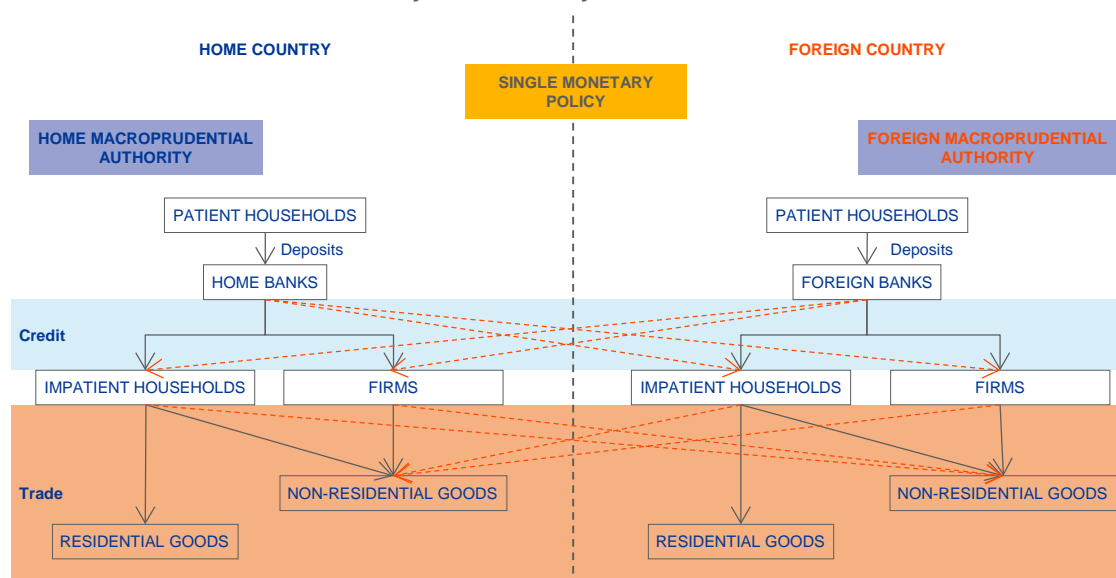
The model is a two-country DSGE model, where the home country represents one country of the euro area and the foreign country represents the aggregation of the other euro area countries. The model was calibrated five times so that each time the home country was calibrated on one of the five largest euro area economies (Germany, France, Italy, Spain and the Netherlands).

The individual economies are modelled following Darracq Pariès et al. (2011)<sup>204</sup> implying that each economy consists of three agents (households<sup>205</sup>, firms<sup>206</sup> and banks<sup>207</sup>) and two sectors producing residential and non-residential goods, respectively. Monetary policy in the model is formalised in terms of an interest rate rule that prescribes a response to inflation, output growth and asset prices.

### Chart D.3

#### A two-country model

##### A schematic overview of the two-country model economy



Notes: Black lines indicate domestic credit and trade transactions. Red dotted lines indicate cross-border trade or credit transactions.

<sup>203</sup> A few recent exceptions include Quint, D. and Rabanal, P., "Monetary and macroprudential policy in an estimated DSGE model for the euro area", *International Journal of Central Banking*, Vol. 10, No 2, pp. 169-236, 2014 and Brzoza-Brzezina, M., Kolasa, M. and Makarski, K., "Macroprudential policy instruments and economic imbalances in the euro area", *Working Paper Series*, No 1589, ECB, 2013.

<sup>204</sup> Darracq Pariès, M., Kok, C. and Rodriguez Palenzuela, D., "Macroeconomic propagation under different regulatory regimes: evidence from an estimated DSGE model for the euro area", *International Journal of Central Banking*, Vol. 7, No 4, pp. 49-113, 2011.

<sup>205</sup> The household sector consists of two types of household, differing in their relative degree of patience. "Impatient" households are financially constrained and borrow from banks in order to buy the residential goods. Residential goods are treated as durable goods and serve two purposes: they can be either directly consumed or used as collateral in the mortgage market.

<sup>206</sup> Firms produce non-residential and residential intermediate goods under perfect competition and face financing constraints.

<sup>207</sup> The banking sector has four business lines (deposit-taking, wholesale, loan book financing and retail loan provision). Banks collect deposits from patient households and provide funds to entrepreneurs and impatient households.

Banks are affected by three layers of financial frictions, which have important implications for the propagation of shocks in the economy. First, banks face risk-sensitive capital requirements as well as adjustment costs related to their capital structure. Second, banks have some degree of market power in the retail market which generates imperfect pass-through of market rates to bank deposit and lending rates. Third, due to banks' imperfect information about their borrowers and hence the costs of monitoring their credit contracts, firms and impatient households face external financing premia which depend on their leverage.

In the model, the two countries are interconnected via trade and banking sector linkages. On the trade side, residential goods are treated as durable goods and are non-tradable, while non-residential goods can be traded across countries. Concerning cross-border credit linkages, it is assumed that households and firms can borrow abroad, as well as at home (see also Chart D.3 for a schematic overview of the key model components including the relevant cross-border linkages).

To explore the potential benefits of tailoring macroprudential policies to national circumstances while taking account of the single monetary policy stance, the two-country model is successively calibrated to capture the banking system characteristics and macroeconomic features of each of the five largest euro area countries, against the rest of the euro area. The cross-country heterogeneity is reflected first through the degree of demand-side and supply-side credit frictions related to: (i) leverage and the credit risk profile of households and firms; (ii) the lending rate pass-through; and (iii) the bank capital channel. Then, countries differ in terms of their size, trade openness and financial interconnectedness.

For the calibration of the banking sector, we use inter alia proprietary granular bank-level stress-test data from the ECB's 2014 comprehensive assessment to set credit risk characteristics (i.e. portfolio-specific probabilities of default or PDs and loss given default or LGD) determining the lending rates. We aggregate individual bank information up to country-level indicators, also taking into account the geographical breakdown of banks' exposures. Bank capital adjustment costs were calibrated based on stress-test data on exposures and capital that were used to compute the target capital ratio at the country level. Country-specific bank interest rate pass-through estimates were used to calibrate the degree of stickiness in retail interest rates across countries, which affects the strength with which shocks to bank balance sheets propagate to the real economy via the cost of bank financing.<sup>208</sup> Household indebtedness is an important structural factor determining how the economy reacts to, for instance, house price shocks. For this purpose, country-specific historical averages of loan-to-GDP ratios for households (sources: ECB and Eurostat) were used to calibrate the degree of private indebtedness at the country level.<sup>209</sup>

With regard to trade and financial linkages, the countries' share of imports and exports in real GDP was used to proxy trade openness (source: Eurostat), while MFI data on intra-euro area cross-

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<sup>208</sup> See Darracq Pariès, M., Moccero, D., Krylova, E. and Marchini, C., "The retail bank interest rate pass-through: the case of the euro area during the financial and sovereign debt crises", *Occasional Paper Series*, No 155, ECB, August 2014.

<sup>209</sup> Technically speaking, in the model, the share of household (housing) loans in GDP is an increasing function of two parameters which capture the share of borrowers and the loan-to-value ratio, respectively. Intuitively, higher steady-state debt levels translate into a higher responsiveness of GDP to house price developments, either via an increase in the proportion of borrowers, or via a rise in the maximum loan-to-value ratio that the bank is willing to grant. As a result, higher debt levels make economies more vulnerable to downward house price corrections.

border credit to MFIs and non-MFIs were used to proxy financial openness.<sup>210</sup> Stronger trade links and/or more pervasive cross-border credit linkages would tend to strengthen spillover effects of macroprudential policies from one country to another.

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### **Taming jurisdiction-specific financial cycles: stabilising properties of macroprudential instruments in the monetary union**

A first step in exploring the interaction between macroprudential oversight and monetary policy in the euro area is to analyse the macroeconomic propagation within the monetary union of selected macroprudential instruments (MPIs), namely: (i) system-wide bank capital requirements; (ii) sectoral capital requirements; and (iii) loan-to-value ratio restrictions. Capital requirements increase the resilience of the banking system as a whole by ensuring adequate buffers to cope with losses. Sectoral capital requirements make lending to certain classes of borrowers more costly and hence prompt banks to reduce their activity in that segment. Restrictions on loan-to-value ratios pertain to the banks' assets side, directly affecting the borrowing constraints of their customers, and hence make the banking system less vulnerable to borrower defaults.

Intuitively two prescriptions would nonetheless hold with respect to the use of alternative MPIs. First, from a domestic perspective, targeted instruments would be superior to non-targeted ones to address sector- or financial segment-specific financial vulnerabilities. At the same time, broad-based signs of financial excesses or uncertainty about the main drivers of financial developments would suggest using instruments that are less intrusive into the asset composition of the banking system. Second, jurisdiction-specific macroprudential instruments may be better suited than the single monetary policy to address asymmetric country-wide developments within the monetary union.

The modelling exercises that follow aim to introduce a quantitative perspective on these aspects and elaborate further on the role of country characteristics, focusing on the five largest euro area countries.<sup>211</sup> For illustrative purposes, we compare the macroeconomic allocations corresponding to a temporary increase in system-wide capital requirements with those resulting from temporary<sup>212</sup> increases of (i) sectoral

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<sup>210</sup> As the interbank market is the major channel of financial cross-border linkages, total credit (i.e. loans and debt securities) granted to both MFIs and non-MFIs was used rather than direct loans to foreign households and firms. In this way, the effective size of cross-border credit spillovers across countries was captured.

<sup>211</sup> For the euro area as a whole, Carboni et al. (op. cit.) covered domestic aspects of the MPIs' transmission mechanisms. We refer the reader to this publication for more details and focus here on the cross-country spillovers and monetary policy interactions in a monetary union.

<sup>212</sup> If we considered permanent changes in the capital requirements, the short-term responses of the economic allocations would not change. In this case, however, over the long run the positive effects of the macroprudential policies considered here might outweigh their short-term negative impact, as the economy might reach a new steady state characterised by a more resilient banking system.

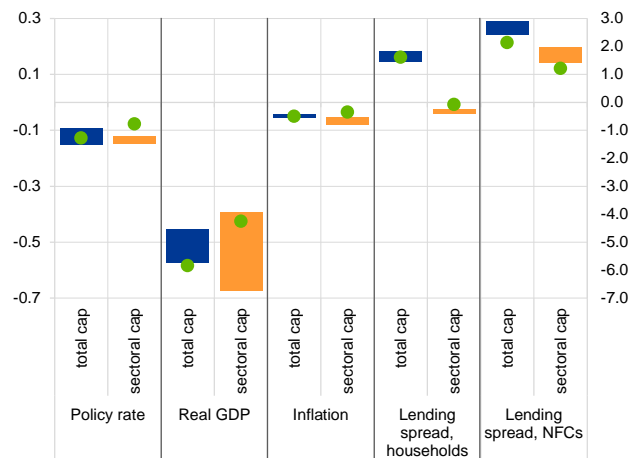
capital requirements on non-financial corporate loans and (ii) caps on the loan-to-value ratio.<sup>213</sup>

Charts D.4 and D.5 show the impact of the macroprudential measures on real economic and financial variables of home and foreign economies, respectively, for the five calibrations. Each bar illustrates the dispersion across the different calibrations of the impact of an increase in the system-wide capital requirements (orange) and of the sectoral capital requirements (blue) on the policy rate, real GDP, inflation and lending spreads after two years. The diamonds represent the average across countries after two years when financial cross-border linkages are shut down. Only results for system-wide capital requirements and sectoral risk weights are shown. The results for the loan-to-value ratio cap are qualitatively similar to the latter case.

**Chart D.4**  
Macroprudential tightening measures negatively affect economy... but impact mitigated by monetary policy...

**Transmission of macroprudential policy measures in “home” country under endogenous single monetary policy**

(real GDP (percentage deviation from baseline, left-hand scale); inflation (percentage point deviation from baseline, left-hand scale); interest rates (percentages, right-hand scale))

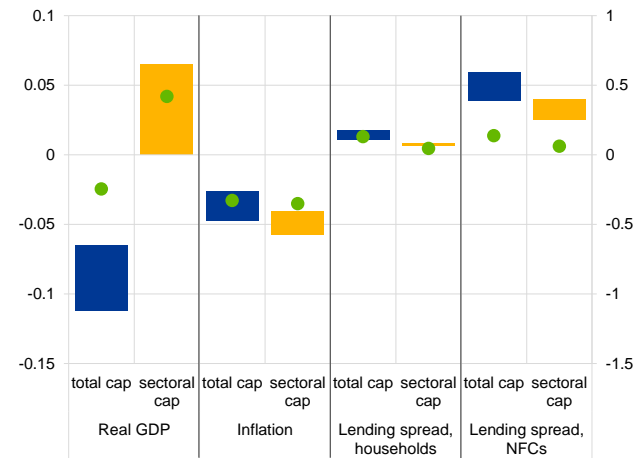


Source: ECB calculations.  
Notes: Coloured ranges indicate the cross-country dispersion of results and green diamonds indicate the simple average impact across countries without taking into account financial cross-border linkages. "Total cap" refers to system-wide bank capital requirements, whereas "sectoral cap" refers to sectoral capital requirements on loans to non-financial corporations.

**Chart D.5**  
... and the measures produce non-negligible cross-border spillovers

**Transmission of macroprudential policy measures in “foreign” country under endogenous single monetary policy**

(real GDP (percentage deviation from baseline, left-hand scale); inflation (percentage point deviation from baseline, left-hand scale); interest rates (percentages, right-hand scale))



Source: ECB calculations.  
Notes: Coloured ranges indicate the cross-country dispersion of results and green diamonds indicate the simple average impact across countries without taking into account financial cross-border linkages. "Total cap" refers to system-wide bank capital requirements, whereas "sectoral cap" refers to sectoral capital requirements on loans to non-financial corporations.

In response to higher regulatory system-wide capital requirements (i.e. broad-based capital buffer requirements, such as a counter-cyclical capital buffer, systemic risk buffer and G-SIFI buffer), banks react by charging higher margins on new loans and curtailing the provision of credit symmetrically to domestic households and firms,

<sup>213</sup> The macroprudential measures have been calibrated so that the loan growth of the targeted sector (i.e. households for the loan-to-value measure and firms for the sectoral risk weights) decreases by 1% on average over the first year.

albeit to different degrees.<sup>214</sup> The resulting contraction in both investment and private consumption depresses capital and house prices, which exacerbates the propagation effects through financial accelerator mechanisms (as the decline in collateral values tightens borrowing constraints). The impact on the economy of the macroprudential tightening is, however, mitigated by an accommodative response of monetary policy.

System-wide capital requirement measures have, on average, a larger effect on the macroeconomic variables of the domestic and foreign economies than more targeted macroprudential measures. At the same time, it is notable that the sectoral risk weight measure targeting corporate loans results in more dispersed macroeconomic effects across countries. This feature can be explained by the current high dispersion of PDs of non-financial corporations across euro area countries. In particular, curtailing credit to firms has the strongest effects on the real GDP of southern European countries which determine the very high dispersion towards more negative values of the real GDP response and are characterised by higher risk weights for these loans. PDs are less dispersed across countries for the retail loan book and hence measures targeting the household sector (such as loan-to-value ratios or sectoral risk weights on mortgage loans) in general lead to less heterogeneous macroeconomic propagation across euro area countries.

In terms of cross-border spillovers, macroprudential measures in the targeted jurisdiction are transmitted to the rest of the euro area through various channels. Trade linkages propagate the expenditure slowdown for the domestic economy into weaker foreign demand for the other country (see green diamonds in Charts D.4 and D.5). Banks' cross-border loan exposures create direct financial spillovers: the deleveraging pressures of domestic banks lead to funding pressures on foreign banks, which ultimately lead to a tightening of the credit conditions offered to their local customers.<sup>215</sup> Finally, in a monetary union, domestic shocks are transmitted abroad through the monetary policy reaction. In particular, the monetary policy response may provide a shield for macroeconomic allocations in the domestic economy, provided that the country is large enough and monetary policy has scope to accompany the bank balance sheet adjustment at times when capital buffers are increasing. However, this may ease the liquidity conditions in the rest of the euro area and contribute to macroeconomic heterogeneity within the monetary union. According to our simulations, system-wide capital requirements generate larger and negative cross-border spillovers to the foreign country, while the sectoral capital requirements on non-financial corporate loans even generate a positive GDP response. In this second case, the accommodative monetary policy seems to play a more relevant role than the negative effects arising from the decline in foreign demand.

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<sup>214</sup> As the average risk weights on credit to firms are higher than those on credit to households, according to the data used in the model calibration (see box), banks reduce their corporate loan book by more than they reduce credit to households.

<sup>215</sup> This assumes full reciprocity of the macroprudential measures to be imposed also on foreign branches operating in the "home" country and ignores any leakages of targeted activities to non-regulated entities (such as shadow banks); see also the special feature by Fahr, S. and Zochowski, D., "A framework for analysing and assessing cross-border spillovers from macroprudential policies", *Financial Stability Review*, ECB, May 2015.



## Cross-country heterogeneity and the scope for macroprudential support to monetary policy conduct through the cycle

The potential interactions between monetary policy and macroprudential policies in a monetary union can also be illustrated with the two-country DSGE model. The following theoretical results are to some extent model-specific and should be considered with caution. At the same time, they shed some light on the role of macroprudential policy through the cycle, also from the perspective of high and persistent cross-country heterogeneity within the monetary union.

The simulation exercise relies on a calibration of the model for two regions: one region corresponds to the countries less affected by the financial crisis and the other region covers the rest of the euro area.<sup>216</sup> Within the confines of this theoretical framework, the scope for macroprudential policies is evaluated through the joint optimisation of an interest rate policy rule for the single monetary policy and counter-cyclical capital rules for the two regional macroprudential authorities. We focus on cooperative policy arrangements.<sup>217</sup>

In order to convey the stabilisation trade-offs, the results are presented in terms of a policy efficiency frontier in the output and inflation volatility space: the efficiency frontier portrays, for all sets of policy-makers' preferences, the output and inflation volatility implied by the corresponding optimised rules. Four configurations are examined. First, we derive the efficiency frontier in the absence of macroprudential intervention and with the full set of estimated business cycle shocks (blue line in Chart D.6). This would span the reference set of macroeconomic allocations against which the benefits of macroprudential support could be assessed. The optimised monetary policy rule responds to output and inflation, but also to debt and asset prices, which could be interpreted as vindicating to some extent "leaning against the wind".

Second, counter-cyclical capital rules are introduced, reacting to credit, asset price dynamics and cyclical economic conditions. This induces an inward shift of the efficiency frontier (yellow dotted line in Chart D.6): macroprudential support to monetary policy enables a superior performance in terms of macroeconomic stabilisation. In addition, the introduction of counter-cyclical macroprudential policies limits the extent to which the central bank incorporates specific signals from credit and financial markets in its systematic monetary policy conduct through the cycle (i.e. the optimised Taylor rule coefficients for credit or asset prices). At the same time, the optimised counter-cyclical capital rules lead to excessive volatility in banks' balance sheets, which could be difficult (and sub-optimal) to implement in practice.

Consequently, the third exercise assumes that policy-makers' loss functions also weight the fluctuations in bank leverage through the cycle. In this case, the inward

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<sup>216</sup> The stochastic distributions of real and financial shocks are estimated on the basis of observed macroeconomic variables for the two regions, allowing for cross-regional correlations in each type of economic disturbance.

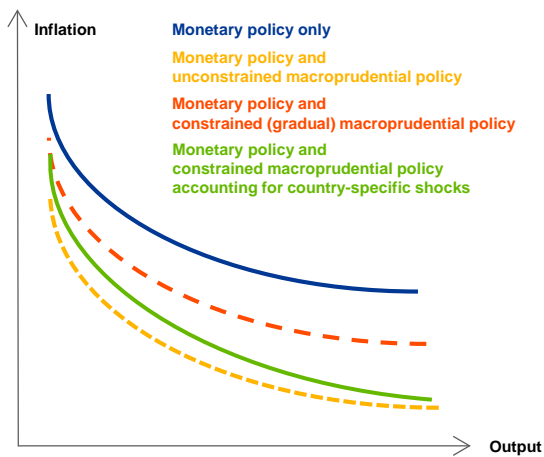
<sup>217</sup> Technically speaking, the optimised policy rules minimise a menu of loss functions, or policy-makers' preferences, that weight output and inflation volatility as well as credit or asset price fluctuations. Darracq Pariès et al. (2011, op. cit.) conduct a similar exercise in a closed-economy context.

shift of the associated efficiency frontier compared with the reference case is much less pronounced (red dotted line in Chart D.6). With some degree of macroprudential gradualism and implementation constraints, the case for monetary policy to lean against financial factors would still be warranted, as suggested by Smets (op. cit.).

### Chart D.6

#### Macroprudential policies targeted at country-specific shocks can alleviate the burden on a single monetary policy

Efficiency frontier between output-inflation policy outcomes



Source: ECB calculations.

The fourth and final exercise is the same as the previous one, but only considers asymmetric financial shocks as cyclical drivers (green line in Chart D.6). It reveals that within the monetary union macroprudential policy support to monetary policy is most suited to a situation where there are financial shocks (as compared with real and nominal shocks) and where the shocks are asymmetric across countries. In such cases, there is scope for targeted counter-cyclical macroprudential policy to alleviate somewhat the need for monetary policy to “lean against the wind”.

#### Curtailing the side-effects of a low interest rate environment

The preceding analysis has shown that through the expansionary phase of the financial cycle, monetary and macroprudential policy may reinforce each other. In crisis times, however, they may conflict, as in the current low-yield environment. The side-effects of abundant liquidity and exceptionally low interest rates

across the maturity spectrum may materialise through financial imbalances in some market segments or jurisdictions.

Should financial stability risks emerge, this would probably require tighter macroprudential requirements precisely when the central bank intends to loosen its stance. The articulation of such policies would entail major calibration and implementation challenges. Failing to act appropriately on the macroprudential side would let the asymmetric financial imbalances develop further within the monetary union, putting an extra burden on the single monetary policy. At the same time, given the limited experience in conducting macroprudential interventions, there is a risk of an inefficient policy mix, with a more accommodative monetary policy for the euro area as a whole and tighter macroprudential conditions in some parts of the euro area.

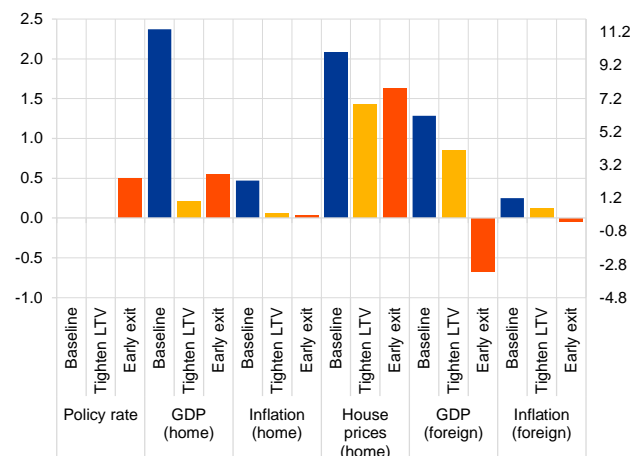
Admittedly, at the current juncture, signs of housing market overvaluation together with rapid credit expansion in some jurisdictions are not visible. Nonetheless, we will illustrate here the situation in which macroprudential instruments can be efficiently set to mitigate the risks of overheating in some housing market segments, on the back of the central bank asset purchase programme and the policy rate at its lower bound. As shown in the previous section, MPis targeted at the jurisdiction at risk would be appropriate to address this source of systemic risk.

## Chart D.7

### Targeted macroprudential interventions to curtail financial imbalances in the housing market

#### Leaning against house price bubbles: LTV ratio measures versus monetary policy

(cumulated responses after two years: real GDP (percentage deviation from baseline, left-hand scale); inflation (percentage point deviation from baseline, left-hand scale); policy rate (percentage point deviation from baseline, left-hand scale); house prices (percentage deviation from baseline, right-hand scale))



Source: ECB calculations.

Notes: "Baseline" refers to scenario with unchanged monetary and macroprudential policies over a two-year horizon assuming 10% growth in home country house prices. "Tighter LTV" refers to scenario where a cap to LTV ratios is introduced in the home country while monetary policy is assumed unchanged. "Early exit" refers to a scenario of increasing monetary policy rates, while macroprudential policy is kept unchanged.

The scenario analysis is based on the same model calibration as in the previous section. We consider the risk of a region-specific gradual rise in house prices by 10% over a two-year horizon, fuelled by positive housing demand factors and loose credit supply conditions on loans for house purchases. In the model, buoyant construction activity, together with the relaxation of financial constraints for the household sector, support the growth momentum and consumer spending in the booming region. The baseline simulation assumes that monetary policy is unchanged for two years. Against this background, two situations are contrasted. In the first scenario, we assume that there is a counter-cyclical macroprudential intervention in the booming region through a cap on loan-to-value ratios, while monetary policy is kept constant. In the second scenario, the early exit from the exceptionally loose monetary conditions assumes that the short-term interest rate starts rising in line with the model-based policy rule over the last three quarters of the simulation. The respective simulations are presented in Chart D.7. It turns out that the macroprudential measures are able to contain the asset price increase in the booming region and to better shield the rest of the euro area. By comparison, the early tightening of monetary policy to

mitigate house price growth in the domestic economy delivers significantly more cross-country heterogeneity and negative cross-border spillovers.

## Conclusion

There are synergies and trade-offs between monetary and macroprudential policies. These interactions may become even more pronounced in a monetary union where monetary policy by definition will be focusing on area-wide economic and financial conditions. In such circumstances, macroprudential policies targeting imbalances building up at the national level within the monetary union can help to achieve better policy outcomes in terms of price and financial stability.

The macroprudential policy framework in the euro area with its distinct role for national designated authorities, in conjunction with a central coordinating role for the ECB, should be conducive to designing targeted macroprudential policies, while also taking into account the single monetary policy stance. This set-up should also make it possible to address potential unintended side-effects on financial stability that may arise in a context of highly accommodative conventional and unconventional monetary policy.

## Abbreviations

### Countries

AT	Austria	IT	Italy
BE	Belgium	JP	Japan
BG	Bulgaria	LT	Lithuania
CH	Switzerland	LU	Luxembourg
CY	Cyprus	LV	Latvia
CZ	Czech Republic	MT	Malta
DK	Denmark	NL	Netherlands
DE	Germany	PL	Poland
EE	Estonia	PT	Portugal
IE	Ireland	RO	Romania
ES	Spain	SE	Sweden
FI	Finland	SI	Slovenia
FR	France	SK	Slovakia
GR	Greece	UK	United Kingdom
HR	Croatia	US	United States
HU	Hungary		

### Others

ABCP	asset-backed commercial paper	EIOPA	European Insurance and Occupational Pensions Authority
ABS	asset-backed security	EMEs	emerging market economies
ARM	adjustable rate mortgage	EMIR	European Market Infrastructure Regulation
AuM	assets under management	EMU	Economic and Monetary Union
BCBS	Basel Committee on Banking Supervision	EONIA	euro overnight index average
BIS	Bank for International Settlements	EPS	earnings per share
BLS	bank lending survey	ESA 2010	European System of Accounts 2010
BRRD	Bank Recovery and Resolution Directive	ESAs	European Supervisory Authorities
CAPM	capital asset pricing model	ESFS	European System of Financial Supervision
CBPP	covered bond purchase programme	ESM	European Stability Mechanism
CCP	central counterparty	ESMA	European Securities and Markets Authority
CDO	collateralised debt obligation	ESRB	European Systemic Risk Board
CDS	credit default swap	ETF	exchange-traded fund
CET1	common equity Tier 1	EU	European Union
CISS	composite indicator of systemic stress	EUR	euro
CLO	collateralised loan obligation	EURIBOR	euro interbank offered rate
CMBS	commercial mortgage-backed security	FiCoD	Financial Conglomerates Directive
CPI	Consumer Price Index	FMI	financial market infrastructures
CRD	Capital Requirements Directive	FSI	financial stress index
CRR	Capital Requirements Regulation	FSR	Financial Stability Review
CSD	central securities depository	FVA	fair value accounting
CT1	core Tier 1	FX	foreign exchange
DGS	deposit guarantee scheme	G-SIB	global systemically important bank
DSGE	dynamic stochastic general equilibrium (model)	G-SII	global systemically important institution/insurer
EBA	European Banking Authority	HICP	Harmonised Index of Consumer Prices
EDF	expected default frequency	ICPFs	insurance corporations and pension funds
EEA	European Economic Area	IFRS	International Financial Reporting Standards
EFSS	European Financial Stability Facility	IMF	International Monetary Fund
EFSM	European Financial Stabilisation Mechanism		

JPY	Japanese yen	O-SIIs	other systemically important institutions
LBO	leveraged buyout	OTC	over-the-counter
LCBG	large and complex banking group	P/E	price/earnings (ratio)
LCR	liquidity coverage ratio	PD	probability of default
LGD	loss given default	RMBS	residential mortgage-backed security
LTD	loan-to-deposit (ratio)	ROA	return on assets
LTI	loan-to-income (ratio)	ROE	return on equity
LTV	loan-to-value (ratio)	RWA	risk-weighted assets
MBS	mortgage-backed security	SBG	significant banking group
MFI	monetary financial institution	SIFI	systemically important financial institution
MMF	money market fund	SIPS	systemically important payment system
MReit	mortgage real estate investment trust	SIV	structured investment vehicle
MRO	main refinancing operation	SMEs	small and medium-sized enterprises
NAV	net asset value	SMP	Securities Markets Programme
NFC	non-financial corporation	SPV	special-purpose vehicle
NiGEM	National institute Global Economic Model	SRM	Single Resolution Mechanism
NPE	non-performing exposure	SSM	Single Supervisory Mechanism
NPL	non-performing loan	SWF	sovereign wealth fund
OECD	Organisation for Economic Co-operation and Development	TLTRO	targeted longer-term refinancing operation
OFIs	other financial intermediaries	USD	US dollar
OIS	overnight index swap	VaR	value at risk
OMTs	Outright Monetary Transactions		

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